

Dragonflies and Damselflies

of Namibia



Frank Suhling
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Gamsberg Macmillan

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Introduction

Jewels of the watershed

Dragonflies are fascinating insects. They belong to the insect order known as Odonata, of which about 6,000 species occur worldwide and about 880 in Africa. There is no doubt that dragonflies are among the most beautiful and interesting animals on earth. Adult dragonflies are aerial creatures with a superb ability to fly; the larvae develop in water and are critical with regard to water quality and aquatic habitat structure.

Living in these two worlds, dragonflies are optimal indicators of wetland health. A full array of different ecological types, from pioneers to specialists, occurs within the Odonata. This allows habitat changes to be monitored on the basis of positive and negative indicators. Dragonflies are already used as indicators for wetland quality in many parts of the world. To use dragonflies this way requires secure identification. This is one of the aims of this field guide.

Why study dragonflies in Namibia? Being the most arid country in sub-Saharan Africa, does Namibia even have a significant population of dragonflies? It indeed does. In fact, Namibia has almost 130 species of dragonflies, most of which occur in the more humid, tropical north. Compared with other tropical countries this may not be a high diversity, but it is about the same number of dragonfly species that occurs in Europe. So not only do a surprisingly high number of species occur in Namibia, there is also the phenomenon of the enormous swarms of millions of Wandering Gliders [*Pantala flavescens*] and some other species that enter the desert every year with the onset of the rainy season. Thus, dragonflies are of importance even in an arid country.

How to use this field guide

The guide opens with a general introduction to dragonflies. The first two chapters, “What is a dragonfly?” and “Biology and ecology of Odonata”, aim to establish the appearance of dragonflies, their ecology and their behaviour in general, with special reference to Namibian species. The third chapter deals with dragonfly habitats in Namibia and their assemblages. The reader is guided on where to find dragonflies in the country, and what their special habitat requirements are. The fourth chapter, entitled “Surveying dragonflies”, introduces the reader to specific methods of recording these insects in respect of surveys or long-term monitoring.

The field guide proper includes identification keys to and descriptions of the families, genera and species of adult dragonflies that occur in Namibia. The keys, which tabulate 150 species of dragonflies, include some species that have not yet been recorded in Namibia but which may occur here.

The scientific name is given for each species according to the International Code of Zoological Nomenclature, which conventionally includes the genus name (first word, beginning with a capital) and the species name (second word) as well as the name of the first describer and the year in which the species was described. Sometimes the describer's name and the year date are given in parentheses. In such cases, the species was originally described under a different genus name. One or more English vernacular names are given as well. Although these names may be more convenient to many, the reader is encouraged to use scientific names instead: unlike the scientific names, the vernacular names are still very young and not yet well defined. Thus, a particular English name may refer to one species in one country, but to quite another species in a different country.

At least one photograph illustrates each species of dragonfly, except for those species for which no photograph was available. An attempt has been made to obtain photographs of living specimens only, but in a few cases only the conserved material was available. The latter does not always show the living colour, but at least the general appearance of a species can be noted.

In respect of the sorting of species entries, the first categorisation is in terms of family relationships, followed by generic relationships. The sorting of the genera and species in relation to each other follows similarities in the various species. The most similar species within a genus are placed next to each other to allow direct comparison.

Each species entry is then divided into a number of sections, as follows:

- **Meaning of scientific name:** This section explains the origin and meaning of the scientific name, which is often cryptic. The basis of many scientific names is ancient Greek or Latin. It is hoped that these explanations will make them more accessible to the reader and will offer an additional insight into research history. Heinrich Fliedner was chiefly responsible for compiling this section.
- **Distribution:** First, an overview is given of the general range of the species. It should be noted that the area referred to as the Cape of Good Hope or the Cape does not imply politically defined provinces. Historic records are often not very precise in this respect, but Cape of Good Hope usually refers to an area somewhere along the coast of South Africa. The range defined as Northern South Africa refers to the Limpopo Province and its adjacent areas. For detailed distributions in South Africa, see the field guides by Tarboton and Tarboton (2002 and 2005; see chapter on useful literature). Old World conventionally refers to Africa, Europe, and Asia, and is contrasted with New World, i.e. the Americas.

Secondly, details are given about the species' distribution in Namibia. Particularly in rare species, distinct localities where they have been encountered are

referred to. In more widespread species, areas such as Caprivi, Damaraland, Kaokoveld or Kalahari are used to describe landscape units – rather than historically or politically defined units. Thus, Caprivi relates to the area from the Okavango River to Namibia's borders with Zambia; Damaraland refers to the area north of the Brandberg up to Sesfontein; and Kaokoveld is the area from Sesfontein to the Kunene River. The maps of the species' distribution in Namibia are derived from the Namibian Odonata database hosted by the National Museum of Namibia.

- **Ecology:** The ecology section briefly describes what is known about a species' habitat, behaviour and life history. Also indicated are the seasonality and duration of the flight season of a species in Namibia, which are inferred from the date adult records were entered on the Namibian Odonata database.
- **Conservation:** Here are listed categories of species regarded as threatened according to the 2006 Global Red List of Threatened Species by the IUCN – The World Conservation Union (formerly International Union for the Conservation of Nature and Natural Resources) (<http://www.iucnredlist.org/>). Additional information is provided on species that are threatened regionally in Namibia, and conservation measures are suggested in some cases.

In addition to the field guide on adult dragonflies, a short key to the dragonfly larvae of Namibia is provided. This key aims to give an overview of the larval forms. It also allows families and most genera – but not species – to be identified. For a more extensive larval key, see Suhling et al. (2006; see chapter on useful literature).

A checklist at the end of the guide provides an overview of the species that occur in Namibia and neighbouring regions.

Finally, the list of useful literature and addresses does not provide the literature references cited in this book, but suggests resources to consult for further reading and offers some useful Internet addresses.

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What is a dragonfly?

Odonates are distinctive in appearance: they cannot be mistaken for any other type of insect. The body is long, the eyes are enlarged, and the four large wings are formed by a network of veins and a mostly transparent membrane. The pterostigma, a pigmented cell near the tip of the wing, is another clear feature. There is only one insect group, the antlions (order Neuroptera), that partly resembles dragonflies, but they are easily distinguished by one feature: the length of their antennae. Dragonfly antennae are short and inconspicuous, while antlion antennae are long and clearly visible. Moreover, adult antlions have a comparatively weak flight capacity and are mostly active at night, whereas dragonflies are strong flyers and, in most cases, are active during the day.



A damselfly [Zygoptera] sitting on a dragonfly [Anisoptera]. Note the different shape and posture of the wings

Dragonfly features and specialist terminology

Head

The head is transversely wide and broader than the thorax. The large globular compound eyes appear on each side. The antennae are thread-like and short, and divided into seven segments. The mouth is on the lower side and consists of several mouthparts. For identification, sometimes the lower lip (*labium*) and the

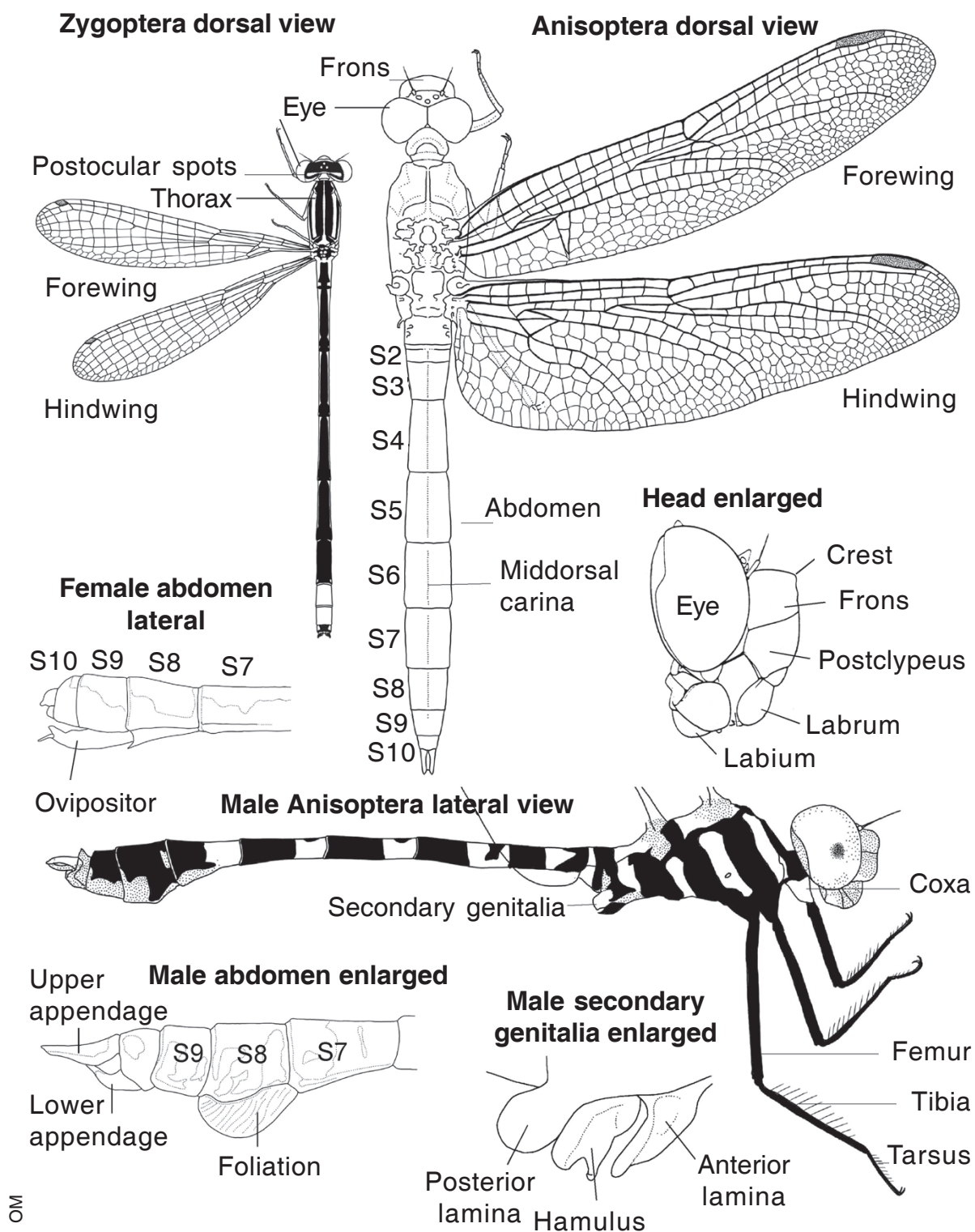


Plate 1: Features of adult dragonflies

upper lip (*labrum*) are useful. The frontal part or face of the head includes several panels. The most dorsal one is the forehead (*frons*), which often has important characteristics for identification. The postclypeus is situated below the frons. In

damselflies, many species bear a pair of bright, postocular spots on the dark, pigmented dorsal area between the eyes, where there is a lot of space.

Thorax

The thorax consists of three segments and bears the six legs and four wings. The first thoracic segment (*prothorax*) carries the pair of front legs but no wings. This differs from some Palaeozoic dragonflies, which had small wings at the prothorax as well. Especially in females, the prothorax often bears species-specific dorsal horns and hooks. The other two thoracic segments are fused to the synthorax, carrying the middle and hind legs and both pairs of wings. The dorsum of the synthorax is often conspicuously marked with brightly coloured stripes or fields. The linear markings between the dorsum and the side of the thorax are known as the *humeral stripes*.

The legs consist of two small basal segments (*coxa* and *trochanter*), two longer elements (*femur* and *tibia*), and three very small segments forming the foot (*tarsus*), which terminates in two claws. The femur and tibia often have very long spines, which are useful when the dragonfly forms a basket for catching prey. The shape and colouration of the tibia as well as the length of their spines may vary considerably between the different genera.

Wings

The elongate wings are usually transparent or glossy (hyaline) between the veins, and can often be coloured. The wing veins form a network of principal, cross- and other veins. The arrangement is characteristic for the main groups within the odonates. For a long time, the venation has been the most useful characteristic for identification, because most odonate specimens tend to lose their characteristic colouration soon after preservation. There is a very complex terminology describing every vein and network arrangement. In these keys, details on wing characteristics have been reduced to a useful minimum.

In damselflies the forewings and hindwings are more or less similar. In contrast, the shape of and the venation between forewing and hindwing in dragonflies show important differences, which is specifically reflected in the hindwing being much broader at the base compared with the forewing.

The principal veins in insects, which all arise from the wing base, are described in fairly general terms. The costa form the anterior margin, the radius reaches the tip of the wing, the media is in the median position, the cubitus is behind it, and the anal vein is short and generally projects from the posterior end. The principal veins may form branches, and supplemental veins may be added to the principal ones (see Plate 2).

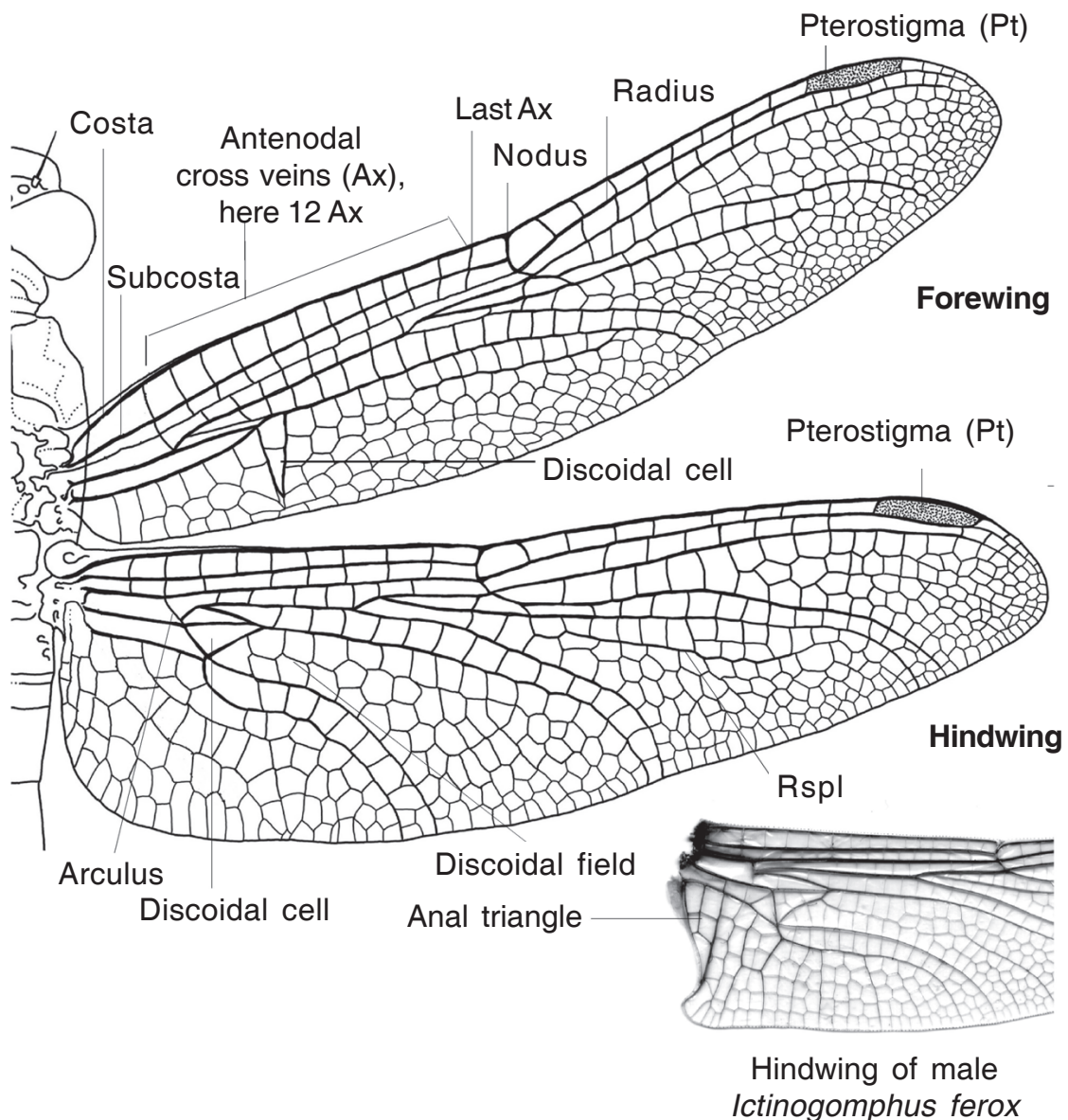


Plate 2: Wing features

The first longitudinal vein is the costa, forming the anterior margin of the wing for its entire length. The subcosta extends from the wing base to nearly halfway down the wing length right to the nodus, a characteristic junction on the anterior margin of the wing. Between the base and nodus are a number of short veins known as *antenodal cross-veins* (abbreviated as *Ax*), which connect costa, subcosta and radius. The number of *Ax* is relevant for identification in some families. In many species of Libellulidae, the *Ax* next to the nodus might only be developed between the costa and subcosta, which is expressed as *last Ax incomplete* whereas in others, the same *Ax* is longer and reaches into the space between the subcosta and radius as well (termed *last Ax complete*). Near the tip of the wing and connected to the costa is a chitinised and coloured cell called the *pterostigma*.

Characteristic for odonate wings is the discoidal cell (also known as *triangle*) in the basal half of the wing, which is triangular in most dragonflies and quadrangular in damselflies. The *arculus* is the first and most basally situated cross-vein between the radius and media, not far from the discoidal cell. The relation of this cross-vein to others may be a group-specific characteristic.

The keys presented in the chapters on species require some other special features as well, e.g. the number of cells between the last branch of the radius and the supplementary vein, referred to as *Rspl* (radial supplement: *supplement* because it has no direct connection to the principal veins), or the shape of the discoidal field – the wing area distally from the discoidal cell.

Abdomen

The abdomen always has ten segments (abbreviated as *S1*, *S2*, etc.). It is long and cylindrical in many species, but shorter and broad in the Libellulidae and Chlorocyphidae. The dorsal surface of each segment is formed by a *tergite* that is more or less convex, with an underside that comprises a flat chitin panel called a *sternite*. Sometimes, the convex surface of the tergite has a mid-dorsal longitudinal ridge called the *carina*. In the Gomphidae and Macromiidae, *S8* is often widened by so-called foliations. In males, the underside of *S2* and *S3* bear the secondary genitalia which might include additional structures (anterior lamina, hamulus, posterior lamina). In females of the Zygoptera and the Aeshnidae families, the underside of *S8* and *S9* bear the strong ovipositor, which is needed to deposit the eggs in plant tissues. In the other species, the egg-laying apparatus is reduced to a basket or flaps.

In males the abdomen terminates in upper and lower appendages. In Zygoptera, both are paired, whereas Anisoptera males have one lower appendage only. These appendages are used for seizing females. They are strongly species-specific, and vary in shape and size. Therefore, they serve as a useful guide to species identification.

Dragonfly larvae

Insect larvae often differ widely from their adult counterparts in body shape. For instance, the butterfly is completely different from its larva, the caterpillar. By contrast, dragonfly larvae do not differ very much from adults, although they have no wings and their body is usually more compact to fulfil the requirements of their aquatic habitat. Principally, they are ordered in the same way as adults, in that the head carries the eyes, antennae and mouthparts; the thorax has three pairs of legs and wing sheets in older stadia; and ten abdominal segments are present.

Labium

A unique feature of dragonfly larvae, in which they also differ to a great extent from adults, is their ejectable labium. The labium serves as the principal apparatus for capturing prey, and allows an extension of the area onto which prey can be fixed. The labium consists of four moveable elements: the postmentum, which is attached to the head; the prementum, which is joined to the postmentum; and two labial palps, which are joined to the anterior part of the prementum. In a resting position, the labium is folded under the body and only the prementum and the palps are visible. The strike of the labium is mediated by hydraulic pressure, initiated by contraction of abdominal muscles and closure of the anal pyramid. While building up pressure, the labium is locked into place by muscles in the labium. Relaxation of the muscles induces an explosive protraction. The retraction of the labium is mainly achieved by muscular action. The labial palps may be shovel- or spoon-shaped, covering parts of the face, as in *Macromiidae* and *Libellulidae*, or may be forceps-like and not cover the face, as in all *Zygoptera*, *Gomphidae* and *Aeshnidae*. A spoon-shaped labium may provide its owner with a greater catchment volume, i.e. it is useful to catch relatively small prey compared with the larval body size, whereas the forceps-like labium is useful for capturing larger prey. Also, the length of the labium varies: it may reach rearwards to the first legs, as occurs in most *Gomphidae*, which use the labium within the sediment; or it may reach as far rearwards as the last legs, such as in *Lestes* and *Anax*, which mainly capture visually detected prey. The differences in the shape of the labium are associated with differences in prey capture.

Sensory organs

The major sensory organs of dragonfly larvae are eyes, antennae and hair-like setae mainly on the legs. The large compound eyes are built of several ommatidia, whose numbers increase during larval development. Early-stadium larvae usually have only seven ommatidia per eye; only aeshnids and lestids have more. Foraging for the latter in particular is performed visually. Generally speaking, species with larger eyes are more inclined to visual foraging, while those with smaller eyes are more often tactile foragers.

The antennae as well as the hair-like setae on the legs and other parts of the body are mechanoreceptors, which are used for the tactile perception of prey. The antennae usually have six to seven segments of almost similar size. Exceptions are *Calopterygidae* and *Chlorocyphidae*, whose usually first antennal segment is usually much larger than the others, and *Gomphidae*, which only have four antennal segments, of which the third is enlarged. The reason for having different-sized antennal segments is unknown. In gomphids, however, the more compact antennae may be useful in the larva's burrowing way of life. Chemoreceptors may be

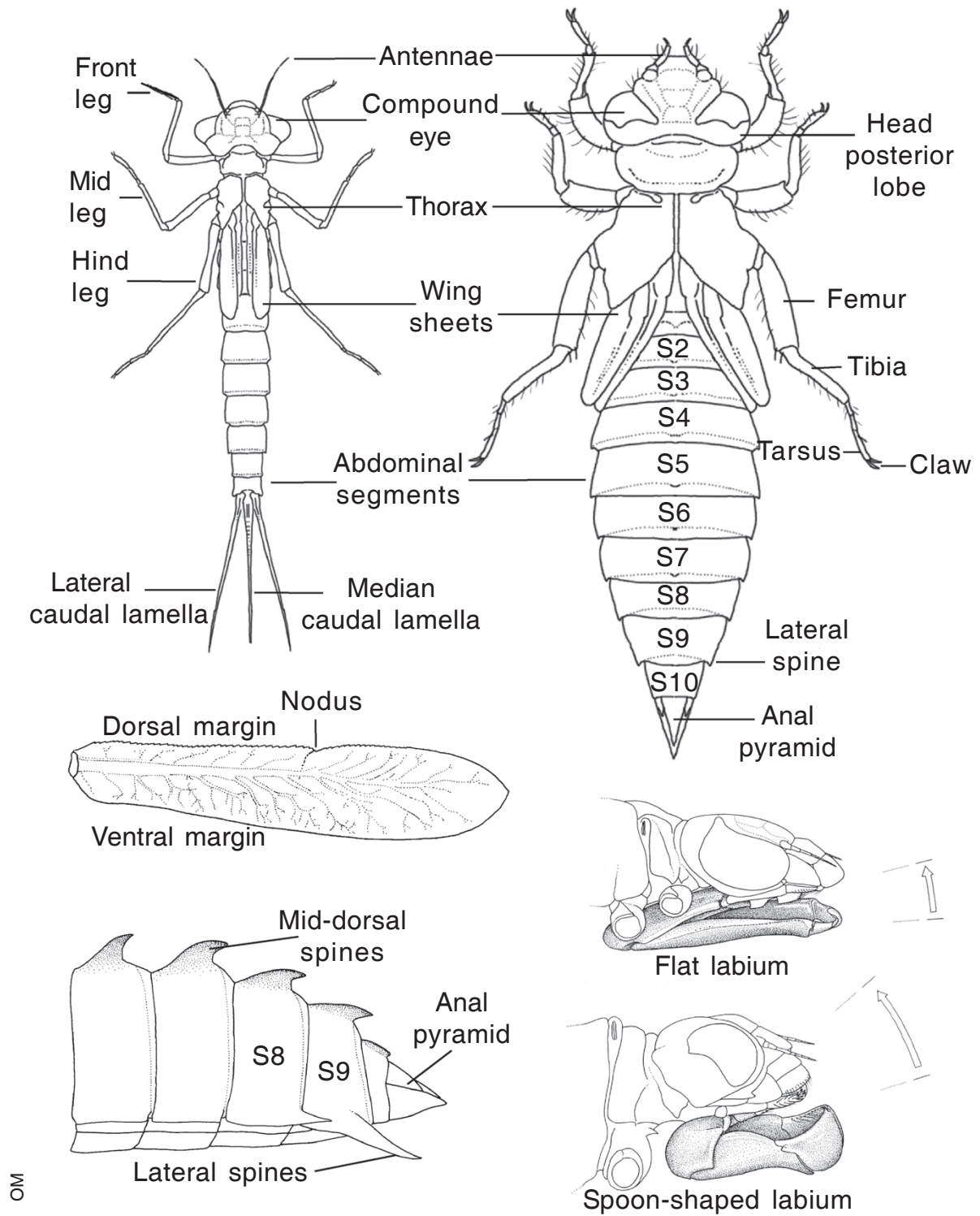


Plate 3: Overview of the morphology of dragonfly larvae

associated with sensillae on the antennae and/or the labium. These receptors are able, for instance, to detect the chemical cues of conspecifics, fed upon by a fish. If such a cue is detected, the larvae of some species reduce activity as antipredation behaviour.

Respiratory system

Another special morphological feature in dragonflies is the respiratory system, which consists of gills in the rectum. Particularly in Anisoptera, the gills are constantly supplied with fresh, oxygen-rich water via a pumping movement of the abdominal muscles. The pumping function can also be used to produce a jet propulsion to speed up swimming. The rectum can be closed and opened by the anal pyramid, which comprises five elements. The pyramid can be very spiky and may be used by some species, particularly aeshnids, as a defence mechanism against larger predators. Gas exchange in Zygoptera occurs mainly via mostly three, sometimes two, rectal leaf-like lamellae, which are suffused by tracheas through which gas is transported to the organs.

The lamellae also serve as flukes for swimming. When a zygopteran larva is grabbed at the lamellae, e.g. by a predator, they can be discarded in much the same way as a lizard drops its tail. The shape of the lamellae in zygopteran larvae varies: they may be broad and very flexible or elongate and rather stiff. Some species have a distinct intersection in the lamellae, known as the *nodus*. Besides the rectal gills and the caudal lamellae, other surfaces of the body may also function as respiratory surfaces. For instance, lateral abdominal gills are present in the mainly Oriental Euphaeidae family.

Colouration

In pattern and colour, dragonfly larvae typically resemble their immediate microhabitat background closely and are, therefore, well camouflaged. Species that predominantly live among vegetation are often greenish, e.g. *Africallagma* larvae, while *Anax*, *Orthetrum* and *Paragomphus* larvae living on or in sand are pale brown. Larvae living in mud or between dark detritus may be completely black, which often occurs in *Crocothemis* and *Diplacodes*. Most species can moderately change colour, usually during moulting periods, when they are translocated to different microhabitats. It is also possible for them to change colour experimentally to reddish or whitish colours. The markings of larvae often mimic their background habitat, e.g. dark patterns on a pale-brown background in many gomphids, while *Phyllomacromia* resemble the pattern of a mixture of different sediments. Particularly younger stadia of aeshnids, e.g. *Anax imperator*, and also of *Tholymis tillarga*, have transverse bands in contrasting dark and light stripes. Such banding probably resembles the patchwork of light and shade near the water surface, where these larvae often hunt.

Spines

Abdominal spines occur particularly in anisopteran larvae. Such spines may serve as an anti-predation trait, e.g. specifically to distract fish. The larvae of species

that occur in lakes with fish have longer spines than those that occur in lakes without fish. It has also been found that the combination of long dorsal and lateral spines is most effective in warding off fish predators. Species like *Pantala flavescens* have very prominent lateral spines but no dorsal ones. However, they usually live in lakes without fish.

There are other potential functions of spines, e.g. the extensive and robust spines at the top of the abdomen in gomphids serve as a protection against pebbles being tossed around by the current or as hydrodynamic elements that stabilise the larvae's position in the current.

Body shape and microhabitat

Dragonfly larvae use very different types of microhabitats. For instance, most gomphid larvae are burrowers that are segregated by the use of different substrata, like sand or mud, in which they burrow. Others, like aeshnids, many libellulids and most zygopterans, live among vegetation or roots. Microhabitat use in dragonflies is associated with varying morphological characteristics, e.g. different lengths of the legs and shapes of the abdomen. Based on microhabitat occupancy, body shape and use of the legs, four types of larvae can be distinguished. Claspers (Type 1) exhibit strong thigmotaxy, i.e. they press and secure their body to a substrate like twigs or stones. Examples from Namibia are the larvae of the genus *Zygonyx* that live in strong current. Most damselflies and some libellulids are sprawlers (Type 2), which use their long legs to support the body on or in a matrix, usually detritus or vegetation. Hiders (Type 3), for instance *Phyllomacromia* larvae, cover their dorsoventrally flattened body with detritus or leaf litter. Macromiid larvae have particularly long legs, which they spread out sideways. Burrowers (Type 4) execute digging movements with their legs, which results in the body being hidden in the sediment. Most burrowers have a compact body and relatively short legs. Most gomphids and some libellulids belong to this type. Some gomphid larvae are elongate with long breathing tubes, up to half their body length, instead of the normal anal pyramid, allowing them to breathe in water when deeply burrowed in the sediment.

Biology and ecology of dragonflies

Life cycle and development

Dragonflies are hemimetabolous insects, which means they have three major developmental stages: egg, larva and adult. The development from the larval stage to the adult occurs without a pupa, which is how it differs from holometabolous insects, such as butterflies, beetles and mosquitoes, which all have a pupal stage. In a pupa the larval body, e.g. for instance of a caterpillar, is transformed into something looking completely different – the butterfly. In dragonflies, the larval stage is more similar to the adult stage because no such transformation occurs. With a few exceptions in other parts of the world than Namibia, all dragonflies have a semi-aquatic life cycle, i.e. the larvae and, often, the eggs develop in water, while the adult lives outside the water, although in many cases spending much of its lifetime close to the water.

The egg stage

The females deposit their eggs directly in the water or in plant tissue close to the water (see the chapter on oviposition). In some species, e.g. of the genus *Lestes*, eggs undergo embryonic development in plants outside the water. However, in most species, eggs are laid in fresh water. The duration of egg development is mainly governed by the ambient temperature; therefore, development increases with increasing temperatures. Most species have an egg-development period between two and four weeks. However, in typical temporary-water species – as are common and widespread in Namibia – the process may be much more rapid. From the authors' own observations, the eggs of a *Sympetrum fonscolombii* specimen caught in central Namibia and raised at about 28°C hatched on the second day after they had been laid – which is probably a world record for egg development in dragonflies. Most temporary-water species reared by the authors needed at least five to eight days before the eggs were fully developed.

At the opposite extreme are temporary-water species, e.g. the Lestidae, that lay their eggs in plant tissue. In such species, the strategy is usually to circumvent drought during the egg stage. Thus, these eggs need up to several months after they are laid to develop fully because development is usually interrupted by an obligate diapause.

Dragonfly eggs are usually oval in shape in species that oviposit in open water, and more elongate in those that oviposit endophytically. Particularly in gomphids such as *Ictinogomphus* and *Lestinogomphus*, the eggs may have strange structures like long yarn- or belt-like flagellae that may help to anchor the eggs in suitable habitats. However, the function of such structures has not yet been fully determined.

The larval stage

After hatching from the egg, larval growth occurs in distinct steps, each of which is associated with moulting. The number of stadia (or instars) – phases between two periods of moulting – varies from species to species as well as within one species, and may even vary among the offspring of one female. Conventionally, the stadia are typified by counting backwards: i.e. the ultimate stadium is F-0 (read: *Final minus zero*), the penultimate (F-1), and so on.

Total embryonic and larval development may last from only 30 to 60 days in tropical temporary water species, up to several years in some temperate- and arctic-zone bog-dwellers. A comparison was made between the larval development of some typical Namibian temporary-water species with that of some species that, in Namibia, only live in small perennial streams. *Pantala flavescens* and *Sympetrum fonscolombii*, which both migrate into the desert and oviposit in temporary pools of rainwater, needed a minimum of about 35 to 38 days from the day the egg was laid to emergence. *Crocothemis erythraea*, *Orthetrum chrysostigma* and *Trithemis kirbyi* are the most common species in the desert. They use a wide variety of habitats, and need about ten days longer to emerge, i.e. 45 to 48 days, whereas the perennial-stream-dwellers (see chapter on habitats) *C. sanguinolenta*, *O. julia* and *T. stictica* take 57 to 67 days to complete development. Thus, all these species have a very rapid development compared, for instance, with species in the temperate zone. But the differences in the duration of development amongst these three groups are distinct, and explain differences in their habitat use. The slowest developers need about twice as long as the quickest developers, which means the slower ones are restricted to longer-lasting habitats.

As indicated by the examples above, larval growth occurs at species-specific rates. However, environmental factors also significantly affect the growth rate. Firstly, dragonfly larvae are benthic, euryphagous, opportunistic predators that require animal food, particularly other freshwater insect larvae and crustaceans (see chapter on feeding and foraging) for maintenance and growth, and their diet closely reflects the availability of prey items in the habitat where they forage. The amount of food available directly translates into growth rates, i.e. high food availability allows rapid growth. Secondly, an increasing ambient temperature accelerates the rate of growth up to a species-specific optimum, which is at about 20–30°C and may be even higher in tropical temporary-pond-dwellers.

Whereas, in the tropics, most species develop directly without any interruption, most species in the temperate zone stop development if temperatures fall below 10°C, i.e. in winter. This interruption is typically achieved by a two-phase photoperiodic reaction operating during the larval stage. In the first phase, the long photoperiods characteristic of summertime induce a diapause at a certain stadium,

mainly in later stadia, thus prolonging development. This may lead to an accumulation of F-1 larvae during summer, followed by their rapid entry into the final stadium close to the autumn equinox.

In the second phase, short photoperiods, characteristic of a time close to the autumn equinox, induce a diapause that commits the larvae to hibernation. This eliminates any possibility that metamorphosis or emergence could occur before the advent of winter. It has not yet been determined whether a similar process occurs in tropical dragonflies as well, to achieve seasonal regulation. Since the latter do not have to circumvent a harsh winter period, a photoperiod control on development may be less common in tropical species (see below).

Emergence

The adult dragonfly hatches directly from the ultimate larval stadium, in a process called *emergence*. The process of moulting the old skin and preparing for aerial life may last from about 20 minutes up to several hours, depending on the species. The whole process, however, starts a few days before the larva leaves the water.

As one of the last steps of development they first have to transform certain organs. The breathing organs in particular have to be transformed so as to breathe in air instead of water. For this, spiracles at the sides of the thorax, which have to be opened, connect the tracheae in the body with the air. Once this opening has occurred, the larva is at risk of being drowned. The labium also has to be transformed into its adult shape, which disables the larvae from catching prey.

After these transformations, the larva has to leave the water within a short time. Otherwise, it would drown or starve to death. When leaving the water the larva attaches itself to a support with its legs. Two major types of posture at emergence can be distinguished: (1) the larva sits in a horizontal to vertical (90°) position, and (2) the larva sits in a vertical to overhanging position. Type 1 allows emergence at shorelines without vegetation and is realised by most Zygoptera and by the Gomphidae. All other Anisoptera perform type 2 emergence, and need an overhanging support to remove their larval skins (exuviae).

Emergence is a very risky phase in development because the dragonfly is not able to escape predators. It has often been observed that, amongst the beings that prey on emerging dragonflies, are birds and ants. Even young crocodiles have been observed doing so. The exuvia left behind is robust and, due to its thick cuticle, can remain at the support where the emergence occurred for days or even weeks, particularly if such sites are protected against rain, e.g. under or in trees. Exuviae are often good signs of the presence of a specific dragonfly species (see the chapter on the larval key).



AM

Emergence in horizontal position (Paragomphus genei)



KG

Emergence in vertical position (Anax tristis)

Maturation and duration of adult life

The newly emerged adult normally leaves the water by way of a so-called maiden flight. In the first hours after emergence, the cuticula of the dragonfly is still soft and its flight insecure. However, this has to change rapidly because a dragonfly may lose much of its weight in the last phase of its larval life. This loss has to be compensated by hunting mainly flying insects (see chapter on feeding and foraging) to become sexually mature (see chapter on reproductive behaviour), which may take from a few days to a few weeks. In females in particular, weight has to be increased to produce eggs. During maturation, a dragonfly's colours – always pale at emergence – intensify. Dispersal or migration occurs during the maturation phase as well as occasionally in mature individuals (see chapter on migration).

In the temperate climate zone, mature adults live for up to two months. In species that commonly breed in temporary waters, the adults may enter an extended phase of diapause, which they spend away from the water. In this phase, the gonads do not mature. Tropical species often seem to have greater longevity, being up to several months longer in some cases. Thus, in the tropics and particularly in temporary-water species, the adult stage may last longer than the larval stage, which is usually vice versa in the temperate zone.

Generation times (Voltinism)

The duration of a generation in dragonflies can range from one generation a year (univoltine) to up to four generations in one year (multivoltine), and even to only one generation in up to seven years (partivoltine), depending on the species' distribution and phenological background as well as the type of larval habitat. In the tropics, where temporary freshwater habitats are common, many species are multivoltine. In the temperate zone as well as in most types of perennial freshwater species, riverine species in particular tend to be univoltine to partivoltine.

Circumventing drought

Living as a semi-aquatic animal in arid Namibia means having to circumvent the harsh conditions of the dry season. Whereas some species are restricted to the few perennial waters that exist in the country, other species that reproduce in temporary waters need specific strategies to survive. In Odonata, several cases of siccation are reported in all life stages. Some larvae may survive long periods of complete desiccation. Interestingly, most such observations are from temperate zones, not deserts – as one would expect. Larvae of at least some species of gomphids and libellulids are able to survive in moist sand for at least one month and emerge successfully. However, survival in desert species in the larval stage seems to be unusual. Siccation in the egg stage is very common in Odonata. Most species of *Lestes* have an obligate diapause in the egg stage, which allows

them to survive several months (and perhaps even a few years) of drought. Some Libellulidae, such as the Indian species *Potamarcha congener*, survive the dry season in the egg stage. In others, such as some species of *Sympetrum*, there is at least a facultative egg diapause, thus allowing certain widespread species to survive droughts. Since lestid eggs are able to survive drought, *Lestes pallidus*, which is widespread in the desert, may regularly survive dry periods in the egg stage, although this species also siccates in the adult stage; the *Anax* species and perhaps *Ischnura* as well may do so facultatively. The implication is that dry-season survival of the aquatic stages appears to be uncommon in desert species, with most of these developing directly and requiring open water.

Tropically centred Odonata frequently feature a relatively long adult stage, compared with temperate species. Also, some Algerian Odonata spend the duration of the dry season in mountains as adults, a habit which is interpreted as aestivation. Such dragonflies remain reproductively immature until they return to their oviposition sites in autumn. Postponed reproductive maturation was expected to be common in Namibian desert Odonata, but, except for *L. pallidus*, not many examples have been reported yet. Another way of circumventing the dry season is to leave the arid environment and migrate to reproduction habitats in regions with more favourable environmental conditions. Species doing so migrate into the desert with the onset of the rainy season. They reproduce there once, and the offspring (i.e. the next generation) migrate back to a more humid region. There, another one or several generations may be produced before the cycle starts again. This behaviour is performed by the so-called obligate seasonal migrants (see chapter on migration), which in Namibia include *Anax ephippiger*, *Pantala flavescens* and *Sympetrum fonscolombii*.

Flight season

The duration of the flight season varies amongst the species of Odonata. Typically, it is adapted to the seasonal conditions of the region where a species occurs. For instance, temperate-centred species are restricted by the winter. In these species, we distinguish two major groups: one flying in spring and early summer, and the other flying in mid-summer to autumn. In the tropics, the major seasonal difference is that between the dry and the rainy season, which is distinct in arid regions and less so in more humid regions. Taking this into account, some differences of flight season could be expected across Namibia, which gradually becomes more arid from the north-east to the south-west, with the seasonality becoming more pronounced in the driest areas. In fact, *Ictinogomphus ferox* flies throughout the year at the northern perennial rivers, but has a shorter flight season at the large impoundments in central Namibia, namely from October to April. In Namibia, which is mainly subtropical in climate, colder temperatures in winter also have an effect, particularly in the central highlands. For instance, *Crocothemis erythraea*, which

flies throughout the year in Namibia, becomes rare in June and July around Windhoek, but is still common in the northern and western parts of the country in the latter months.

Besides the effects of climate, there are also species-specific strategies. Although for many Namibian species the database is too poor for analysis, two major patterns and some sub-patterns can be tentatively distinguished, as follows:

1 **Flight season is throughout the year:** This pattern probably occurs in 35 Namibian dragonfly species. Among them there are particularly many desert-dwellers, for instance the widespread *Ischnura senegalensis*, *Paragomphus genei*, *Anax imperator*, *Crocothemis erythraea*, *Orthetrum chrysostigma*, *O. trinacria*, *Trithemis kirbyi*, *T. annulata* and *T. arteriosa*. Typical species of small perennial streams also show this pattern, e.g. *Pseudagrion kersteni*, *A. speratus*, *C. sanguinolenta*, and *O. julia*. In contrast, the number of typical species who show this pattern and who are common at the large perennial rivers is surprisingly low. Examples of the latter are *Phaon iridipennis*, *Elatoneura glauca*, *Brachythemis lacustris* and *B. leucosticta*.

A few species that only occur in the Namibian central highlands or in southern Namibia show a winter gap in their flight season, i.e. in June and July, or in July and August, which is in all likelihood caused by the low temperatures that can occur at night. This gap is particularly evident in *Africallagma glaucum*.

2 **Flight season is the rainy season:** There are two different groups showing this pattern. The first of these comprises several species of the large perennial rivers, which seem to emerge with the onset of the rainy season, i.e. in October or November, although some also emerge a little earlier. The flight season may last for the whole rainy season or can be somewhat shorter, either because the flight season stops earlier or starts a bit later, e.g. in the late rainy season. However, the knowledge about the phenology of the more tropical species in Namibia is still poor.

The second group comprises species that start migration with the onset of the rainy season. For these migratory species the duration of the flight season decreases from north-east to south-west, as the length of the rainy season decreases. Examples are *Pantala flavescens*, *Sympetrum fonscolombii* and *Tholymis tillarga*.

Reproductive behaviour

Females at the water are rare

At a pond or along a stream, males are superior in number. They lurk on perches in the sun or patrol up and down, permanently ready to pounce on a female. Often the females appear only for a few seconds, and then they are gone: driven away or

within the grip of a mate. But the sex ratio is nearly 50:50, and the number of male and female individuals that become adults is similar.

Females appear at the water for reproduction only. They spend much of their time away from the water, preying on small insects. They are obliged to consume large amounts in order to be able to produce the eggs. The males' investments in their gametes are not as high, although they spend much of their time and energy at the water, searching for a female partner and contesting territory with their rivals.

Dragonfly females produce eggs during their entire adult lifespan. They may also copulate several times during their lifespan. This exerts a considerable influence on the evolution of reproductive strategies in odonates. For example, a female has to maximise her reproductive success by producing as many eggs as possible and depositing them at suitable sites. She succeeds primarily by maximising her lifespan. A successful male, on the other hand, is measured by the number of eggs he has fertilised. He has to copulate with as many females as he can in order to guarantee that his mates lay as many eggs as they can before they copulate with other males.

Odonate males have evolved different strategies for mate-searching. A widespread strategy is territoriality, i.e. the defence of a space against rivals in the quest for a mate, and the defence of a space in which a male can monopolise a site where females appear highly predictable. Territory is worth fighting for – especially when there is something limited and necessary in it, such as a good site for egg deposition. Territoriality in odonates occurs either in a long-term relationship to a site that will last a number of days, or in a short-term relationship that lasts from a few minutes to an hour. However, there are also many species that do not defend particular territories to find mates. Also, besides the general strategies in mate-finding and mate-guarding, which will be described in the following section, there is a high flexibility in individual tactics, depending on how much energy the male has; what his body size, age, and experience are; and whether any rivals are present.

Waiting for days or being an autocrat for a few minutes

Platycypha caligata males appear at running water in the morning and share suitable sites among them before the females come. A good site is marked by a piece of wet, barkless driftwood situated in a fast-flowing part of a river and in full sun. They mostly stay in the same area and know it very well. Every now and then they conduct an inspection, with their conspicuous blue bodies in flight offering ample evidence of their presence. When a rival intrudes into a male's territory he flies directly towards him and threatens him by showing him the red sides of his legs. As a rule, the resident wins the contest in the air, and the invader flees.

When a female appears at the water and tests the piece of timber with her egg-laying organs, the male begins his intensive courtship display: he dances around

her, showing her the white inner sides of his six legs. If she accepts him, she flies to a perch beside the water where both partners form a copulation wheel. Afterwards he leads her back to the floating piece of driftwood, into which she begins to insert her eggs while he guards her.

A male's constitution also plays a part in his ability to guard his territory. Because much of their time is spent on defending their territory, such males do not have ample opportunity to feed. Such a situation may last for several days in successful males. Their initial fat supply – as an energy source – is crucial, therefore. Males with high initial fat may keep territories for longer.

Males without territory may have copulations as well. Often this type of male uses a so-called satellite tactic: they do not fight off rivals or court females, but simply sit to one side and grasp a mate. This tactic proves successful, without expending energy on fights and chases.

Females that only want to deposit eggs can hoodwink a territorial male to achieve their purpose. If she can land near a female who is already laying eggs, the male will not bother her because he cannot distinguish between his mate and the intruder. Indeed, instead of fending her off, he protects her from harassment by other males.

The second form of territoriality is where a male defends a pond or a section along the shoreline for a brief period of the day. At such times, males permanently patrol the area and inspect suitable egg-deposition sites. Any other conspecific male is chased away. However, his willingness to fight weakens after a while, and a rival is able to chase him away. If no rival appears, the males leave the water without losing a fight. Species who show this type of territoriality are seen at the water as single individuals only; hence, the actual population size is not discernible by counting adults at the water. In the case of *Anax speratus*, the male's territory includes several ponds and parts of a stream, while *Zygonyx torridus* will patrol the area around the white spray of a rapid or small waterfall. In *Tholymis tillarga*, the male defends a territory in the twilight.

Scrambling competition and aerial races

In many odonate species, the males do not have any territory. Their repeated return to one perch is not enough to define them as being territorial. Thus, just because they chase a rival away from a perch does not justify arguing that a suitable resource is being monopolised in order to find a mate.

In searching for females, *Pseudagrion massaicum* males fly along the vegetation at the water's edge. Sometimes they interrupt their inspection flights and settle on leaves or twigs, often at preferred places. Females are rare; they cross the patrol zones only intermittently during the course of the day. Males have to wait for females, but they have to fly around in order to improve their chances of finding a

mate. When males encounter each other, they pounce on one another. After a brief attack, they continue their flight and search for a mate.



FS

Aggressive behaviour among males (Palpopleura lucia)



AM

Zygonyx torridus patrolling

This behaviour is also common in gomphids. At open shorelines they have a good view and do not constantly need to be on patrol. In these cases, they lurk about at the shore. They depart from time to time, usually to fight off rivals. Often, they do not return to the perch they have left, but land somewhere else. A female appearing at the water often results in several males taking part in an aerial race to get to her. In such species, alertness and body manoeuvrability in flight are essential.

The first contact

Odonate males respond to anything that moves. Damselfly males, in particular, respond to erratic flights, while dragonfly males respond to straight flights. Resting Aeshnidae females can be detected by their wing vibrations. In libellulids and gomphids, the movement of the body is an important signal, especially up-and-down sequences resembling egg deposition. Additionally, the colour and patterns on the body and the wings are important for recognising the opposite sex.

The odonate male pounces on the female and tries to grasp her. He lands on her thorax between the wings, and while in flight or if they have fallen onto the water or vegetation, he bends his abdomen and grasps her with his abdominal appendages, and the pair forms a so-called tandem. In anisopterans, the male's appendages hold the female by the head, while zygopterans grip females behind the prothorax. In many species males have appendages forming conspicuous forceps (see e.g. *Paragomphus* and *Lestes*) that interlock perfectly with the corresponding structures on the body of conspecific females. Thus, mistakes are rare. Tandem formation between different species is more frequent when there is a high population density and stormy weather, when females are rare and male motivation to mate is high.

Courtship

In some cases, contact between first-time partners is very careful. Courtship in general is rare amongst odonates. In Namibian odonates, the best examples of courtship displays are the damselfly *Platycypha caligata* and the dragonfly *Brachythemis lacustris*.

When a *Platycypha caligata* female appears at the water, lands on some driftwood and tests it for egg deposition, the territorial male begins his intensive courtship behaviour. He dances half circles around her by waving his stretched legs and facing their white inner sides towards her. He mostly takes her in tandem.

The *Brachythemis lacustris* male vibrates his bright orange wings while standing still over an oviposition site, and holds his abdomen downward. Thus, odonate courtship may allow a female to choose between males according to male quality, or by assessing oviposition sites in the male's territory. Additionally, courtship may provide an indication of the receptivity of a female that a male has encoun-



Courtship display of Platycypha caligata

tered in his territory, and the courtship behaviour helps to avoid senseless and risky pursuits and copulations.

The pair forms a wheel to mate

Before mating, the male fills a sperm reservoir at the base of his abdomen. He does so by bending his abdomen and bringing its tip into contact with his copulation organ. This brief procedure may occur before or after he has grasped a female. Once he has a female he bends his abdomen downward, while his mate bends her abdomen towards his. The genitalia come into contact and are fixed to each other.

The duration of mating in odonates can be divided into three categories:

- Brief, usually airborne copulations lasting a few seconds only (*Crocothemis*, *Acisoma*);
- Copulations of medium duration, lasting from 30 seconds to 30 minutes and terminating upon being settled (many damselflies, e.g. *Sympetrum*); and
- Long-lasting copulations taking more than an hour (Aeshnidae, most Gomphidae, Macromiidae, *Ischnura* in Zygoptera), that take place while the pair is settled.

Long-lasting mating can be disadvantageous to both sexes: the male may lose the opportunity to defend his territory and find other mates, and the female may lose the time she needs to feed and lay eggs. Nonetheless, long-lasting copulations have their advantages, as explained below.



Mating wheel (Paragomphus genei)

When odonates mate, the male's sperm is transferred to the female's sperm-storage organs, but her eggs are not fertilised during this part of the mating process. They will only be fertilised once they are passed into the region of the sperm-storage organs during egg-laying.

In several species, the male may first remove some or most of his rivals' sperm from the female's storage organs before he introduces his own. Therefore, the male's organ for transferring sperm also has structures that can scrape, scrub or polish the female's sperm-storage organs. In damselflies, the copulation process can be divided into three distinct stages. Stage 1 involves the male making rhythmic movements with his abdomen to remove any sperm deposited by his rivals. Stages 2 and 3 are marked by him making rocking movements or by holding his abdomen nearly straight while he transfers his sperm to the female.

Protecting his investment: Mate-guarding

Thus, a male having mated with a female does not guarantee fatherhood, because other males can remove his sperm and destroy his investment. Odonates, therefore, prevent females from accepting other suitors in a number of ways.

In a firm grip: Egg-laying in tandem

In many species, the partners do not split up after copulating. The male stays connected to the female by holding her with his appendages, and the pair remain in tandem. This long-lasting tandem formation is advantageous to both partners: during the egg-deposition phase that follows, she is well protected from harassment by other males, while he can guarantee his fatherhood.

Guarding the female without physical contact

After disconnecting from the female after copulation, the male remains near her, follows her and guards her against rivals. However, this form of mate-guarding is not as safe as the male keeping the female within his grasp. Also, while he is able to chase away one rival, when there are two his ability to protect her successfully wanes. The advantages of guarding her could be that he is simultaneously able to defend his territory, that he is not prevented from mating with another female, and that his risk of being preyed on while his mate lays eggs is greatly reduced.

Unguarded, but not unmolested

In *Phyllomacromia* and in most gomphids and aeshnids, the females are unguarded during oviposition. However, they also need protection against male harassment. To avoid further copulation, the female employs a broad spectrum of tactics. For example, she may –

- deposit her eggs at hidden places and do so very secretively
- appear at the water when the males are absent
- appear at sites or waters where males are rare
- demonstrate her unwillingness to copulate
- form groups with other egg-laying females, and
- flee.

Ischnura senegalensis females lay eggs in the evening, when male activity and aggression are low. *Anax imperator*, *A. speratus* and *A. tristis* females are able to reject the advances of their male counterparts by bending their abdomens down in flight – in which case the males stop pursuing them.

Laying eggs

In odonates one finds two types of egg deposition:

- In endophytic oviposition, females insert the eggs into plant tissue. This form of deposition is of long duration, and only occurs while the female is settled.
- In exophytic oviposition, the eggs are dropped or stripped off in flight. A special type of exophytic oviposition is epiphytic, whereby females deposit their eggs by gluing them onto the surface of plants.

Endophytic and exophytic oviposition compared

	Endophytic oviposition	Exophytic oviposition
Apparatus (ovipositor)	Saw-and-drill	Flaps With or without a spine or with or without a basket
Egg shape	Cylindrical, conical (without a gel coating)	Gobular, egg-shaped (with or without a gel coating)
Deposition process	While settled Each egg is inserted separately	In flight (sometimes while settled) A clump of eggs is tipped, dropped or thrown onto the substrate
Substrate	Living or dead plant tissue (soil)	Water, soil, plant surfaces
Egg flow	5–20 eggs per minute	1–30 eggs per second
Duration	30 minutes – 3 hours (in total)	10 seconds – 10 minutes
Change of the oviposition site	Frequent	Rare
Egg number	50–300	150–5,000
Distribution	Zygoptera and Aeshnidae	Gomphidae, Macromiidae, Libellulidae

Although the females make the movements typical of oviposition, one cannot be sure that they have actually laid eggs. Especially in damselflies, there is a longer phase of exploration and testing that is indistinguishable from successful egg-laying behaviour. The shape of the eggs is strongly related to the mode of egg-laying. Eggs inserted into plant tissue are conical. Eggs deposited outside of plants are more or less globular and often have a gel coating on the tip of or around the whole egg, which becomes sticky briefly after contact with water and fixes the egg onto the substrate. Eggs deposited outside water have a diapause, i.e. a phase of interruption in further development. As a rule they continue their development if conditions are optimal as regards temperature or flooding. On the other hand, eggs deposited in a wet environment, including eggs deposited in water and into aquatic plants, develop without interruption. Some days after deposition the white or light-yellow eggs turn to yellow or brown.

Egg-laying under water

In several damselflies, the females or even the whole tandem submerge totally during oviposition. Under water, their bodies are covered by a fine layer of air. This continuous film of air on the body and wings allows respiration under water.

Mate-guarding in libellulids: Results of a research project in Namibia

During oviposition, males often accompany female odonates; this is interpreted as *mate-guarding*. By this behaviour the male dragonfly tries to ensure that he becomes the father of the offspring. He cannot be sure of his paternity because, during copulation, he only inserts his sperm into the female's sperm-storage organ, but does not fertilise the eggs. The female fertilises the eggs during oviposition, using the sperm she has received from her partner. However, she may also use the sperm of a later partner. Thus, the male may take advantage of guarding his female until she oviposits.

In dragonflies, three categories are distinguished with respect to mate-guarding:

- The female may oviposit without the presence of a male (*non-guarding*). Although this behaviour may generally occur in all dragonflies, in many species the female is never guarded by the male, e.g. in most Gomphidae.



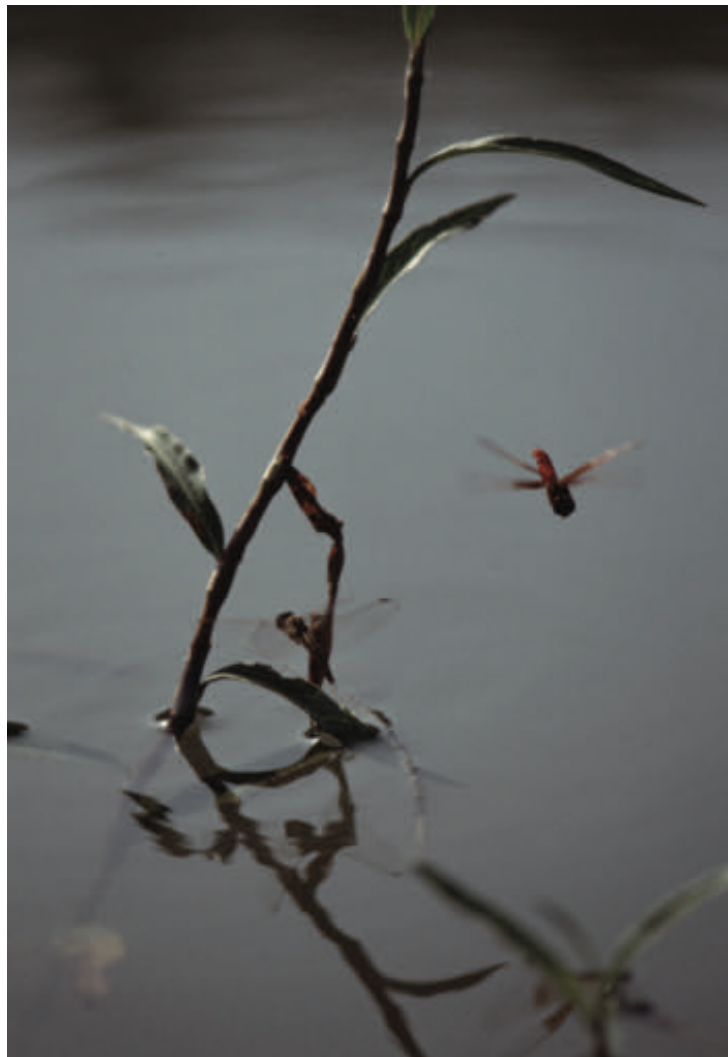
Unguarded oviposition of a libellid female (Olpogaster lugubris)

- The male may guard the female by flying or sometimes sitting very close to her, often somewhat above her (*non-contact guarding*). This is a common behaviour in many dragonflies, shown by species of Calopterygidae, Chlorocyphidae, Aeshnidae and Libellulidae.

- Contact-guarding occurs when the male is connected to the female during oviposition and both fly in tandem. This latter behaviour is common in many Coenagrionoidae as well as in Aeshnidae and Libellulidae. This type of mate-guarding seems to be related to the oviposition site selection. It has often been reported that species laying eggs in tandem repeatedly change sites during one oviposition session, whereas females of other species prefer to stay in one locality.

It is a common feature among organisms living in spatially and temporally variable environments, like most Namibian fresh waters, to produce diverse offspring that follow variable life history strategies. The variability among the number of surviving offspring per habitat increases with the higher numbers of eggs per oviposition site. Therefore, it seems to be advantageous to oviposit many eggs in only a few oviposition sites during one oviposition session. However, this presents a high risk of losing an entire oviposition site if the environmental conditions at that site are bad due to predation or drying out. Each lost oviposition site lowers the females' reproductive success substantially. In contrast, visiting more oviposition sites with fewer eggs per site seems to lower the risk of losing a major part of the offspring.

There might be an advantage to increasing the number of oviposition sites as long as the cost, e.g. the predation risk or in expended energy, of moving from one oviposition site to another, is not high. Consequently, in permanent waters or habitats where eggs and larval stadia are less subject to predation, females are assumed to have a low number of oviposition sites per oviposition session. However, in order to lay more eggs at a single oviposition site, females



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Non-contact guarded oviposition: the male flies close to the female (Brachythemis lacustris)



Contact guarded oviposition in tandem (Africallagma glaucum)

need to spend more time there – which increases their risk of falling victim to a predator or being harassed by other males. In contrast, in temporary waters with a high risk of drying out, females spread their eggs by laying smaller amounts of eggs in each of several suitable oviposition sites. However, for a female to change habitat several times during oviposition bears the risk of her losing her mate. Hence, tandem species need to be well suited for oviposition habitat changes and for dispersing their eggs over wide areas, whereas non-contact-guarded females need to restrict their egg-deposition to one locality.

It was hypothesised that different patterns of egg dispersion should be reflected in the variety of egg sizes within clutches. In non-contact-guarded species, the longer it takes females to oviposit at one place, the greater the risk caused by predation and harassment. Therefore, eggs laid first should be the ones that stand the best chance of development. Similarly, the first-laid eggs ideally produce large larvae with a good rate of development. In contrast, egg sizes in tandem species that disperse their eggs over several oviposition sites are usually randomised over the clutch.

Studying the number of changes between oviposition sites is difficult because one cannot directly identify what the dragonflies treat as different sites. Therefore, eight artificial ponds, each regarded as separate units, were dug in 2001 in the Swakop River valley at Tsaobis. At these ponds, oviposition behaviour of the



Artificial ponds used for experiments at Tsaobis

most common species, mainly libellulids, was observed. The individuals were counted, their eggs measured, and their larvae reared. Examining the number of eggs in each pond and their size distribution after each laying session is virtually impossible in the field. Hence, a simple but effective method developed to achieve this was to capture females during copulation. If caught at this time, females usually start laying eggs as soon as their abdomens come into contact with water – a process known as *hand-held oviposition*. For this purpose a box containing 130 small jars was used, each of which was filled to the brim with water. The female's abdomen was brought into contact with the water surface of all the jars, one after the other, simulating the dip frequencies of natural oviposition (abdomen contacts with water surface per minute). With this method it was possible to tell whether eggs were from the beginning, the middle or the end of oviposition. The eggs were counted in the jars and their lengths and widths measured using a dissecting microscope with an ocular micrometer. Then the larvae were reared to the second larval stadium to see if large eggs were more likely to produce larger larvae, which are better competitors.

The observation revealed that, as expected, the number of habitat changes was lowest in species in which the females were non-contact-guarded or not guarded at all, and highest in tandem species. Egg size within the egg clutches of non-contact species decreased during oviposition. Thus, a rival that might grasp an ovipositing female later would only fertilise eggs with lower chances of survival. It



Treatment of an Orthetrum chrysostigma female to obtain eggs for experimental ecological studies

was found that smaller eggs led to smaller larvae, which generally had reduced survival rates compared with large larvae. Hence, in such cases, a male need not spend too much effort in guarding his mate. Due to the close connection between male and female, tandem guarding is generally more effective in protecting females from being taken over by rivals, particularly when the female oviposits in several habitats. Also, because oviposition takes longer, rival attacks can only interrupt the oviposition episode or force the pair to change the oviposition site – they cannot disrupt it entirely. In the latter case, males have a low risk of losing the paternity of eggs laid at the end of an oviposition session. This gives the species the opportunity to distribute the offspring size, and therefore their chances of survival, randomised over the whole clutch of eggs. Thus, larvae with a high survival rate tend to derive from eggs laid at the beginning as well as at the end of oviposition. So males who take better care of their mates during the entire oviposition session will ensure they have fathered larvae with the greatest chance of survival.

The study also showed that all species that did not employ mate-guarding or that employed only non-contact-guarding were not obligatory migrants (see chapter on migration), but stayed in more or less the same area or migrated irregularly. These species bred in perennial as well as temporary waters. Due to oviposition at one site and the deposition of larger eggs at the beginning of oviposition, mate-guarding intensity was reduced.

By contrast, all tandem species studied belonged to the obligate migrant species. These species migrated regularly and for long distances, and bred in temporary waters in particular. Spreading the spatial risk during oviposition seems to be a good adaptation to temporary waters, where the risk of oviposition sites drying out is high. On the other hand, this risk-spreading requires strong mate-guarding to secure the male's paternity.

Foraging and predation

Feeding and foraging

Dragonflies are aerial predatory insects. They have to behave as opportunists: they take whatever is suitable as prey. While in flight, they grasp flying insects with their six legs. The legs have bristles that project sideways to form a basket with which to catch other flying insects effectively. They may consume them in flight or, with larger prey, after settling. Odonates often congregate in large numbers on the leeward side of trees or above swamps at sunset as the day winds down, especially when mosquitoes or other small insects are about.

Gomphids and most libellulids look for prey while perched, usually sitting on a prominent place like the twig of a tree or bush. Odonates that employ this method of hunting use very little energy. Aeshnidae, Macromiidae and some Libellulidae, e.g. *Pantala flavescens*, *Tramea basilaris* or *Zygonyx torridus*, fly continuously as they search for prey. They can also hunt successfully during long, gliding phases within flight, which are not as energy-consuming as phases of wing-beating. In most damselflies, the feeding strategy is a mixture of the techniques described above. Additionally, many damselfly species are able to grasp small insects from the surface of leaves and twigs – or steal them from spiders' webs.



One dragonfly (Orthetrum trinacria) feeding on another (Trithemis kirbyi)

The time of day and duration of feeding changes throughout a dragonfly's life. The immature insect feeds whenever there is food available, while the adult usually feeds before and after diurnal reproductive activity. Males and females feed in the early morning and near sunset, but females spend a little more time doing so. At noon, both sexes are busy searching for mates, disputing territories, or occupying themselves with preparations for egg-laying.

Some dragonflies are strong enough to capture and eat insects as large as butterflies as prey, while some also feed on other dragonflies.

Odonate larvae are predatory as well. With an extremely rapid strike of their labium (see chapter on dragonfly larvae) they can capture aquatic animals without even leaving their ambush site. They are opportunistic, feeding on anything they can overwhelm. Small larvae feed on rotifers and water fleas; medium-sized larvae consume mosquito larvae and other aquatic insects; and large larvae survive on larger prey including tadpoles and small fish. Beside this, many are also cannibalistic.

Based on differences in their activity, two major types of dragonfly larvae can be distinguished. On the one hand are very active larvae, and on the other are the shy, lurking type. The active type goes out and hunts for prey, while the shy type employs a sit-and-wait strategy. The active ones grow fast and become top predators in their habitats. The shy larvae develop much more slowly, but they are able to survive when fish share their habitat (see chapter on habitats).

Dragonflies as prey



A bee-eater has caught a large gomphid (Phyllogomphus sp.)

A variety of predators are highly interested in adult odonates – particularly at emergence, when their flying skills are poor and their skin is soft. Ants, orb-web spiders and wasps feed on emerging odonates, while many nesting birds feed their offspring on them.

In their immature phase, odonates may fall victim to orb-web spiders and other terrestrial predators such as praying mantids or lizards when they settle on twigs, or to cicindelid beetle larvae when they come to rest on the soil. However, the most effective hunters of dragonflies, may actually be other dragonflies. One can often observe large libellulids or aeshnids feeding on Zygoptera – but also on other dragonflies. Cannibalism, i.e. predation within a species, is not uncommon.



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*A mantid feeding on a dragonfly
(Trithemis kirbyi)*

When the adults hover around water, they are eagerly taken as prey by fish, frogs, water scorpions and other aquatic animals. Dragonfly mortality is especially high during egg-laying, when there is no cover and predators may approach from both the water and the air.

The most prevalent predators of dragonfly larvae are usually fish. However, as described in the chapter on habitats, the larvae of some species of dragonfly have evolved antipredation traits like inactive behaviour or long spines that allow them to coexist with fish. Those that cannot coexist with fish are usually preyed on by other dragonfly larvae, water beetles (Coleoptera) and water bugs (Heteroptera).

Migration and dispersal

In Odonata, *migration* is defined as spatial displacement that typically entails part or all of a population leaving the habitat where emergence took place and moving to a new habitat in which reproduction takes place. In general, dragonflies are highly mobile organisms that may cover wide distances in order to find new habitats because the flight apparatus of adults is well developed. The flight perform-

ance varies among odonates. Damselflies, having smaller wings, usually cannot fly actively over longer distances. This does not necessarily inhibit their ability to reach distant places (see below). By contrast, most of the larger anisopteran dragonflies are powerful flyers. Due to their large wing surface in relation to their body weight, many species, e.g. in the families Aeshnidae and Libellulidae, even have the ability to glide, i.e. to fly longer distances without active wing beats, which is generally rare in insects. Thus, at least these dragonflies can fly economically for quite long distances.

Obligate migration

Migration may be a facultative or an obligate part of the life cycle of a dragonfly. Obligate migration is usually associated with temporal habitat discontinuity, particularly if caused by seasonal drought or seasonal cold. Obligate migration is common in tropical Odonata and particularly widespread among African species. In many obligate migrants, the major range corresponds with the Intertropical Convergence Zone (ITCZ). The ITCZ describes the belt of low pressure encircling the globe approximately along the equator. Due to low pressure, air masses that have collected moisture over the tropical oceans move towards the low pressure. The moisture rains down when these air masses ascend at the low-pressure zone and cool. Seasonal movements of the ITCZ following the apparent movement of



Pantala flavescens, the *Wandering Glider*, is an obligate migrant mostly seen on the wing

the sun cause the seasonality of the rainfalls associated with it. With the arrival of the ITCZ, temporary waters may fill up again with water after the dry season. Obligate migrants travel with the same air masses that bring the rains, which enables them to exploit temporary pools as larval habitats. Typically, these species produce one new generation in the temporary pools; this generation leaves the emergence site and does not return. New results indicate that they may fly back to the regions from which their parents came.

Seasonal migration by dragonflies is easy to spot because gigantic swarms of these creatures may arrive at one specific place. Swarms of several million individual dragonflies have been recorded. A swarm made up mainly of *Pantala flavescens* passed the authors' field station at Tsaobis in the Swakop River valley, which took almost an entire day. These swarms may consist of different species; in Namibia, they are typically made up of *Pantala flavescens* together with some *Tramea basilaris*, and sometimes *Anax ephippiger* and *Diplacodes luminans*, flying in with the first strong rains. Swarms of *Sympetrum fonscolombii*, by contrast, often arrive in the late rainy season. Other Namibian species that have been recorded to migrate this way are *Diplacodes lefebvrei*, *Tholymis tillarga*, *Tramea limbata*, and *Zygonyx torridus*.

The swarms of these migrants may travel vast distances, crossing oceans or the Sahara Desert, and thereby leaving the ITCZ. *Anax ephippiger* often arrives in central Europe in summer, and may be one of the common species there for a short period before it disappears again. The species has even been recorded from Iceland in the North Atlantic Ocean, where no other dragonflies occur. A general characteristic of the obligate migrants is their wide range, with *P. flavescens* being the most widespread dragonfly on earth.

Usually, the active flight during migration is supported by the winds of the ITCZ. However, in China it has been shown that swarms of at least *P. flavescens* even travel against air currents. The migration of Zygoptera, by contrast, needs the support of air currents. Members of the latter family are predominantly small, and the adults probably exercise negligible influence over their orientation during travel. Their only active part in migration is to purposefully expose themselves to the air masses to allow translocation. Most typical Zygopteran migrants belong to the genus *Ischnura*, including the widespread African *I. senegalensis*. Another species that may migrate in such way into Namibia is the tiny *Agriocnemis exilis*.

Facultative migration

In facultative migrants, migration is not an obligate part of the life cycle. Nonetheless, in some years, these species may migrate in huge aggregations. The incidence of such migration events is not predictable. Alternatively, only parts of the populations may migrate. The latter seems to be common in some typical Namibian

desert species, such as *Crocothemis erythraea*, *Trithemis kirbyi* and *T. annulata*. Principally, most dragonflies may migrate at least accidentally into the desert. Even *Olpogastra lugubris* and *Trithemis hecate*, typical species of the perennial northern rivers, have appeared at Tsaobis. The species did not breed at the site, however. Thus, it is easy to imagine that such influxes at perennial waters, which fit the habitat requirements of the adults and larvae, may lead to the establishment of isolated populations. One such example is *Phyllomacromia picta*, another riverine species, breeding at the Oanob Dam. It is not clear which mechanisms guide these species into the desert. It may be that irregularly strong winds translocate individuals. On the other hand, individuals may be attracted by larger swarms of other dragonflies, which they would follow on their way into the desert.

Mechanisms of regular species translocations into the desert

Migration into the desert is highly relevant in order to understand the species diversity in the most arid parts of Namibia. Without migrations, the species number in the few isolated freshwater habitats would probably be very low. Observations by the authors, mainly in the Swakop River at Tsaobis Farm, on the margin of the Namib Desert, revealed that several species enter the desert – among them some rather unexpected ones, who most probably follow the course of the river. Daily observations over long periods between 2001 and 2003 at Tsaobis recorded several such vagrant species, which caused a comparatively high diversity of 25 species observed there during the three-year period. Four mechanisms appear to guide dragonfly species into the desert:

- **The onset of rain:** Species typically arrived every year after or with the onset of heavy rainfalls associated with the southward movement of the ITCZ (see above). Typical species arriving with such rains were the obligate migrants *Pantala flavescens*, *Tramea basilaris* and *Sympetrum fonscolombii*.
- **River vegetation as pathway:** Although the river is dry for most of the year, the band of green riparian vegetation may serve as a pathway for many species. A short-distance exchange between habitats along the riverine vegetation has been observed for *Trithemis kirbyi* at least, by way of individuals that were marked and recaptured at different waterholes over a distance of about 9 km.
- **River discharge:** Masses of *Trithemis annulata* and some *Zygonyx torridus* were observed to occur in the Ugab River in 2001, just after the otherwise dry river had flowed as a result of strong rainfalls in its catchment. Hence, species may generally follow floods in Namibia's ephemeral rivers.
- **Adiabatic winds:** Another arrival event observed at Tsaobis was during an episode of strong winds in autumn 2001 and 2002, when it became cold in the highlands and therefore heavier air masses flowed down the escarpment.

Zygoptera, in particular, arrived, e.g. *Africallagma glaucum* and *Pseudagrion sublacteum*. Such events are known to cause accidental migration into the desert, which may lead to the colonisation of suitable habitats.

Biogeography of Namibian Odonata

Biogeographical patterns

The broad distribution patterns of the dragonflies occurring in Namibia vary from extremely widespread species distributed over greater parts of the world, to species that have a much smaller range, i.e. being distributed only in southern Africa or parts of it. No Namibian endemics are currently known and the occurrence of such species is not very likely. *Crenigomphus kavangoensis*, which has thus far been recorded exclusively in Namibia, is sure to occur in Angola as well, as it is distributed along the Okavango River, which borders Angola. However, it may be endemic to the Okavango River system. The following categories of global species' ranges can be distinguished:

- Species widespread in the Old World tropics and circumtropical species
- Widespread African savanna species ranging into the Palaearctic
- Species occurring in most of sub-Saharan Africa
- East and southern African savanna species, usually absent or rare in West Africa
- Mainly West African species
- Southern African species, which may range northwards to Tanzania, northern Zambia, the southern Democratic Republic of Congo, and southern Angola
- Species (mainly) confined to the upper Zambezi flooded grassland ecoregion, i.e. to the swamp ecosystems from Lake Bangweulu, Zambia, to the Okavango Delta, Botswana, and
- South African endemics.

About 60% of the Namibian dragonflies (shaded grey in the figure) belong to those species that are fairly widespread all over sub-Saharan Africa, while some range into Europe, western Asia or even further. Among these widespread species, four species range as far east as Japan (*Ischnura senegalensis*, *Acisoma panorpoides*) or even Micronesia (*Tholymis tillarga*). *Pantala flavescens* occurs all over the tropics and regularly migrates into the temperate zone. Quite a number of species (16) range into Europe. Most of them are restricted to the southernmost parts of Europe. However, *Anax imperator* reproduces even in Great Britain, and recently spread into Sweden. *Crocothemis erythraea* and *Trithemis annulata* are also currently spreading northwards. *Crocothemis erythraea* reached northern Germany, where it has been reproducing successfully for a number of years, whereas *T. annulata* reached south-western France during the same period. By contrast,

Sympetrum fonscolombii and *Anax ephippiger* only migrate into northern Europe when air currents are optimal. They may reproduce once, but often do not survive the winter season. Most of these widespread species are well suited to living under arid conditions, such as the savanna landscapes across most of Africa. In such landscapes, many freshwater resources are temporary. Therefore, the widespread species have a number of features, particularly short larval development, that allow them to thrive under these conditions (see the chapter on life cycles). Many of these species are also able to migrate over vast distances; some are even obligate migrants, entering the south-western region of the continent with the rainy season following the Intertropical Convergence Zone (see the chapter on migration), e.g. *Pantala flavescens* and *Sympetrum fonscolombii*. Consequently, species of these groups become even more dominant in the more arid parts of Namibia, e.g., in Damaraland, the Naukluft, and the region around Okahandja, making up about 90% of the dragonfly communities in the country (see Plate 4).

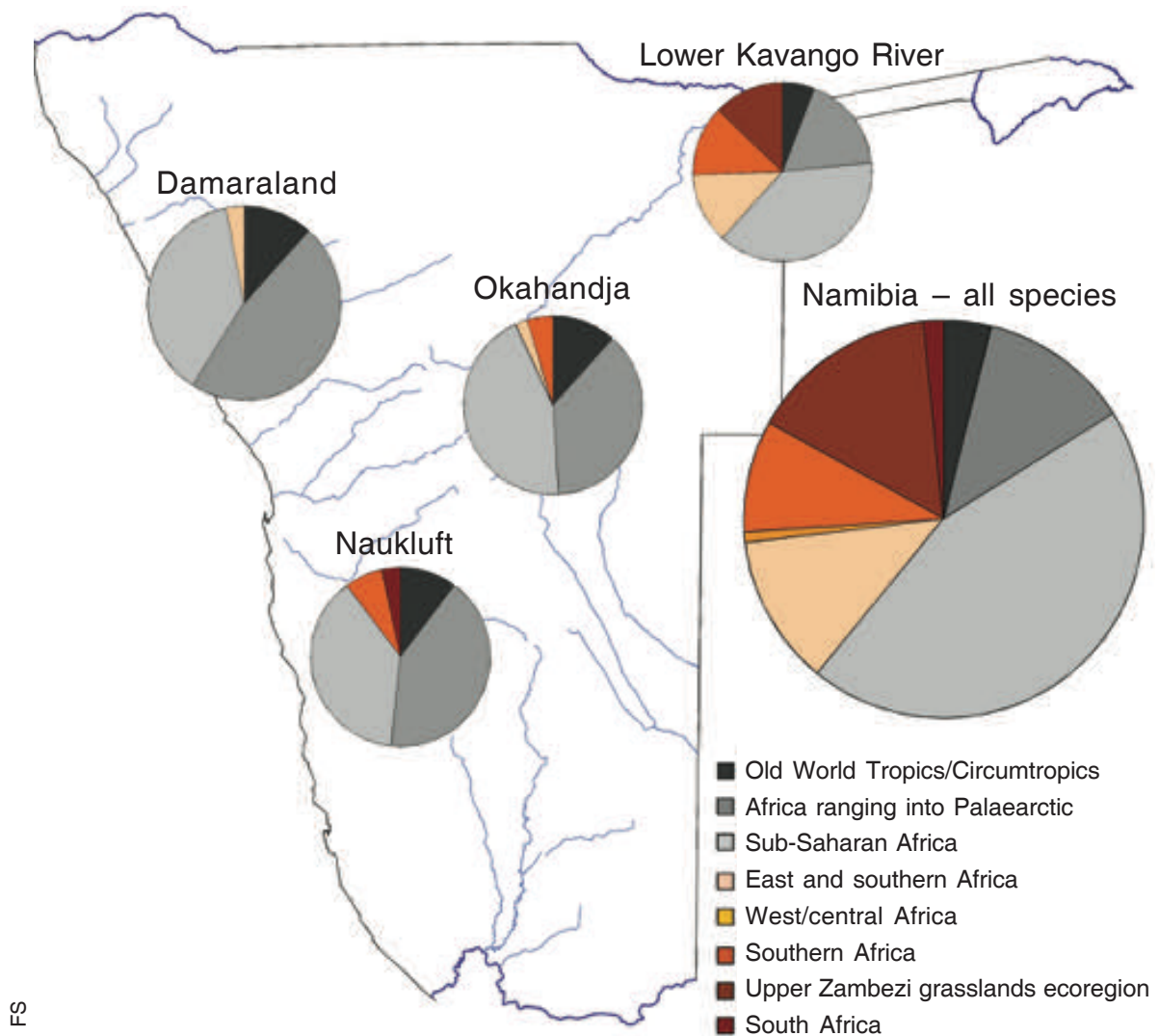


Plate 4: Overview of species composition in different parts of Namibia

The remaining Namibian species are more restricted in their range. About 12% occur in eastern and southern Africa, but not in West Africa, among them proportionally many gomphids (5). These species often have very close relatives in West Africa. In West Africa, for instance, *Gomphidia quarrei* is replaced by *G. bredoi* and *Zygonoides fuelleborni* by *Z. fraseri*. Only one species, *Ceriagrion corallinum*, has a distribution ranging from West Africa into Namibia. It has only been found at a few sites along the Kwando River. If one also takes the Okavango Delta into account, two more West African species have been recorded: *Brachythemis wilsoni* and *Nesciothemis minor*. However, the relationship to West African fauna is much more limited than to East African fauna.

Species that are endemic to southern Africa as defined above make up about 30% of the assemblage of Namibian Odonata. Here, three groups are distinguished: (1) species that are endemic, but are widespread over most of southern Africa; (2) species that are restricted to the upper Zambezi flooded grassland ecoregion; and (3) species that occur only in South Africa and have small populations in Namibia. Of some special interest is the group comprising 20 species that are mainly or exclusively distributed in the ecoregion of the upper Zambezi flooded grasslands of the Kalahari Basin. In Namibia, these are to be found in the Caprivi and along the Okavango River. Many of the species of this group live in swamps or swampy perennial river courses. Thus, they have no closed range, but occur, for instance, in the Lake Bangweulu region and in the Okavango Delta where there are large swamps. In Namibia, a number of these have recently been recorded at the Kwando and lower Okavango Rivers. Examples are *Pseudagrion rufostigma*, *P. deningi*, *Ictinogomphus dundoensis*, *Anax bangweuluensis* and *Trithemis aequalis*. One species of this group, *Paragomphus cataractae*, is a true river species, however, confined to rapids of large rivers. The influx of South African endemic species, by contrast, is comparatively low, but *Pseudagrion vaalense* and *Aeshna minuscula*, being otherwise confined to South Africa, also occur in small populations in Namibia.

Interestingly, a number of species may have colonised Namibia via South Africa. These typically occur in southern Namibia, but some are also found up to central Namibia. These are *Africallagma glaucum*, *Pseudagrion salisburyense*, *P. vaalense*, *Ceratogomphus pictus*, *Crenigomphus hartmanni*, *Aeshna minuscula*, *Trithemis furva* and *T. stictica*. Except for *P. vaalense*, *C. pictus* and *A. minuscula*, all also occur in equatorial Africa, but not in northern Namibia. A colonisation via South Africa, maybe following the Orange and Fish River systems, may explain their restriction to southern Namibia. The Naukluft area in particular, which hosts a unique assemblage of dragonflies (see chapter on habitats), may have been colonised during wetter periods that have occurred in the southern African region several times to date.

Species diversity

Our current knowledge of the distribution of Odonata diversity in Namibia follows two main trends. Firstly, a gradient of increasing diversity from south-west to north-east, with increasing tropical humidity; and secondly, a distribution more or less restricted to permanently flowing waters. By far the highest species diversity occurs at the Okavango River (91 species) and in Caprivi (87), followed by the Kunene River catchment (50). North-eastern Namibia is distinctly more humid and tropical than other parts of Namibia, with higher annual precipitation, less evaporation and warmer winter months. In these areas, a high variety of species that require perennial habitats or even conditions of flowing water occur. The greater part of Namibia is arid and poor in permanent water sources. These arid regions and even the perennial watercourse of the Orange River are comparatively poor in species. In the central highlands, the species number reaches 43, including a number of species otherwise confined to the northern perennial rivers. It is likely that a number of such species irregularly migrate into the central highlands during seasons with higher than average rainfall. Today, some of these species find suitable conditions for reproduction due to the construction of larger dams with associated wetlands. In more arid parts, like the Naukluft Mountains, the species numbers drop to 30. In the southern Kalahari only 18 species occur. The low species diversity along the lower reaches of the perennial Orange River requires attention. Possible reasons are summarised in the chapter on habitats.

Dragonfly habitats in Namibia and their assemblages

Dragonflies colonise almost all kinds of inland waters, but predominantly fresh waters. Some species of Odonata are able to complete their development in waters with highly variable salt concentrations, which may even exceed those of sea water (although the major components in this case, unlike sea water, may not be sodium chloride). Of the Namib Desert species, *Ischnura senegalensis*, *Anax ephippiger*, *Orthetrum trinacria* and *Pantala flavescens* sometimes reproduce in brackish waters. A few species, e.g. *Anax ephippiger*, have even been recorded breeding in marine coastal marshes.

Most wetlands in Namibia depend on local rains or local groundwater resources, except for those associated with large rivers. Such rivers do not originate in the country and, thus, depend almost exclusively on rainfall in the highlands of neighbouring countries, namely Angola and Zambia in the case of the Kunene, Okavango and Kwando Rivers, and South Africa and Lesotho in the case of the Orange River. These rivers have no perennial tributaries originating in Namibia, with the exception of the Kunene, which receives water from small streams in the Baynes Mountains.

Most wetlands in the arid parts of Namibia are temporary. They may directly depend on the irregular precipitation characteristic of Namibia's rainy season or be filled up by water from rivers that flood after rains in their upper catchments. However, some natural perennial waters also occur. Most of these depend on different kinds of springs. In more recent times, human activities have altered the occurrence of wetlands. On the one hand, springs have been damaged by over-exploitation of water, and the amount of water reaching the lower courses of ephemeral rivers after rain has been reduced due to large impoundments and farm dams erected in the upper courses of such rivers. On the other hand, dams have increased the density of long-lasting wetlands, particularly in the highlands. The large impoundments resemble lakes and, therefore, form a type of wetland otherwise absent in the arid parts of the country (except for Lakes Otjikoto and Guinas). To some extent, however, the dragonfly faunas of the large rivers and wetlands in arid areas are linked via dispersal.

Temporary waters

All temporary wetlands have in common that they hold water only for a certain period of the year and, in the more arid parts of the country, for even shorter periods. Often, this period of inundation is unpredictable because rainfall is not evenly distributed over the country, and does not fall always at the same time of year. Dragonflies have specific ecological traits enabling them to develop in temporary waters, one being the ability to circumvent unsuitable conditions in the dry



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Temporary pool filled by flood water at the Palmwag Lodge



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Rain pool in north-eastern Namibia

season (see the chapter on life cycles). In Namibia, species that typically inhabit temporary waters are those that develop rapidly. The most successful species develop in less than 40 days from the time the egg has been laid to larval emergence. Temporary waters that exist for periods much shorter than 40 days would, therefore, not allow successful dragonfly development. However, this does not prevent dragonflies such as *Pantala flavescens* from ovipositing even in rain pools of short duration, because they are not able to estimate how long such a pool will hold water. Therefore, the females distribute their eggs over different pools in order to spread the risk (see chapter on mate guarding). Temporary waters that last for about 40 to 50 days allow only a few species to develop successfully, among them mainly *P. flavescens* and *Sympetrum fonscolombii*. Longer-lasting temporary waters allow the successful development of an increasing number of species, for instance those needing about 45 to 50 days to develop (see chapter on life cycle). Thus, the communities may additionally include *Trithemis kirbyi*, *Crocothemis erythraea* and *Orthetrum chrysostigma*.

Even if a pool lasts long enough to allow the slower-growing species to emerge successfully, it is not a given that they will emerge from it. Dragonfly larvae feed on all prey organisms they can handle, including other dragonfly larvae. Because the density of dragonfly larvae in such pools may be very high, predation among these larvae is evident. The winners are usually those larvae that grow faster than the others because larger larvae feed on smaller ones. Due to high species-specific growth rates, larvae of *P. flavescens* often exterminate almost all other species from temporary pools. In artificial temporary ponds that were installed for three years at Tsaobis in the Swakop River valley in order to conduct research (see chapter on mate guarding), each year the larvae of at least seven species were found. But, each year, around 1,000 *P. flavescens* individuals emerged – almost exclusively. The only other dragonflies that emerged were one individual of *O. chrysostigma* and one of *C. erythraea*. The only way the slower-growing species can survive predation is to colonise the pond at a much earlier phase than more rapidly growing species. Only then will their larvae have reached a certain size before the rapidly growing larvae develop, and thus they can put predation pressure on the later arrivals. This is called the “priority effect”, i.e. the first one in, wins.

Another factor that influences the community at temporary waters is the presence of plants like grasses or rushes. In longer-lasting temporary waters and in those that are not mechanically disturbed by floods, grasses and herbs may grow within a short period and rushes may even survive the dry season. If plants are present, the number of species colonising usually increases because endophytically ovipositing species are also attracted. Thus, such waters may host Zygoptera like *Lestes pallidus*, *Ischnura senegalensis*, *Africallagma glaucum* or *Pseudagrion massaicum*.

Rain pools in northern Namibia generally have more species than those in arid areas of the country not only because they usually last longer, but also because more species that may colonise occur in the north. Typical species in such waters include *Lestes dissimulans*, *Anax tristis*, *Diplacodes luminans* and *D. lefebvrii*.

Perennial wetlands in arid environments

Natural perennial wetlands are rare in the arid environments of Namibia. Most derive from different types of springs. Three major types are distinguished: (1) Wetlands with a sandy substrate along the lower courses of ephemeral rivers; (2) streams, mostly with a rocky substrate, that usually occur in mountainous areas; and (3) relatively stagnant spring-fed pools.

Perennial wetlands in ephemeral rivers

Large perennial wetlands occur along the lower courses of the western ephemeral rivers, for instance in the Hoanib, Hoarusib, Huab and Ugab Rivers, resulting from a resurgence of underground water depending on the surrounding geology or topography. These waters may run for a number of kilometres before evaporating or seeping back into the ground. Typically, they have a mainly sandy substrate, and are here referred to as “sand streams”. These wetlands may be well vegetated with dense stands of reeds and rushes. However, floods following rainfalls in the upper catchments may raise the water levels and the current, dramatically shifting



Sand-stream wetland in the Huab River



Tracks of Paragomphus genei larvae in the sand of the Hoarusib River

and stirring the sandy substrate and washing away most of the vegetation. It is easy to imagine that such strong mechanical disturbances strongly affect dragonflies, either directly by causing damage to the larvae, or indirectly by removing the larval habitats, e.g. the vegetation. Even moderate floods may cause major damage to dragonfly larvae if they do not have the ability to cope with strong current, i.e. they may drift downstream and be deposited in reaches where the water dries up again. On the other hand, when there are no floods for extended periods, most of the water surface may gradually have been covered by vegetation. Very few species of Odonata choose habitats with dense vegetation for oviposition. Hence, as dragonfly habitats, these wetlands vary between being

too harsh due to strong floods and being too overgrown by vegetation. Only the period between these two extremes is appropriate for the majority of species.

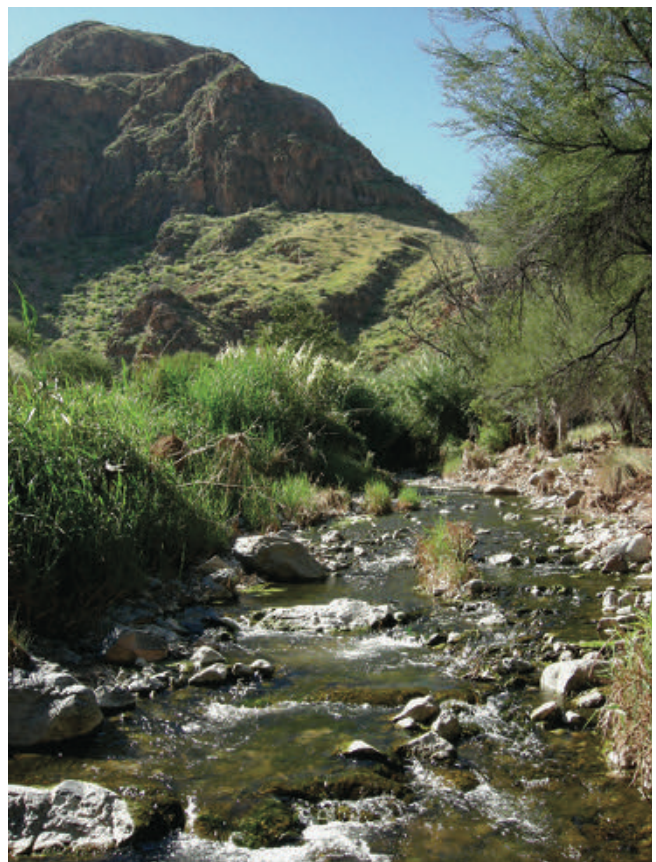
Dragonflies that live in sand streams need to be able to re-colonise an area after a flash flood. Hence, they typically show migration behaviour. Most species also have a rapid life cycle, usually lasting less than 60–80 days, which allows them to develop within a short period under suitable habitat conditions. In these characteristics, they do not differ much from species that live in temporary waters; indeed, the dragonfly assemblages at sand streams differ only slightly from those at temporary waters (see above). However, the sand streams are dominated by different species. Typical species that can be seen there almost throughout the year are *Ischnura senegalensis*, *Paragomphus genei*, *Crocothemis erythraea* and *Orthetrum chrysostigma*. Among these, *P. genei* is best adapted to survive the harsh floods. It is a typical running-water species whose larvae burrow into the sandy substrate. Their rapid digging movements and short legs prevent them from being covered under thick layers of shifting sand. In unvegetated reaches of these sand streams, larval density may be particularly high, reaching more than 100 individuals per square metre. As the density of vegetation increases, however, the

occurrence of *P. genei* becomes less frequent because it oviposits only in open water, while the populations of *I. senegalensis* and *C. erythraea* tend to dominate because they prefer dense vegetation. Besides these, several other species may at least temporarily be seen at sand streams, the most frequent of which being *Anax imperator*, *Diplacodes lefebvrii*, *Trithemis kirbyi* and *T. annulata*. Some obligate migrants colonise seasonally, particularly *Anax ephippiger*, *Pantala flavescens* and *Sympetrum fonscolombii*, and usually produce one generation before they disappear again until the next year.

Spring-fed streams

In the upper catchments of river courses, mainly in mountainous regions, springs may feed small permanent streams. These streams, which usually have rocky substrates, run for a few hundred to a few thousand metres, for instance in the Naukluft or Baynes Mountains. Typically, the morphology of such streams varies along the watercourse, for instance forming deeper pools which may host submerged aquatic vegetation, as well as having swiftly flowing sections and even small rapids and waterfalls. Although strong floods after heavy rains in the catchment may cause some alterations in the course of the stream, the rocky substrate is often stable compared with the sandy substrates under flowing waters. Thus, they provide structurally diverse habitats in only moderately disturbed environments – which are suitable habitats for dragonflies with more restricted habitat requirements. For instance, the development of such species, as demonstrated for the libellulids *Crocothemis sanguinolenta*, *Orthetrum julia falsum* and *Trithemis stictica*, take at least 20% longer to develop than their congeners *C. erythraea*, *O. chrysostigma* and *T. kirbyi*, which also breed in temporary waters and sand streams.

Streams may have unique features providing special habitats for dragonflies. A good example of this can be observed in the area around the Naukluft and Tsaris Mountains, where the abundance of such streams is highest in Namibia. Here one finds streams that flow all



Open Naukluft River

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year, whereas others become stagnant during the dry season and, except for the deeper pools, they partly dry up. Some streams cross steep altitudinal gradients, causing rapids to occur. These may provide a habitat for *Zygonyx torridus* and *Crocothemis sanguinolenta*, which breed exclusively in such stretches. Whereas smaller springs may be completely shaded by large trees, others are widely exposed to the sun. Full shade is only tolerated by a few species, for instance *Orthetrum julia falsum*. The aquatic vegetation also varies. Sedges as well as floating freshwater plants like *Potamogeton* species occur at very few sites. *Africallagma glaucum* may occur in large numbers in streams with floating plants, but the species is rare where such plants are absent. *Pseudagrion kersteni* only occurs at sites with sedges, although it is not clear if there is a direct relationship between them.



*Spring shaded by wild fig trees
at the Zebra River Farm*

In Namibia, another specific characteristic of spring-fed streams is their relative geographical isolation in the arid landscape. Comparable perennial waters may occur only at great distances from each other. For example, a distance of at least 500 km today isolates the streams in the Naukluft area from the nearest neighbouring stream. The more habitat-restricted species typically do not migrate regularly over larger distances. Doing so would be inappropriate behaviour because the probability of finding suitable habitats in the arid landscape is very low. Thus, the individuals should rather stay where they are in terms of finding suitable conditions and partners for reproduction. The three remaining populations of *P. kersteni* in Namibia, for instance, are isolated from each other by about 300, 500, and 800 km, respectively. Hence, the exchange between these populations is likely to be zero. In fact, the Naukluft population is genetically very different from the two northern populations, implying isolation from genetic exchange. Which of the spring-dwell-

ers occurs in a specific area may be influenced by a single historic colonisation event. One example is *O. julia*, which occurs in the Naukluft, the Waterberg and the Otavi Mountains, but not in Damaraland, although the streams there are suitable habitats. By contrast, *Anax speratus* occurs in the Naukluft and Baynes Mountains, but does not occur in between the two. Therefore, the isolation results in distinct differences between one dragonfly community and another in respect of such streams in the various parts of the country.

As discussed above, spring-fed streams provide a habitat for specialised species, while most of the typical species that live at temporary waters and sand streams may occur as well. For this reason, the dragonfly fauna of spring-fed streams is more diverse than that of any other natural freshwater habitat in the arid environment. Therefore, these habitats, in particular, contribute to odonate diversity in arid Namibia. Today, many spring-fed streams in the country are under severe anthropogenic pressure, e.g. habitat degradation due to water extraction or over-use by cattle. They demand special conservation attention that addresses the habitat requirements of aquatic animals. Most such habitats that occur in the Otavi Mountains and at the Waterberg are already widely or totally degraded, and have lost most of their habitat-restricted odonate species.

Stagnant spring-fed pools



Gai As spring

A third type of perennial water is the small, shallow pool filled by a spring. Such springs are often in depressions in flat landscapes, and the amount of water arising from them is not enough to feed a stream. Typically, these habitats are well vegetated, often by rushes but sometimes also by higher reeds. These springs serve as waterholes for game or cattle, which causes some pressure on the structural quality of the habitat, e.g. by feeding on the vegetation or trampling. This may cause some damage to dragonflies as well if the density of game or cattle becomes too high. However, without the animals, the habitat would be completely overgrown by vegetation – with the same consequences as those described for the sand streams. Thus, the dragonfly fauna of such springs is widely limited to the more common and widespread species occurring in a landscape. Species numbers increase towards the north-east, where species numbers are generally higher.

Impoundments and wetlands originating from leaking dams

Large impoundments form large perennial water bodies that do not otherwise exist across most of the Namibian landscape. They come close to natural lakes, with the one major difference being that the water level of impoundments may change rapidly due to human activities. This limits the aquatic vegetation to some extent, which cannot rapidly follow the shifting shorelines. Thus, species ovipositing in water plants do not continuously re-colonise their habitats. Typical species are *Ictinogomphus ferox*, *Ceratogomphus pictus*, *Brachythemis leucosticta* and *Trithemis annulata*, which all prefer larger open areas of water. The larvae live on



Naute Dam in southern Namibia

muddy to sandy substrates and, due to their spines and robust cuticula, may be well protected against predation by the fish that have been released in the lakes. These are accompanied by many common species that regularly show up, and by some rare ones that only occur at certain lakes. The latter are *Trithemis donaldsoni* (at the Sartorius von Bach and Oanob Dams) and *Phyllomacromia picta* (at Oanob). The species mentioned here have in common that they are typical species of large perennial rivers. They would definitely not occur in central Namibia without the impoundments. Indeed, they are most likely to have colonised the impoundments after the dams had been constructed, either from the northern rivers (most species) or the Orange River on the southern border (*C. pictus*).

All larger impoundments leak water to some extent, which forms wetlands below the dams. These may comprise small perennial streams, larger ponds, and swampy areas. Such wetlands are very rich in different habitat structures, e.g. different vegetation, and stagnant and running waters, and, therefore, provide habitat for a wide variety of species. The Sartorius von Bach Dam and the large wetland below the dam wall host the most diverse dragonfly fauna in central Namibia, with more than 40 species having been encountered there. A number of the species found at the dam, such as *Acisoma panorpoides*, *Hemistigma albipunctum*, *Orthetrum machadoi*, *Rhyothemis semihyalina*, and *Urothemis edwardsi*, otherwise occur only in the north of the country, mainly in the backswamps of the larger rivers. Even *Olpogastra lugubris* has been recorded at the dam; this species otherwise only dwells at the large rivers. All of these species may regularly migrate into



Wetland below the Sartorius von Bach Dam

central Namibia, attracted by the large swarms of *Pantala flavescens* entering the country with the onset of the rainy season. The impoundments and the wetlands originating from leaking dams are the only habitats in central Namibia that attract these species and allow reproduction. Whether or not all species successfully breed in these wetlands is, however, unknown. Although perennial streams are formed, which resemble natural spring-fed streams, these are not colonised by the typical Namibian stream species as described above. These obviously were not able to colonise the newly set-up habitats.

Artificial waters: Waterholes and swimming pools

Besides the large impoundments, several other artificial waters exist in Namibia, among them farm dams, concrete waterholes, and swimming pools. All these may attract dragonflies as well, and it is sometimes surprising how many species may be observed. However, only farm dams and, to a lesser extent, waterholes are suitable reproduction habitats for a limited number of species. If these farm dams exist for somewhat longer periods and allow the growth of aquatic vegetation, as found in the upper Kuiseb catchment, they may even be moderately rich in species. Typical species associated with artificial waters are *Pantala flavescens* and *Trithemis kirbyi*. The latter is common all over the arid parts of Namibia, and can be seen even at small artificial water bodies. It is the typical dragonfly that can be observed sitting at swimming pools. Although the females use these ‘habitats’ for oviposition, reproduction is normally impossible due to the cleaning of the pools.



Waterhole at Tsaobis

Wetlands associated with large perennial rivers

Perennial rivers provide by far the highest diversity of possible dragonfly habitats in Namibia. In the river itself, slow-flowing stretches are distinct from rapids and waterfalls, and stretches lined by riverine forest are distinguished from more open or deforested stretches. The large flowing waters are a habitat for quite a number of Namibian dragonfly species, among them the Calopterygidae, Chlorocyphidae, most Gomphidae and all Macromiidae, as well as many species of *Pseudagrion* and *Trithemis* and other libellulids like *Zygonoidea*. Besides the main river channel there are smaller, usually shallow, and sometimes temporary side channels, oxbow lakes, backswamps and pools in the flood plain that are filled when the rivers are in flood.



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A shallow side channel of the Kavango River

Rapids and waterfalls

Rapids and waterfalls are a harsh environment for most dragonflies. Due to the strong current, larvae will be washed away or even damaged by drifting stones. Also, aquatic plants cannot usually grow in the torrent, so the oviposition substrates necessary for endophytic egg-laying species are absent. A number of dragonfly species show specific characteristics that allow them to live in such torrential waters, particularly *Platycypha caligata*, *Paragomphus cataractae* and



Rapids at Popa Falls

Zygonyx natalensis. In Namibia, all three species are restricted to stretches of river that provide such conditions. The larvae of *Zygonyx*, for instance, attach themselves tightly to the surfaces of stones by means of claws on their legs. Furthermore, the flattened legs function like spoilers, so that the current forces the larval body down to the stone. Also, the reproduction behaviour of *P. caligata* and *Z. natalensis* is related to the fast currents. Since no vegetation is available, *P. caligata* females often lay their eggs in pieces of driftwood, which are defended by the males as territories. Other dragonfly species are not that specialised but definitely prefer strong currents, such as *Phaon iridipennis*, *Mesocnemis singularis* and *Elattoneura* sp. These are not restricted to rapids, but can typically be found there. Besides the specialists of fast currents, sections with rapids and waterfalls usually provide the maximum diversity of habitats on a small scale and, therefore, such sections are the most diverse dragonfly habitats in Namibia. For instance, Popa Falls hosts at least 75 species of dragonflies.

Slow-flowing sections of rivers

Along river stretches where the current is weak, fine sediment deposit may occur along with large stands of *Papyrus* or *Phragmites* reeds, as well as water lilies and submerged water plants. The reeds may form a labyrinth of smaller channels meandering through the main flood channel. This is, for instance, the situation along the Kwando River and the Linyanti swamps, as well as in the Okavango Delta.



Kwando River

Thus, the river transforms into a large, well-vegetated wetland through which water permanently runs, providing fresh nutrients as well as oxygen. These habitats have a unique dragonfly fauna that occurs only in the swamps from Lake Bangweulu, Zambia, to the Okavango Delta, Botswana, and parts of Angola. Species present in Namibia include *Anax bangweuluensis*, *Ictinogomphus dundoensis*, *Trithemis aequalis*, *Pseudagrion deningi* and *P. rufostigma*.

Riverine forests and deforestation

The presence of riverine forest is a relevant factor in the composition of the dragonfly community, since a number of species are shade-loving, e.g. *Phaon iridipennis* and *Trithemis aconita*. These only occur at sections of river where shady forest occurs directly at the river bank. Other shade-loving species such as *Lestrogomphus angustus* also tolerate it if forest occurs some distance from the river. At the same time, several widespread species are uncommon because they avoid shade. Thus, forested stretches have rather different dragonfly communities than riverine areas that are naturally without forest or have been deforested. Deforestation of river banks occurs all along the Namibian part of the Okavango River in particular, and very few forested areas are left. The general effect on the dragonfly fauna is that, even at stages of moderate deforestation, some highly specialised shade-lovers disappear while others remain and species that prefer sunny habitats come in. Thus, the general species diversity at such sections of river increases. Thus, these sections may host a wide variety of species of *Pseudagrion*,



Forested section along the Kavango River at Andara



Deforested section along the Kavango River upstream of Rundu

Brachythemis and *Trithemis*, together with some gomphids and macromiids. With ongoing deforestation, however, the diversity will decrease because only the common and widespread species remain. Of course, riverine forest is also the habitat of other, rare organisms; for this reason special measures to conserve it are required in Namibia. Dragonflies respond rapidly to deforestation and may serve as bio-indicators for the condition of riverine forests.

Dead river arms and oxbow or horseshoe lakes

Dead arms of the larger rivers may be only partly connected to the main river channel or even completely disconnected from it. In both cases, such arms form larger stagnant waters in the flood plain, and have much in common with lakes. On the other hand, due to their shape, they still resemble a stretch of a river. For this reason, the dragonfly fauna comprises some species that prefer flowing water, as well as several species associated with stagnant waters. In contrast to many other stagnant waters in Namibia, dead arms of rivers or oxbow and horseshoe lakes usually contain fish, which are major predators of dragonflies. Larval dragonflies co-existing with fish typically have antipredation mechanisms, therefore; for example, they show less movement than species that do not co-exist with fish, hide or are camouflaged to avoid detection, or they have defence mechanisms – usually strong spines – with which to protect themselves. Species typically associated with temporary waters have no such mechanisms and, therefore, do not or rarely occur in such lakes. Characteristic species at more open sections of oxbows are *Brachythemis leucosticta*, *Parazyxomma flavicans*, *Trithemis annulata* and *Ictinogomphus ferox*. Where more vegetation is present, a wide variety of species may be observed. A species that seems to be restricted to reedy parts of oxbows and dead arms is *Sympetrum navasi*.

Backswamps

When the river is in flood, it fills depressions in the flood plains and forms larger or smaller wetlands. Smaller wetlands may dry up after some weeks or months, like most other wetlands in Namibia. Larger and deeper depressions may hold water most of the year. Some characteristics make these habitats unique. Firstly, they are temporarily connected to the river and are, therefore, part of the river. This allows all kinds of river-living organisms including fish and dragonfly larvae to colonise the pools for a certain time of the year. Secondly, they usually have at least some vegetation throughout the year. In the deeper depressions where water remains year-round, swamps occur which may be densely overgrown by higher reeds or by shallow reeds combined with water lilies, such as occurs in the Okavango panhandle. A number of dragonfly species typically occur in such habitats, among others *Agriocnemis gratiosa*, *Diplacodes deminuta* and *D. lefebvrei*, *Orthetrum icteromelas*, *Rhyothemis fenestrina*, and *Trithemis hecate*.



Swamps with small streams in the Linyanti

Smaller depressions that dry up as the season progresses normally have no aquatic vegetation, but may be overgrown by grass. Here, one finds several temporary water species, including *Lestes dissimulans*, *Anax tristis*, *A. ephippiger*, *Crocothemis erytharea*, *Diplacodes luminans*, *Pantala flavescens* and *Tramea basilaris*. Such habitats are also the only sites in Namibia where *Africallagma subtile* have recently been recorded.

Oshanas

A special case of temporary waters fed by flood water are the oshanas in northern Namibia. These seasonal pans depend on rains from the upper catchment of the Cuvelai system, which in good years feed right into the Etosha Pan. On their way south, the waters run along several arms and the large, flattish landscape becomes a wetland. In respect of their ecology, oshanas resemble the temporary wetlands in the flood plains of the large rivers. Due to the regularity of floods, water plants, including water lilies and reeds, may grow in oshanas, providing habitats for a number of dragonfly species. However, since the Cuvelai River does not flow perennially, the influx of real riverine species is limited. Most dragonfly species in the oshanas are stagnant-water species, usually adapted to survive in temporary waters. So far, 28 species have been discovered in the oshanas, which is far fewer than expected. The area is under-surveyed and needs more attention in this respect.



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Oshanas – flooded shallow depressions in the Cuvelai River system

Differences in fauna at perennial river systems

There are considerable differences in the fauna associated with the perennial river systems at Namibia's borders. For example, the Kunene, Okavango and Zambezi Rivers host some species confined to rapids, as described above, but such species are absent at the Kwando River. In turn, swampy sections of river occur in abundance all along the Kwando as well as downstream from Popa Falls along the Okavango River, but are uncommon at the Kunene River. Swampy habitats host several typical swamp species. Most striking, however, is the difference in the dragonfly fauna between the northern rivers and the Orange River at the southern border. Whereas all of Namibia's northern rivers host at least 60 species of dragonfly, the species number at the Orange is only 20. The apparent presumption is that the aridity of the region around the Orange has such a major influence that no flood plain habitats occur there. However, the main river fauna is also poor. This is perhaps attributable to the immediate banks of the river having been treated with pesticides for years, and the effects of these chemicals on the dragonfly community cannot be excluded. Unfortunately, there are not enough historic data from that part of the region to assess the effects of pesticides.

Surveying dragonflies

Odonata fulfil several relevant requirements for bio-indicators, i.e. organisms used as indicators for environmental quality. One requirement is that they are often very specific in their habitat requirements, and may stand for larger communities of other organisms (see chapter on habitats). Another is that dragonflies are relatively easy to survey. Very little equipment is needed to record dragonflies at freshwater habitats. Moreover, adult dragonflies are comparatively easy to identify. With some experience, it is possible to distinguish most species without even catching them. Here, we describe some methods of surveying Odonata.

Before going into detail, it needs to be noted that collecting dragonflies often requires a permit. In Namibia, this can be obtained from the Ministry of Environment and Tourism.

Recording adult dragonflies

Adult dragonflies may be found almost anywhere in a landscape. However, they are most easily recorded at their freshwater habitats where they have to return for reproduction. Exceptions may be some elusive species, some gomphids in particular, that only approach the water for short periods and can more easily be found in forest or shrubland not far from the freshwater areas. The best times for recording adult dragonflies are the sunny and warm hours of the day, when activity at the water is highest. During the rainy season the activity may concentrate to a few sunny hours. Very few species fly while it is raining. Also, few species are active only at dusk and dawn. In Namibia, this applies mainly to the libellulids *Tholymis tillarga* and *Parazyxomma flavicans*, and to aeshnids of the genus *Gynacantha*. However, other aeshnids and libellulids may also fly at dusk. Some species may even fly in total darkness, e.g. some gomphids, but not much is known about this. When searching for particular dragonflies, one needs to take their flight season into account (see chapters on species).

There are two major methods of identifying a dragonfly: (1) catching it, and (2) identifying it without catching it. Both methods need some training. Identification of free-flying dragonflies is, of course, more difficult than identifying those one can hold in one's hand. Thus, the second method requires more experience. Catching dragonflies requires an insect net. This should have a long handle of at least 150 cm. The Japanese often use hand nets made of carbon fibre that can be stretched out to about 600 cm in length, which is useful for catching high-flying aeshnids and macromiids. The net itself should have a circular opening with a diameter of 40–50 cm made of stable wire. The net needs to be deeper than nets for other insects, about 70–80 cm, to prevent the dragonflies from escaping. When catching a dragonfly one should keep in mind that insects generally see human movements

as being in slow motion. Thus, a dragonfly's ability to change flight direction almost immediately, together with being able to fly upwards as well as backwards makes it a little difficult to catch. The easiest method is to catch specimens sitting on a perch. One should approach a dragonfly very slowly, without sudden movements, until a specimen is in immediate reach of the net. Never try to catch a dragonfly from the front. The best is to strike the net over a dragonfly from the back. Specimens sitting on the ground should be caught from above because they will try to fly upwards. In aeshnids and other taxa that fly most of the time, one should wait until the specimen comes really close enough. Usually, these dragonflies fly along the same path again and again. With some patience, one stands a good chance of catching them.



Catching dragonflies with an insect net

Once caught, a dragonfly is not difficult to handle. It is best to hold them with all their wings folded together between your thumb and forefinger. Although the wings look peculiar, they are surprisingly robust structures, provided they are not kinked. However, avoid holding them if your hands are sweaty or if you have any lotion like sunblock on them.

Identification can often be done directly in the field, e.g. by using this or other field guides and identification keys. For some structures, like the appendages or genitalia, one should use a hand lens with a 10x magnification. However, some species are more difficult to identify, for instance in the large genera *Pseudagrion*, *Orthetrum* and *Trithemis*, and need to be kept for later identification. Also, it may be worthwhile collecting some voucher specimens.

Various methods are used to preserve adult dragonflies. Only two are described here, since they have proved useful under Namibian conditions. The first method entails depositing the dragonfly in a paper envelope with all four wings flapped together. The envelope with the insect should be placed on a car dashboard or some other similarly hot place. The heat will kill the dragonfly very quickly and it will be rapidly preserved by drying out. After a few hours, once the insect is completely dry, the whole envelope can be stored in a box with a lid. The box needs to be kept away from ants: if ants find the preserved dragonflies, they will carry them away in pieces. The second method is to preserve the dragonfly in 90-99% alcohol in jars.

Each collection needs labelling. The species name, locality name, preferably the geographical coordinates, the date, and the collector's name should be noted either on the envelope or on a paper label using a pencil.

Identifying free-flying dragonflies in the field is possible for many species. The more specimens one has caught and identified, the more experienced one becomes – and the easier it is to distinguish most species on sight. In general, it is useful to have a close-focus pair of binoculars in order to examine specific details on specimens caught in the field. The binoculars should allow focusing up to just in front of the observer's feet.

For a survey, one should visit each site a number of times throughout the year because the dragonfly community may change due to different flight seasons. Also, the number of visits possible depends on the complexity of the habitat. For instance, at temporary waters one or two visits during the rainy season may be enough. By contrast, forested sites along the northern perennial rivers should be surveyed as often as possible, i.e. at least six to seven times per year.

Collecting dragonfly exuviae and larvae

The key characteristics of most larval keys are based mainly on exuviae, i.e. the skins of the final-stadium larvae, which remain on supports near the water after the adults have hatched. The exuviae, therefore, resemble the final-stadium larva of a dragonfly in all its features. Younger-stadium larvae differ from these, and it is impossible to distinguish between species. Exuviae are relatively easy to find around all kinds of freshwater habitats. In most cases, the final-stadium larva

crawls onto stems of plants such as reeds emerging from the water, or into trees or other vegetation along the edge of the water. Because tree trunks protect the exuviae from being washed away after heavy rains, they are very good collection sites. Gomphidae often emerge on bare ground near the shoreline or even on floating algal mats. For emergence, the larvae may climb up to 3 m into the tree or crawl as far as 20 m away from the shoreline. However, these are maximum distances and, usually, the exuviae are much closer to the water. For collecting, one should carry a few small containers in which to store the exuviae. The date and locality of the collection also need to be written onto a label, allowing a clear localisation of the record. Sometimes exuviae are wet, e.g. if it is raining. In such cases they should be dried to prevent them from decaying. Also, small spiders often use the interior of exuviae as 'homes'. The spiders should be removed to prevent them from spinning silk over the exuviae.

For identification, it will often be necessary to clean the exuviae. A case in point are the skins of those species that live on or are buried in sediment and are covered with mud. For instance, exuviae of the genus *Orthetrum* have mud stuck between the setae which densely cover the body. For cleaning, the exuviae should be soaked in a small amount of water with a drop of washing-up liquid until the mud can easily be removed with a fine brush. Always use a forceps for handling exuviae. Many people prefer soft, flexible forceps made from watchmaker's steel to prevent damaging the exuviae. After the cleaning process, the exuviae should be dried again for storage, or preserved in 70% alcohol. Generally, it is useful to wet the exuviae prior to handling them, because this reduces damage and allows the flexible parts to be moved, e.g. for opening the labium, which may be necessary to count setae.

Collection and rearing larvae is a good method of identifying the larvae of unknown species. After hatching from the exuviae, an adult can usually be identified quite easily, so the characteristics of the larvae can be compared with known larvae of other species.

The best tool for sampling dragonfly larvae is a hand net with a long and robust handle. The frame of the net should have a straight edge to allow sampling of bottom substrates. A solid frame allows collecting between vegetation, e.g. reeds and rushes, while the net gauze needs to be finer than normal fishing nets, e.g. a mesh size of 0.5 mm to 2 mm. Two sampling methods can be applied. The first is to 'shovel' the net back and forth among aquatic weeds, along rushes, and along the bank. The second is the so-called kick-sampling method, during which a current is produced by means of one's foot (hence, kicking the water) or a broom, thus shovelling water and substrate into the net. One should avoid collecting too much mud or debris, since this will hamper finding the larvae. The net is then lifted out of the water and its contents emptied into a larger pan, preferably with a white bot-

tom, which allows one to detect larvae more easily. Dragonfly larvae usually start to move a little while after they have been removed from the water. One should only collect final-stadium larvae, which are likely to emerge within a short period after collection. These are easily recognised by the prominent wing sheets extending over at least half the abdomen. When sampling dragonfly larvae one needs to be aware that tropical waters, particularly in the north, might harbour organisms that threaten human health, such as crocodiles or parasites causing bilharzia.

For transport, the larvae should be kept individually. The containers should not be filled with too much water as the oxygen in the water may otherwise be used up, particularly if the duration of their transport is for an extended period. For the latter, dragonfly larvae are best kept on well-wet filter or tissue paper. Dragonfly larvae are able to breathe in air as long as their respiratory organs are wet.

If, for some reason, the larvae cannot be reared but they need to be preserved, it should be taken into account that the cuticle of dragonfly larvae is thick. If they are simply put into alcohol, the preservative will not penetrate to the stomach so the larva will partly decay, which hampers identification. To avoid this, one should use a needle to make one or more holes in the larval cuticle from the ventral side that will perforate the stomach. In this way, the alcohol can penetrate and preserve the inner organs.

For rearing purposes, it is necessary to keep a single larva in each rearing container to ensure the right association of larvae and adults. The containers should contain some substrate onto which the larva may climb (in the case of Zygoptera, Aeshnidae or many Libellulidae) or some sand for burrowing larvae like Gomphidae. An emergence support that allows the larvae to leave the water also needs to be provided. The container also needs to be closed by a lid, e.g. of gauze.

The water in rearing containers needs to be de-chlorinated and replaced by fresh water every now and then. Aeration of the water is not necessary in most cases, with the exception of some running-water species. The larvae should be fed with mosquito or chironomid larvae or, mainly in the case of larvae that have a shovel-shaped labium, fed with water fleas. Other freshwater organisms can also be used as prey, including mayflies, smaller dragonfly larvae, small tadpoles, and small fish (the latter particularly for Aeshnidae). Larvae should be fed daily and uneaten food remains need to be removed from the containers on a regular basis to reduce the growth of fungi or bacteria. After emergence, the exuviae and emerged adults should be handled as described earlier.

Key to the families of Odonata

The distinctive features and terms used in the following key sections are explained and depicted in the chapter entitled “What is a dragonfly?”.

Distinctive features of the Odonata families that occur in Namibia
(Grey = Zygoptera [damselflies], Blue = Anisoptera [dragonflies])

First distinction	Second distinction	Third distinction	Family
Fore- and hindwing similar in shape	Each wing with more than 4 Ax	Abdomen distinctly longer than wings. Front of head not prominent	Calopterygidae
		Abdomen shorter than wings. Front of head quite prominent	Chlorocyphidae
	Each wing with exactly 2 Ax	Pterostigma above one cell or less; formed as square, rhomboid or parallelogram	Lestidae
		Pterostigma above 2 or more cells; rectangular	Coenagrionoidea
Fore- and hindwing differ in shape: hindwing much broader at base	Discoidal cells dissimilar in fore- and hindwings	Compound eyes separated	Gomphidae
		Compound eyes in contact which each other on top of the head	Aeshnidae
	Discoidal cells similar in all wings	Hind margin of eyes abruptly arched at about mid-height. All species black and yellow; usually fly most of the day	Macromiidae
		Hind margin of eyes not abruptly arched at about mid-height. Most species sit on perches for much of the day	Libellulidae

Calopterygidae [Demoiselles]

Demoiselles belong to the most spectacular odonates, in most cases having coloured wings, metallic coloured bodies, and conspicuous territorial display behaviour among the males. Calopterygids are the largest damselflies in southern Africa. About 160 species of the family are known worldwide. Most African species are tropical forest stream-dwellers. Southern Africa has only three species. In Namibia, only one species, *Phaon iridipennis*, has been recorded. Another species, *Umma femina*, occurs in south-western Angola, while some more species of *Umma* occur in northern Angola. Although the genus *Umma* is not expected to occur in Namibia, a key to both species is presented here for those who may wish to visit southern Angola.

Key to the Calopterygidae

- 1 Body length more than 60 mm. Thoracic suture between front leg and forewing with broad pale borders separating metallic areas. *Phaon iridipennis*
- Body length less than 50 mm. Thoracic suture between front leg and forewing enclosed in metallic areas. *Umma femina*

Phaon Selys, 1853 [Demoiselles]

The genus *Phaon* is endemic to sub-Saharan Africa and represented by only two species, of which *P. iridipennis* is widespread in tropical Africa and the second one is confined to West Africa. For identification see under *P. iridipennis*.

Phaon iridipennis (Burmeister, 1838) [Glistening Demoiselle]

Identification: This is a large damselfly, up to 75 mm in length. Compared with most calopterygids it is less colourful. The body has a metallic, copper-green sheen. The forewings have a mauve iridescence; the hindwings have a translucent amber colour. In most cases the pterostigma is totally missing.



Meaning of scientific name: According to an ancient Greek legend, *Phaon* [Greek “the Shining One”] was a ferryman on the isle of Lesbos. As a reward for carrying Aphrodite, the Goddess of Love, to the island, he received an ointment that made him the most beautiful of men. The species name, *iridipennis*, is a combination of Greek *irid-* – “rainbow” and Latin *penna* – “feather/wing”, in an apt description of the forewings that glimmer in several colours, especially in flight.

Distribution: Widespread in sub-Saharan Africa, and the most common calopterygid in the sub-Saharan region. In Namibia, it is rare and restricted to the northern perennial rivers. Records are from the Kunene, Okavango and Zambezi Rivers.

Ecology and behaviour: Most records in Namibia are from rapids and waterfalls in the rivers mentioned. All sites also share the feature that some shady patches of pristine riverine forest remain. The species is definitely shade-loving, and adults can hardly ever be seen out of the shade. Only occasionally, the males may perch on stems of herbs or on shrubs in the sun, and every now and then display their wings or make short flights to attract females. Oviposition is in plants. The larvae live among submerged vegetation in swiftly flowing water. In Namibia, the flight season seems to be throughout the year, but the highest abundance has been noted in December.

Threats and conservation: In Namibia, the species depends on a type of habitat that is rare and under some severe threat by human activities. Decimation of the riverine forest will definitely cause the population to reduce further.



Chlorocyphidae [Jewels]

Jewels are the most spectacular damselflies in Africa, in most cases having intensively coloured bodies. The males perform a conspicuous territorial and courtship display behaviour. Compared with the Calopterygids, which are long and slender, the Chlorocyphids are short and stout. About 140 species are known worldwide. Most African species are tropical forest stream-dwellers. Females mostly lay their

eggs in driftwood or roots. In southern Africa, the species number is limited to ten, of which most live in northern Zambia and Angola. Only one species, *Platycypha caligata*, has been recorded in Namibia. Another one, *Chlorocypha crocea*, occurs in south-western and west-central Angola. Although the latter species is not expected to occur in Namibia, a key for the members of the two genera is given for those who may wish to visit southern Angola.

Key to the Chlorocyphidae

- 1 Abdomen mainly blue dorsally. (male) 2
- Abdomen mainly brown dorsally; ovipositor at the tip of the abdomen. (female) 4
- 2 Tibiae not foliate; black or black and creamy-yellow. *Chlorocypha crocea*
- Tibiae broad foliate; red on the outer side, white on the inner. 4
- 3 Head frontally black. Tibiae not expanding abruptly. *Platycypha caligata caligata*
- Head frontally mostly red. Tibiae expanding abruptly. *Platycypha caligata angolensis*
- 4 S4 and S5 with black mid-dorsal stripe. *Platycypha caligata*
- S4 and S5 without black mid-dorsal stripe. *Chlorocypha crocea*

Platycypha Fraser, 1949 [Broad-legged Jewels]

The genus *Platycypha* is restricted to Africa. In southern Africa the members are marked by foliate legs in the male. Only one *Platycypha* species occurs in south-western Africa. For identification see under *P. caligata*.

Platycypha caligata caligata (Selys, 1853) [Dancing Broad-legged Jewel]

Identification: In the southern African region, the males are unique in having distinctly foliated tibiae; in mature males the outer side is red and the inner side white. The dorsum of the abdomen is bright blue. The females have the same body shape, with short wings and a thick abdomen, but the tibiae are not foliated and the body colouration is black and brown.



Meaning of scientific name: Greek *platys* – “wide, broad” points to the widened tibiae of the males; *kyphos* – “hunchbacked” is a reference to the prominent clypeus characteristic in Chlorocyphids. Latin *caligatus* – “booted” or “in boots”, describes the conspicuous legs of the males.

Distribution: Widespread in East and southern Africa, and the most common chlorocyphid in the southern African region. In Namibia it is rare and restricted to the northern perennial rivers. Records are from the Okavango and Zambezi Rivers. There are no records from the Kunene River or the slow-flowing Kwando. The subspecies *P. c. angolensis* Longfield, 1959 is known from south-western Angola.

Ecology and behaviour: The Dancing Jewel inhabits fast-flowing stretches of permanent rivers and streams. Males occupy a piece of driftwood as a territory, waiting for females. An owner of a territory defends it against a rival by facing his red legs and blue abdomen towards his rival in intensive flights. When a female appears at the water, lands on a piece of driftwood and tests it with her egg-laying apparatus, the male will begin his elaborate courtship behaviour. He dances half circles around her by waving his stretched legs and facing the white inner sides toward her. When she accepts him, he takes her in tandem by grasping her with his appendages. They fly to a rock or twig for copulation. Afterwards he leads her back to the driftwood and releases her, after which she starts to lay eggs into wet, barkless parts of driftwood. To avoid further copulations, females often land just near an egg-laying female, where they will not be bothered but protected by the male territory owner.

Most records in Namibia are from rocky, fast-flowing sections of river. The genus is exceptional in the family in that it lives at open sites within full radiation of the sun. The larvae live in swiftly flowing water. The flight season seems to be throughout the year because records are from August, September, November and December, as well as February to April.

Threats and conservation: In Namibia, the species depends on a type of habitat that is rare and under some severe threat by human activities.

Note: *Platycypha caligata caligata* is the most well-studied odonate species in Africa. It has also been the subject of a broad range of descriptive and experimental studies utilising a spectrum of scientific applications.



AM

Lestidae, Genus *Lestes* Leach, 1815 [Spreadwings]

Spreadwings are often rather dull and inconspicuous damselflies, which typically perch with the wings half-open. Compared to most other damselflies they have an elongate pterostigma, being as long as at least two other wing-cells. Members of one species may differ in their colouration significantly from conspecifics, depending on their habitat or age. Under arid conditions there is a trend to lose the green colour and black markings. Both types of marking may be more or less covered by a blue pruinosity, especially in males.

Most species prefer temporary waters and may be found in dry bush far from water. Usually, lestid females lay eggs guarded in tandem by the male. They deposit the eggs in stems of rushes and other reedy plants. The eggs may siccate for months until the next rains.

About 160 species in 8 genera occur worldwide. In southern Africa, ten species occur, all belonging to the genus *Lestes*. Four species have been encountered so far in Namibia. In Botswana, *Lestes plagiatus* and *L. virgatus* occur; they are, therefore, considered in the key.

Meaning of scientific name: *Lestes* [Latin pronunciation] is a Greek word for “robber”. Why Leach chose this name he did not indicate.

Key to the *Lestes* males

- 1 Upper appendages straight in lateral view; tips pointing towards each other, like a pair of pliers or forceps ((view from above). 2
- Upper appendages bent downwards in lateral view; tips not pointing towards each other (view from above). 5
- 2 (1) Yellowish wings. Pterostigma bulbous and pale. *L. virgatus*
- Wings hyaline. Pterostigma dark and not bulbous. 3
- 3 (2) Thorax with straight greenish-black stripes above and at the sides; stripes may be partly obscured in the pale form. *L. pallidus*
- Thorax with dark ornamental pattern above and only some dark dots on the sides. . 4
- 4 (3) Pterostigma short (< 1 mm). Sub-basal tooth of upper appendages of male large and angular. *L. dissimulans*
- Pterostigma longer (> 1 mm). Sub-basal tooth of upper appendage small or moderate and rounded. *L. tridens*
- 5 (1) Upper appendages bent only slightly downwards; the tip broad and spatulate. In large species, the hindwing length is 22–28 mm. *L. plagiatus*
- Upper appendages bent distinctly downwards at almost a right angle; the tip tapering and pointed. In smaller species, the hindwing length is 19–23 mm. *L. pinheyi*

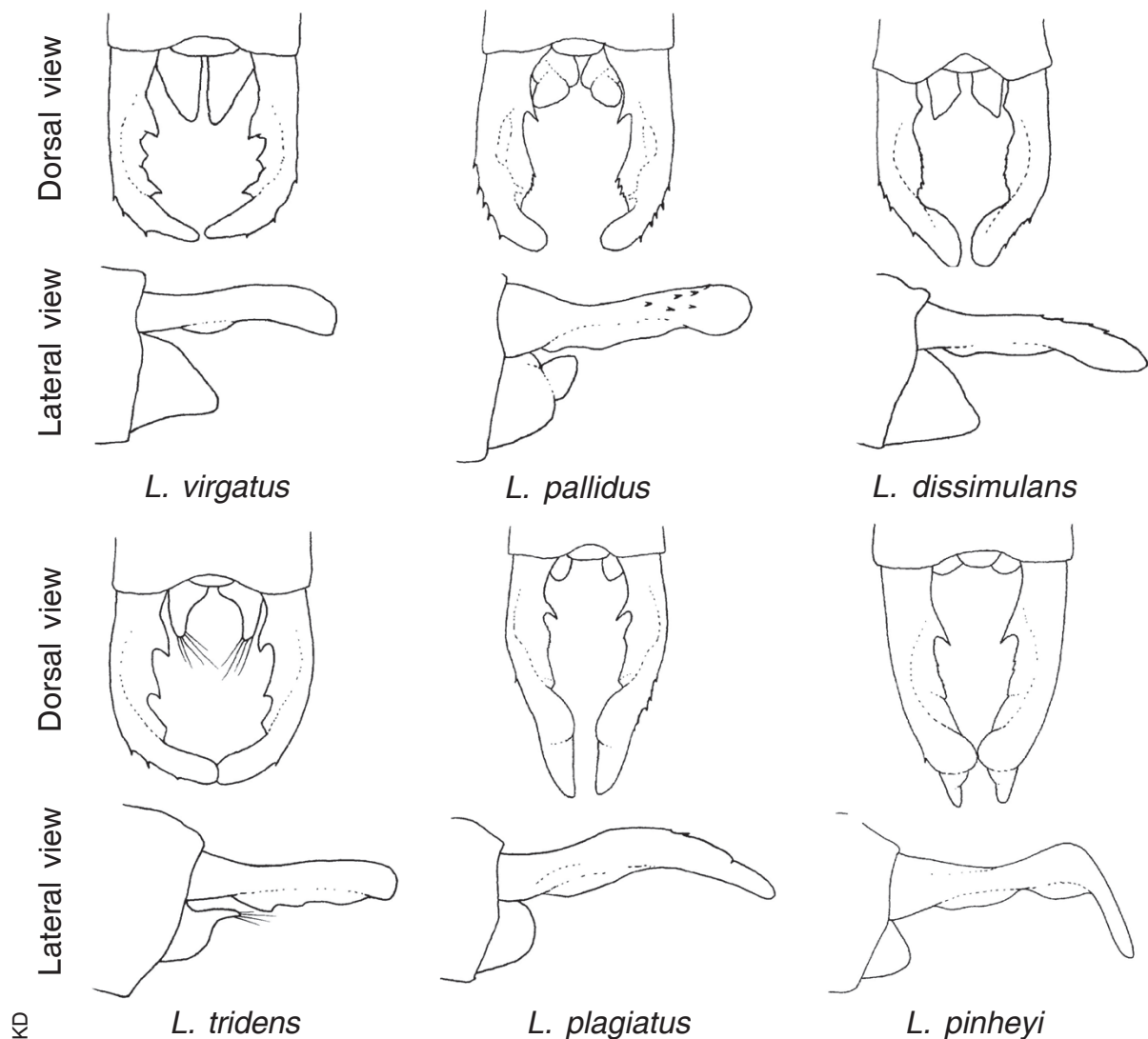
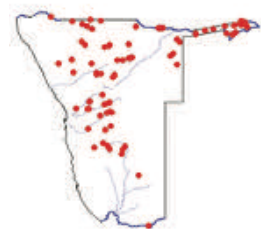


Plate 5: Appendages of *Lestes* males

Lestes pallidus Rambur, 1842

[Pale Spreadwing, Pallid Spreadwing]

Identification: The Pale Spreadwing is very variable in colouration. The thorax, in particular, may range from sandy brown to greenish, blue (from the cover of a bluish wax which extends during the lifespan of the adult) to almost black (from melanism, mostly developing in more humid surroundings). In the arid parts of the country it is predominantly the pale form that occurs. The latter has a sandy brown to pale green thorax, with only weak dark patterns. In these specimens pruinosity is mainly restricted to the sides of the thorax and the last two abdominal segments. In the north, mainly in Caprivi, the knob-like structure on the lower appendages (see Plate 5) should be used for identification.



Meaning of scientific name: Latin *pallidus* – “pale”. The name owes itself to the sandy brown form of the species.

Distribution: The species occurs in sub-Saharan Africa and southern Arabia. This is the most widespread *Lestes* in Namibia, with records in most parts of the country – even in some of the most arid regions.

Ecology and behaviour: The larvae develop mainly in temporary waters with rushes and other reed-like vegetation, including submerged grass. Because they develop from the resting egg stage, they are usually found in ponds that receive water at least every second year. However, single records from the winter imply that the adults may also siccitate, often far away from the water. The larvae develop in a short time. The flight season is throughout the year, but there are few records from the winter season, particularly in the arid west.

Threats and conservation: Not threatened.



JK

Male



ES

Pale female

Lestes dissimulans Fraser, 1955 [Cryptic Spreadwing]

Identification: This species and *L. tridens* are very similar. Secure identification requires an examination of the males' appendages (see Plate 5). The thorax shows a pattern of sin-



gle dark spots on the sides and some ornamental markings on the top. These patterns may be partly covered by blue pruinosity, but remain at least partly visible. In males, the two last abdominal segments are fully covered by a light blue or whitish pruinosity.

Meaning of scientific name: The name *dissimulans* refers to the very similar and closely related taxon *Lestes simulans* [Latin – “simulating, pretending”] and should be understood to mean “not (being) *L. simulans*”. Indirectly, the name refers to similarities with *Lestes tridens*: *L. simulans* was supposed to be closely related to *L. simulatrix* (Latin – “she who is simulating”; McLachlan in 1895 erroneously treated *Lestes* as feminine), while the latter got its name because of its similarities to *L. tridens*.



ES

Distribution: The Cryptic Spreadwing is widespread in tropical Africa. In Namibia, it occurs mainly in the north-east: in Caprivi, along the Okavango River, and in the Khaudum Game Park. A few historic records are from the Otavi Mountains.

Ecology and behaviour: Habitats are temporary, vegetation-rich waters (vleis) that fill after rains. Like the other lestids, the species oviposits into vegetation and the eggs siccitate, protected by plant tissue during the dry season. The flight season in Namibia is from the end of November to March; one record is from August.

Threats and conservation: Not threatened.

Lestes tridens MacLachlan, 1895 [Spotted Spreadwing]

Identification: The species is very similar to *L. dissimulans* in colouration. Secure identification, therefore, requires an examination of the males’ appendages (see Plate 5). In contrast to *L. dissimulans*, only the posterior half of S9 is covered by pruinosity.



Meaning of scientific name: Latin *tridens* – “having three teeth”. In this species, the inner margin of each of the male’s upper appendages carries three teeth.

Distribution: This species occurs from the Ivory Coast and Ethiopia to South Africa. In Namibia, only two females have been collected so far, namely near Tsumkwe in February 1958. The presence of the species in Namibia requires confirmation.

Ecology and behaviour: The species frequents grassy ponds, pans and pools. Nothing is known about its habitats in Namibia, but it can be expected that the specimens were collected in pans.

Threats and conservation: Not threatened.



***Lestes pinheyi* Fraser, 1955**
[Pinhey's Spreadwing]

Identification: *L. pinheyi* males are easy to identify by their upper appendages being distinctly bent downwards at practically a right angle after about half their length. Colour patterns are variable, as in most African *Lestes*. A whitish pruinosity develops laterally and ventrally on the thorax, but not dorsally. The back of the thorax may be very dark pruinose. This pruinosity usually contrasts strongly with the darker top of the thorax. S10 may also be covered by white pruinosity.



Meaning of scientific name: The species was named in honour of Elliot CG Pinhey (1910–1999).

Distribution: *Lestes pinheyi* occurs from Nigeria and Somalia to South Africa (Kwazulu-Natal). In Namibia, all records are from the flood plains of the Okavango, Kwando and Zambezi Rivers.

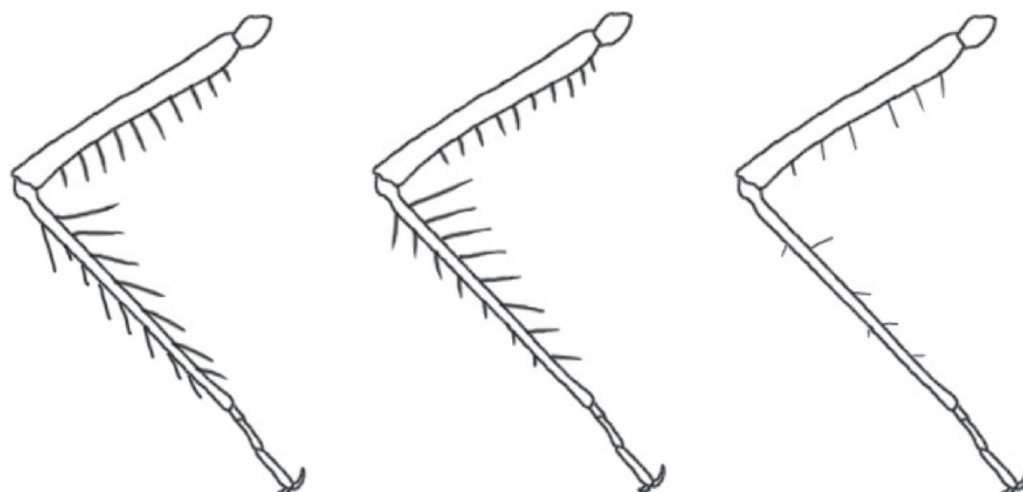
Ecology and behaviour: Of the three more common lestids in Namibia, this seems to be the most restricted. It was never seen in temporary waters outside flood plains. It is most common at temporarily flooded backswamps with dense sedges which dry up only a few months per annum. The flight season may depend on regional flooding. Records of Pinhey's Spreadwing adults from Namibia date from September to December, and from February to March, whereas in the Okavango Delta the species is rare in February and March and most abundant in April and May.

Threats and conservation: Not threatened.



Coenagrionoidea [Narrow-winged Damselflies]

This large group of damselflies comprises three groups that are usually referred to as separate families: the Coenagrionidae, Platycnemididae and Protoneuridae. Each family is very heterogeneous and the characteristics used to distinguish them are either unreliable or do not separate them into natural groups. The genera are, therefore, combined in the superfamily Coenagrionoidea.



OM

Mesocnemis singularis

Elatoneura glauca

Pseudagrion kersteni

Plate 6: Legs of *Mesocnemis singularis* and *Elatoneura* compared with those of *coenagrionids* (*Pseudagrion kersteni*)

Key to the Coenagrionoidea genera

- 1 Legs with hairy appearance due to long and robust setae at all limbs. Males with pruinosity. 2
- Legs with short and inconspicuous setae. Body more slender. 3
- 2 (1) Robust body. Thorax with small black markings. *Mesocnemis*
- Slender body, head twice as wide as the thorax. Thorax with broad black stripes.
..... *Elatoneura*
- 3 Thorax without black mid-dorsal line or field; thorax orange or green. *Ceriagrion*
- Thorax with black mid-dorsal line or field. 4
- 4 (3) Males with red tip of abdomen, female may be entirely red. Arculus stands distal of Ax2 by about its own length. Tiny species, < 25 mm in length. *Agriocnemis*
- Never with red abdomen beyond S2. Arculus stands at or closer to Ax2. Most species larger. 5
- 5 (4) Apex of S10 bears black denticles. Humeral stripe usually with a twist.
..... *Pseudagrion* B
- Apex of S10 without black denticles. Humeral stripe straight. 6
- 6 (5) Upper appendages distinctly branched. Body often covered with pruinosity. Red eyes and red lines on head common. *Pseudagrion* A
- Upper appendages not branched. Body without pruinosity. Eyes blue or green. 7
- 7 (6) Distal end of apex of S10 extended to a bifid projection. Species long and slender, = 40 mm in length. *Aciagrion* (subgenus *Mombagrion*)
- Distal end of apex of S10 not extended to a bifid projection. Species smaller, at maximum 35 mm in length. 8

- 8 (7) Upper appendages distinctly longer than lower appendages. *Aciagrion*
 – Upper appendages about as long as lower appendages. 9
- 9 (8) S8 without blue above, S9 blue above, and S10 sometimes with traces of blue. .. 10
 – S8 and S9 with blue above. 11
- 10 (7) Pterostigma not red; in males, bicoloured with white. Postclypeus metallic.
 *Ischnura*
 – Pterostigma red, not bicoloured. Postclypeus non-metallic. Bluets: *Pinheyagrion*
- 11 (10) S9 above entirely blue. Appendages about as long as S10. ... Bluets: *Africallagma*
 – S9 above black on first half. Appendages shorter than S10. Bluets: *Azuragrion*

OM

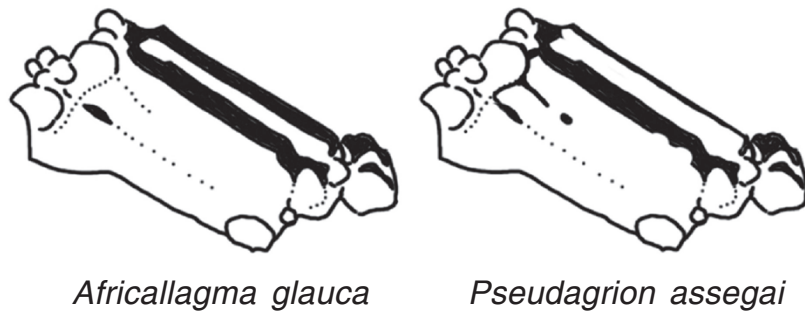


Plate 7: Sides of the thorax of *Africallagma glaucum* and *Pseudagrion assegai*

Mesocnemis Karsch, 1891 [Riverjacks]

Riverjacks belong to the family Platycnemididae [Featherlegs]. The Featherlegs are an Old World group of damselflies. In southern Africa the species number is limited to four. In Namibia only one species, *Mesocnemis singularis*, has been recorded. Besides wing venation there are no family characteristics which distinguish a member from the Coenagrionidae or Protoneuridae, but there are species features which help to identify them easily. The bodies of the odonates in this family are much more robust, while the bodies of the adult males are also covered with a pale blue pruinosity. The genus *Mesocnemis* is endemic to Africa, where four species occur. Most species inhabit open rivers and lake shores, where they prefer to sit on sunny rocks. They are robust damselflies, and have a pale brownish colouring with a few black markings when teneral. The males become entirely dark when mature, and are extensively covered with a thick, whitish pruinosity.

Meaning of scientific name: From Greek *mesos* – “middle” and *cnemís* – “greave, legging”. The second word element, *-cnemis*, is used widely in the generic names of damselflies and is common in the family Platycnemididae. While the genus name *Platycnemis* makes sense literally, meaning “flattened leg” (Greek *platys* – “wide, broad, flattened”), one can understand the name *Mesocnemis* only by interpreting the word elements independently from each other and in relation to other names.

The first element of the name points to a special feature of the wing venation: the position of the arculus is between the two antenodal veins. This is characteristic in the genus, and separates it from the related genus *Metacnemis*.

***Mesocnemis singularis* Karsch, 1891**

[Common Riverjack]

Identification: The body is much more robust than in all other members of the Coenagrionoidea in the southern African region. The body of the adult males is covered by a pale blue pruinosity. Other species in the region with pruinosed blue males are *Pseudagrion kersteni* and *P. salisburyense*; in both, the underside of the eyes is green. The third species, *Elatoneura glauca*, which often co-occurs with *M. singularis*, is much more slender and the areas of pruinosity on the thorax and abdomen form a sharp contrast to the black body, whereas in *M. singularis*, these sharp contrasts are missing.



Meaning of scientific name: Latin *singularis* – “remarkable, unusual, singular”. When it was described, it was emphasised that this damselfly is unique in that the position of the arculus vein lies between the two antenodal veins in the wings.

Distribution: The species occurs from east and west equatorial Africa to South Africa (Kwazulu-Natal). In Namibia, it inhabits the Kunene, Okavango, Chobe and Zambezi Rivers, but there are no records from the Kwando River.



Ecology and behaviour: The Common Riverjack inhabits swift-flowing stretches of rivers and streams. Adults prefer unshaded sections of water. The pale pruinosity on the body prevents this damselfly from overheating. Females lay their eggs in driftwood as well as living woody plant material, being accompanied by the male in tandem. During oviposition the tandems behave socially and form groups. The main flight season seems to be between November and April, but single records occur in July and September.

Threats and conservation: Not threatened.

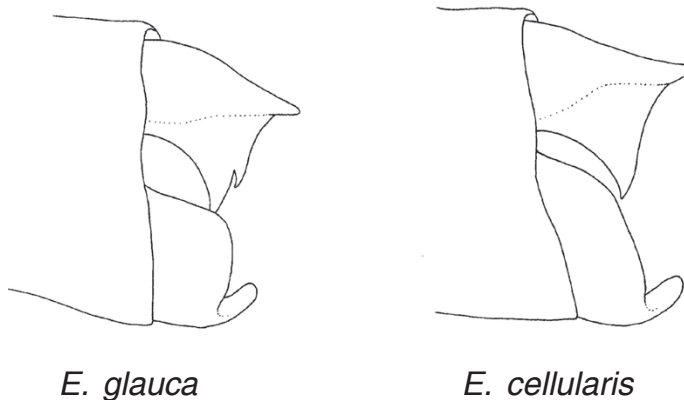
Elattoneura Cowley, 1935 [Threadtails]

Threadtails belong to the family Protoneuridae. They are found in tropical Africa and Asia, but not in Madagascar. Of the over 30 *Elattoneura* species, only three occur in southern Africa. Most *Elattoneura* species favour shaded places along streams. Threadtails are very slender, with the head being much wider than the thorax. All species are pale brown with black markings at emergence; females have a distinct cream-coloured stripe on the side of the thorax. With aging, the males become black with bluish-grey pruinosity and bright blue eyes. In both sexes a narrow pale band at each segment rings the abdomen. Identification of species is difficult due to their similar colouration. The shapes of the male appendages can best distinguish the two Namibian species.

Meaning of scientific name: Greek *elattôn* – “smaller”; *neuron* – (in entomology) “vein in a wing”. The name refers to the reduced length of vein playing a role in Zygoptera systematics.

Key to *Elattoneura* males

- 1 Upper appendages with one tooth touching downwards. *E. cellularis*
- Upper appendages with two teeth touching downwards (these may be very close; best seen in lateral view). *E. glauca*



KD

Plate 8: Male appendages in the two *Elattoneura* species in Namibia

***Elattoneura cellularis* (Grünberg, 1902)**
= *Elattoneura tropicalis* Pinhey, 1974
[Tropical Threadtail]



Identification: The colouration of this species is almost identical to that of *E. glauca*. The only secure identification characteristic is the shape of the male upper appendages, which have only one downward-directed tooth in *E. cellularis*.

Meaning of scientific name: Latin *cellula* – “cell”; *-aris* – “pertaining to”. The name refers to a special feature of the species, namely in the hindwings, near the rear margin and the quadrilateral, two additional cells are formed by a traverse vein.

Distribution: The Tropical Threadtail occurs from equatorial Africa southwards to Botswana, Zimbabwe and Mozambique. The species has not yet been recorded on Namibian territory, but occurs at the Chobe River rapids opposite Impalila Island.

Ecology and behaviour: The habitats are rivers. Insufficient information is available on the flight season in southern Africa.

Threats and conservation: The species is definitely rare in Namibia. However, since it is marginal from its range, conservation is not required.



JK

***Elattoneura glauca* (Selys, 1860)**
[Common Threadtail]

Identification: With aging, the males become black with a sharply contrasting bluish-grey pruinosity on the head and back of the thorax, along with bright blue eyes. In both sexes, a pale narrow band at each segment rings the abdomen. The male upper appendages have two downward-directed teeth. Females are pale brown, having a distinct cream-coloured stripe on the side of the thorax.



JK

Male



JK

Female

Meaning of scientific name: Latin *glaucus* – “bluish-green, grey”; the name refers to the male’s blue pruinosity.

Distribution: The Common Threadtail occurs from equatorial Africa to the Cape, South Africa. In Namibia, the species occurs at the Kunene, Okavango and Zambezi Rivers. To date there have been no records from the Kwando River.

Ecology and behaviour: It inhabits swift-flowing stretches of rivers and streams and is often seen among reeds. The flight season in Namibia may be throughout the year; records are from July, September, November and December, as well as February to April.

Threats and conservation: Not threatened.

Ceriagrion Selys, 1876 [Oranges]

There are about 50 species of *Ceriagrion* in Africa, Europe, Asia and Australia, and more than 20 members of the genus occur in Africa. Of the four species that occur in Namibia, only *Ceriagrion glabrum* is widespread, whereas the others occur only in the north-east. In the southern African region, Oranges are instantly recognised by their unmarked orange to red abdomen. Colours given in the key and descriptions apply to mature living specimens. Differentiation of the species is sometimes difficult; diagnostic are the male appendages (see Plate 9, p. 89).

Meaning of scientific name: From Latin *cerinus* – “waxen, wax-coloured” and Greek *agrion* – “that which is living in the fields, wild”. The first word element points to the yellowish colouration of most members of the genus, while *agrion* was a genus name composed by Fabricius to comprise all damselflies. The latter element was later used in compound genus names to indicate that the new genus belonged to the Coenagrionidae, while the first part of the name alludes to a species in the new genus.

Key to the *Ceriagrion* males

- 1 Upper appendages about twice as long as lower ones, with prominent internal tooth at mid-length. Mature males mainly bright red and black. *C. katamborae*
- Upper appendages at most only slightly longer than lower. Internal tooth or angle, if present, is small. Mature males mainly orange with green or yellow at thorax. 3
- 2 (1) S10 with black denticles on the back. *C. glabrum*
- S10 without such processes. 2
- 3 (2) Head and thorax bright green, sharply contrasting to red abdomen. Lower appendages distinctly longer than upper ones. *C. corallinum*
- Head and thorax of similar colour as abdomen (pale red/orange). Lower appendages about as long as upper ones. *C. suave*

Ceriagrion katamborae Pinhey, 1961
[Katambora Orange]



Identification: The head and thorax are red to reddish brown. The eyes are brown and the face is white to bluish-white. The abdomen is dark red, with S3–7 dorsally, often blackened and separated by a thin, distal red line. The species appears entirely dark red from a distance and is the only damselfly species of this colour.

Meaning of scientific name: Named after the village of Katambora, Zambia, where a single male was collected at a stream flowing into the Zambezi River in October 1960.

Distribution: The species occurs in Zambia, Namibia and Botswana. In Namibia, it has only been recorded at the Okavango River in the Mahango Game Reserve. It may also occur at the Kwando River.

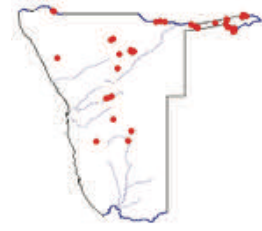
Ecology and behaviour: Individuals have been observed in a backwater swamp and among reeds and papyrus at a river channel in the Mahango Game Reserve. The species has been observed flying in November and December.

Threats and conservation: Not threatened.



JK

***Ceriagrion glabrum* (Burmeister, 1839)**
[Common Orange]



Identification: The head and thorax are yellow to reddish-brown; the eyes are greenish. The abdomen is a bright orange-red in fully mature males, and dull orange in immature males. Females are brownish. The males have distinct distal denticles on top of S10, which do not occur in the other *Ceriagrion*.

Meaning of scientific name: Latin *glabrum* – “without hair, smooth”. In his first description Burmeister said that this species was very smooth.

Distribution: The species is widespread in sub-Saharan Africa, on the Arabian peninsula, and on the African Indian Ocean islands. In Namibia, it is common and widespread along the Okavango River and in Caprivi. In the rest of the country it is more scattered, occurring south to Mariental (Hardap Dam).

Ecology and behaviour: The Common Orange occurs along swampy river sections and in seasonal rain pools in Caprivi and along the Okavango River. In the more arid regions it is found at well-vegetated perennial waters including streams and wetlands formed by leaking dams. The flight season is throughout the year.

Threats and conservation: Not threatened.



***Ceriagrion corallinum* Campion, 1914**
[Coral-red Orange]



Identification: The males are very conspicuous, having a coral-red abdomen and bright green thorax and head. The photograph shows a male that is not yet fully mature; his colours will become brighter with maturing. The colouration is diagnostic and cannot be confused with that of other *Ceriagrion*. The females are more similar to all other *Ceriagrion* females.

Meaning of scientific name: Latin *corallinus* – “coral red”.

Distribution: The species occurs from West Africa to Uganda, and southwards to Angola and Botswana. In Namibia, it has only been recorded at the Kwando River.

Ecology and behaviour: Not much is known about the ecology of this species. The adults were observed perching in the dark shade of trees on a slope close to a reedy swamp. Records were from December to April, but the flight season may be longer.

Threats and conservation: A rare species in Namibia, but may not yet be threatened.



***Ceriagrion suave* Ris, 1921**
[Pleasant Orange]



Identification: In colouration this species is most similar to *C. glabrum*, but often duller. Head and thorax are pale brown to orange. The eyes are green. The abdomen is orange-red. The females are brownish. The Pleasant Orange can be distinguished from the Common Orange by the lack of denticles at segment 10.

Meaning of scientific name: The Latin word *suavis* means “sweet, pleasant, aesthetically attractive, charming”.

Distribution: The species is widespread in tropical continental Africa. In Namibia, most records are from the Okavango and Zambezi River flood plains; few records are from the Khaudum Game Park and the western Caprivi Game Park.

Ecology and behaviour: The Pleasant Orange has been observed at oxbow lakes and backwaters, and often also at rainpools in Caprivi. The flight season may be throughout the year.

Threats and conservation: Not threatened.



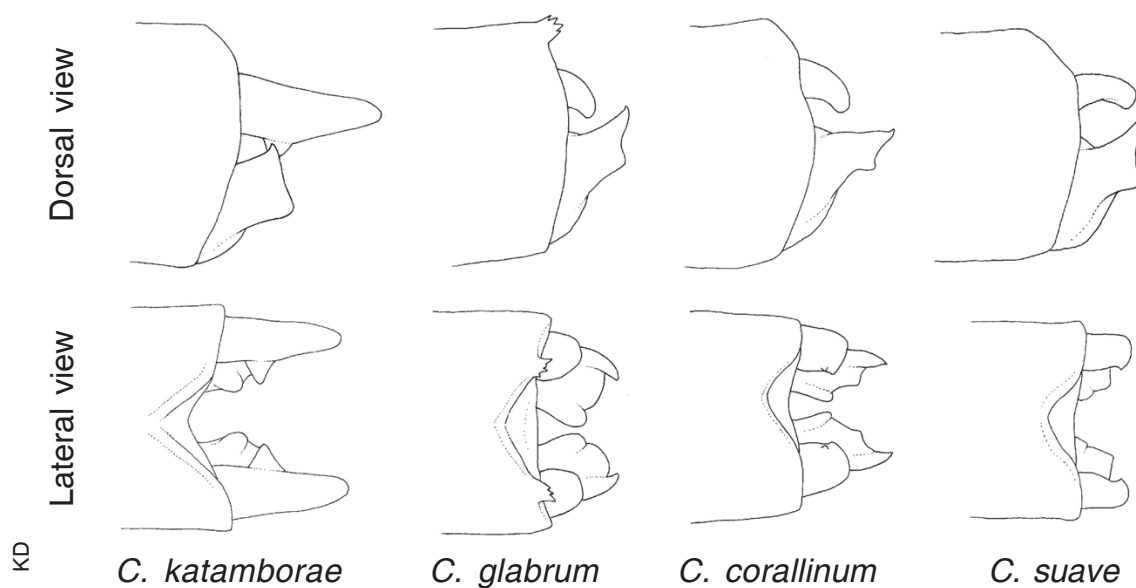


Plate 9: Appendages of *Ceriagrion* males

Agriocnemis Selys, 1869 [Whisps]

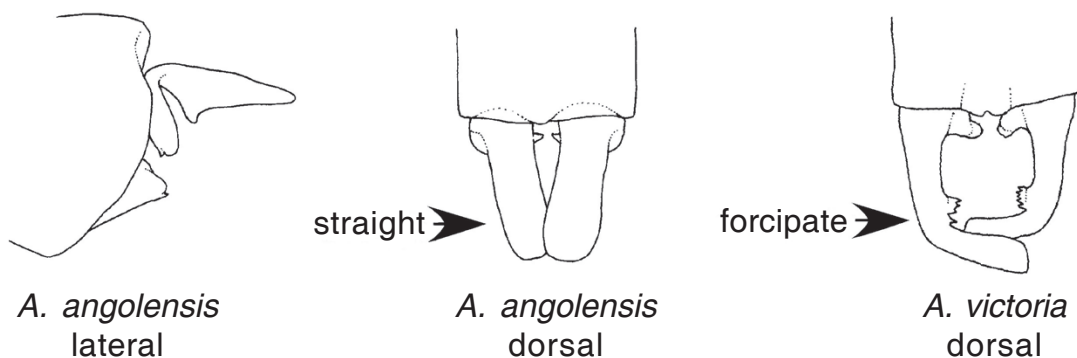
Whisps occur from Africa to Asia, Australia and the Pacific islands. Seventeen of the 40 species are African. In Namibia, five species have been found, of which all except *Agriocnemis exilis* occur exclusively along the perennial northern rivers. They are among the tiniest odonates: many individuals of the species occurring in Namibia have wings shorter than a centimetre. It is possible that their small size may help some species in colonising very isolated habitats like desert ponds or oceanic islands by drifting as “aerial plankton”. Most species live among dense grassy or reedy vegetation standing in water. Because of their size and their inconspicuous short flights between blades of grass, they are easily overlooked. The species occur in different colour forms, depending on sex and age. Males of all species have a reddish tail end, but very mature specimens of some species have blackened tail ends and may also develop white pruinosity on parts of the head and thorax. Colouration is, therefore, not a good key characteristic. Descriptions refer to mature males, but younger ones may be very different, e.g. with a reddish abdomen or a bluer thorax. The best diagnostic characteristics are the male appendages, which demonstrate high diversity, whereas females are difficult to identify. The key will only refer to male characteristics.

Meaning of scientific name: Greek *agrion* means “that which is living in the fields, wild”; *agrion* was a genus name composed by Fabricius to comprise all damselflies. The latter element was later used in compound genus names to indicate that the new genus belonged to the Coenagrionidae. The word element *knemís* – “greave” was used firstly in *Platycnemis* with reference to the tibiae and is widespread in the generic names of the damselfly groups Platycnemididae and Coenagrionidae.

Key to the *Agriocnemis* males

- 1 A distinct black line on the side of the thorax projecting to the mid-leg; underside of the eyes black; both features also in females; male upper appendages forming a forceps. *A. victoria*
- No black line on the side of the thorax; mostly a small black spot near the wings; underside of the eyes not black. 2
- 2 (1) Upper appendages distinctly longer than lower ones; finger-like. *A. angolensis*
- Upper appendages not longer than lower ones. 3
- 3 (2) Lower appendages slightly longer than upper ones and S10. *A. gratiosa*
- Lower appendages as long as upper ones and shorter than S10. 3
- 4 (3) Apex on the dorsum of S10 distinctly raised. *A. ruberrima albifrons*
- Apex on the dorsum of S10 not raised. *A. exilis*

Upper appendages longer than lower



Upper appendages not longer than lower

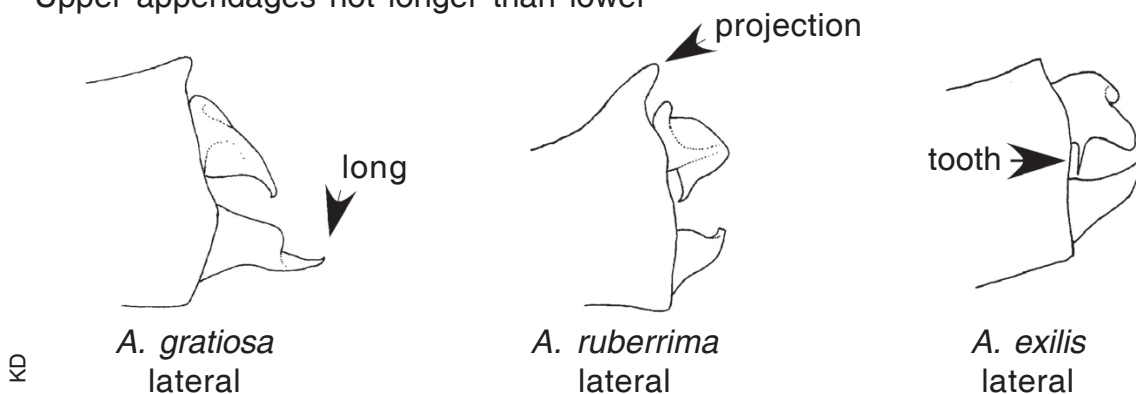


Plate 10: Appendages of *Agriocnemis* males

Agriocnemis victoria Fraser, 1928 [Victoria Whisp]

Identification: Diagnostic in both sexes are the distinct black line on the side of the thorax projecting to the mid-leg, and



the black underside of the eyes. The male upper appendages form a forceps. The dorsum of the abdomen is mostly black from S1–S7/8, while S8–10 are red.

Meaning of scientific name: Named after Lake Victoria, where specimens of the new species were collected at the Ugandan shores in 1927.

Distribution: This species occurs in western Africa and Uganda, southwards to Angola, Zambia, Namibia and Botswana. In Namibia, it is restricted to the Kwando River.

Ecology and behaviour: The adults fly at the swampy and grassy margins of the Kwando River. The flight season in Namibia is at least from August to March.

Threats and conservation: Not threatened.



***Agriocnemis angolensis* Longfield, 1947**
[Angolan Whisp]

Identification: Diagnostic in males are the tip of the club-shaped abdomen and the finger-like upper appendages. The dorsum of the male's abdomen is pale blue with broad black markings from S1–S7. S8–10 are red.



Meaning of scientific name: From Latin *angolensis* – “from Angola”; the type specimen of this species is from Sangévé, southern Angola.



Distribution: The species lives in Angola, Zambia, Botswana and Namibia. In Namibia, it only occurs at the Kwando and Okavango Rivers.

Ecology and behaviour: The Angolan Whisp is a typical species of the Kalahari basin perennial river systems. It inhabits swampy and grassy fringes of rivers. The flight season in Namibia is at least from September to April.

Threats and conservation: Not threatened.

Agriocnemis gratiosa Gerstäcker, 1891 [Gracious Whisp]

Identification: Diagnostic in males is the length of the lower appendages, which are distinctly longer than the upper appendages and S10. The dorsum of the male's abdomen is greenish with broad black markings from S1–S7; S8–10 are red. With a maximum abdominal length of 21 mm in males, the species is the largest member of the genus in the southern African region.



Meaning of scientific name: The Latin adjective *gratiosus* means both “gracious, kind” and “respected, favourite”. This name is supposed to refer to the charming quality of the species, like other such names (e.g. Latin *jucunda* – “pleasing, appealing”).

Distribution: The Gracious Whisp occurs in continental Africa from southern Sudan and the Democratic Republic of Congo to Namibia, Botswana and South



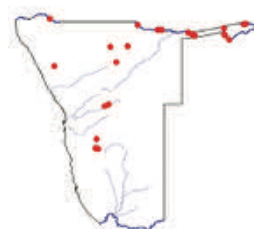
Africa (Kwazulu-Natal), and also on Madagascar. In Namibia, it has been encountered only along the Okavango River from about Rundu to the Mahango Game Reserve.

Ecology and behaviour: The species dwells at swampy and reedy fringes of rivers. The flight season may be throughout the year, except for the winter months of April through August.

Threats and conservation: Not threatened.

Agriocnemis exilis Selys, 1872 [Little Whisp]

Identification: Diagnostic in males is the needle-like projection facing downwards in the middle of the upper appendages. This characteristic is visible from the side only with the use of a hand lens or microscope. The male's abdomen is mainly orange-red on S8–10. The back of S1 to S7 is widely black in mature males, and orange-red in immature males. The dorsum of the male's abdomen is pale blue with broad black markings from S1–S7, S7–10 are orange-red.



Meaning of scientific name: From Latin *exilis* – “lean, slender”; this tiny species is rather thin.

Distribution: The Little Whisp is widespread in sub-Saharan Africa, from Senegal and Ethiopia to Namibia, Botswana and South Africa (Kwazulu-Natal). It also occurs on the Comoros, Madagascar, Réunion and Mauritius. In Namibia, the species is common along the north-eastern perennial rivers and scattered southwards to the Tsaris Mountains.

Ecology and behaviour: The species prefers swamps or swampy margins of pools. In the arid western parts of Namibia it mainly occurs at perennial streams but also at some temporary waters. The flight season in Namibia seems to be throughout the year, with the exception of the winter months May to August in the central highlands.

Threats and conservation: Not threatened.



Agriocnemis ruberrima albifrons Balinsky, 1963
[Orange Whisp]

Identification: The male's abdomen is mainly red on S8–10. The back of S1 to S7 is widely black. In mature males the frons is covered with a whitish pruinosity.



Meaning of scientific name: Latin *ruberrimus* – “the reddest”, but this should not be taken literally. Certainly, it is a mostly red species, but there are others in which immature males show a much more shining red. Latin *albifrons* – “with a white forehead” relates to the conspicuous pruinous white frons in the males of this subspecies.

Distribution: Whereas *Agriocnemis ruberrima ruberrima* Balinsky, 1961 is restricted to the Richards Bay area in South Africa, the Namibian subspecies occurs mainly in the Okavango Delta. There is also a record from the Barotse flood plain in Zambia. In Namibia, only one individual has been recorded to date, namely in the Mahango Game Reserve in 2005.



Ecology and behaviour: The single individual was encountered among a higher stand of papyrus, which is also a major habitat in the Delta. The flight season is unknown; the only record was from December.

Threats and conservation: The occurrence in Namibia is marginal; the species is not threatened because a large population occurs in the Okavango Delta.

Pseudagrion Selys, 1876 [Sprites]

The genus *Pseudagrion* is one of the largest in Odonata, including approximately 140 species worldwide. Nearly 100 species occur in Africa and Madagascar. The genus reaches the Levant, Japan, Samoa and Australia. Sprites are medium-sized and slender damselflies. However, due to their high morphological diversity, it is hard to describe simple general characteristics and to separate the genus as a whole from other genera such as *Aciagrion* or *Africallagma*. Additionally, there has been quite some taxonomic confusion – mainly caused by age-dependent changes of colouration and the loss of colour in collected specimens. Thus, the colouration of the eyes, although one of the most striking specific characteristics in the field, is usually not given in species descriptions. The identification of females, which mostly show differences in marking from males, is a challenge and difficult in the field, except when a female is in tandem or a copulation wheel.

The continental African forms can be separated into two major groups. Group A has no terminal spines on S10 in the male adult, and mostly inhabits running waters in forests. Namibia is poor in these forms. So far only two species, *P. kersteni* and *P. salisburyense*, are known in Namibia; both carry a blue wax on their body, which is characteristic for species of Group A living under more open conditions. Three other species of Group A known from neighbouring countries are included in the key. In Group B, the males have terminal spines on S10. These species live in more open habitats, some also in stagnant and temporary waters.

Group B forms the majority of species in Namibia. In our key these *Pseudagrion* are separated into three sub-groups, based mainly on the colour of the eyes and thorax in mature living males. However, the best diagnostic features are the shapes of the male appendages (see Plates 11, 13 and 14).

Meaning of scientific name: From Greek *pseudo*- – “false” and *agrion* – “that which is living in the fields, wild”. *Agrion* was created by Fabricius in 1775 as a genus name to comprise all damselflies; later on, this element was used in compound genus names to indicate that the new genus belongs to the Coenagrionidae. The name of this genus derives from the fact that it is not easily distinguished from *Coenagrion* (then *Agrion*).

Key to the mature *Pseudagrion* males

- 1 Apex of S10 lacks black denticles. (Group A) 2
- Apex of S10 bears black denticles. (Group B) 6

Group A

- 2 (1) Thorax and other parts of the body with blue pruinosity. Postocular spots blue; eyes not red. 3
- Thorax without blue pruinosity. Postocular spots not blue; eyes red. 4
- 3 (2) Pruinosity of body pale blue; postocular spot of the same colour. *P. kersteni*
- Pruinosity of body dark blue; blue of postocular spot much brighter. ...*P. salisburyense*
- 4 (2) S8 dorsally black; small blue markings only on S9 and 10.*P. fisheri*
- S8 dorsally blue. 5
- 5 (4) Second black line on the side of the thorax short, parallel to the third black line (Plate 12).*P. angolense*
- Second black line on the side of the thorax long, obliquely reaching the third black line (Plate 12).*P. hageni*

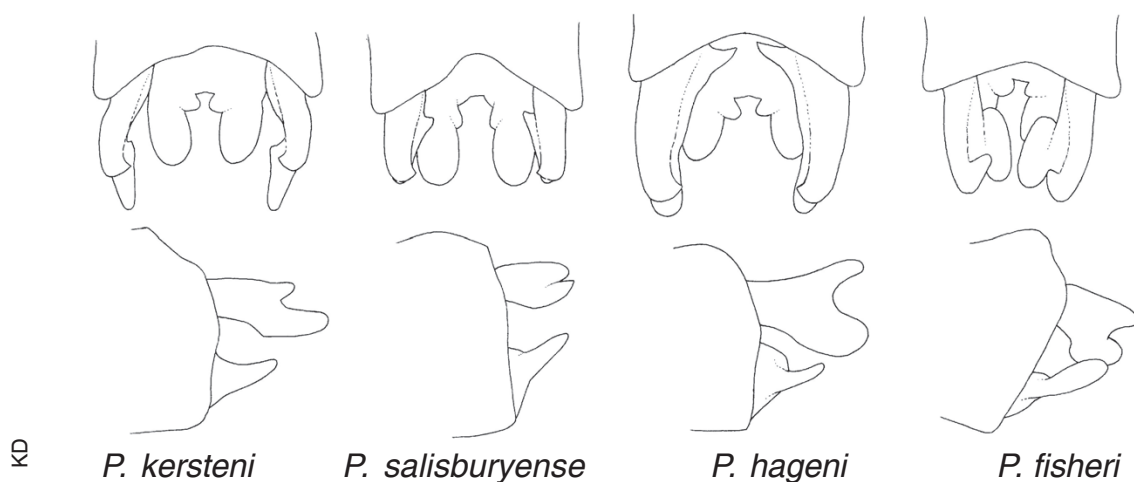


Plate 11: Shape of terminal appendages of *Pseudagrion* Group A in ventral and lateral views

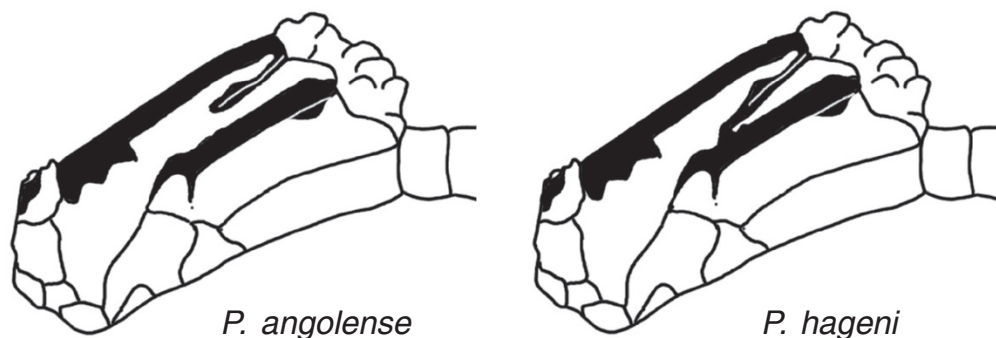


Plate 12: Thorax markings of *Pseudagrion angolense* and *P. hageni*

Group B

- 6 (1) Eyes predominantly red or reddish. 7
 – Eyes predominantly greenish, without any red. 15

Group B: Red-eyed

- 7 (6) Eyes black above. *P. commoniae nigerrimum*
 – Eyes not black above, but in some cases dark reddish. 8
 8 (7) Thorax above dark brownish or purplish, sometimes pruinose. 9
 – Thorax above vermillion red. 11
 9 (8) Postocular spots blue. *P. sudanicum rubroviride*
 – Postocular spots missing (Plate 15) or having another colour than blue. 10
 10 (9) Thorax above brownish to almost black. Eyes brownish-red (maroon). ... *P. hamoni*
 – Thorax above purplish. Cherry-red eyes. *P. sublacteum*

Group B: All red-eyed with a vermillion thorax

- 11 (8) S8 and S9 with broad black bands covering one third to half the segment lengths. Lower appendages point upwards. *P. acaciae*
 – S8 and S9 without such broad black bands, at maximum with thin black terminal lines. Lower appendages point backwards. 12
 12 (11) Lower appendages with a midway upward-projecting tooth. Upper appendages distal with one tip in ventral view. 13
 – Lower appendages straight without an upward-projecting tooth. Upper appendages distal with two tips. 14
 13 (12) Lower appendages about as long as upper appendages in ventral view. *P. massaicum*
 – Lower appendages shorter than upper appendages in ventral view. *P. vaalense*
 14 (12) Upper appendages bulbous and about as long as lower appendages. Sides of thorax bright red. *P. rufostigma*
 – Upper appendages not bulbous and shorter than lower ones. Sides of thorax greenish to orange. *P. sjoestedti jacksoni*

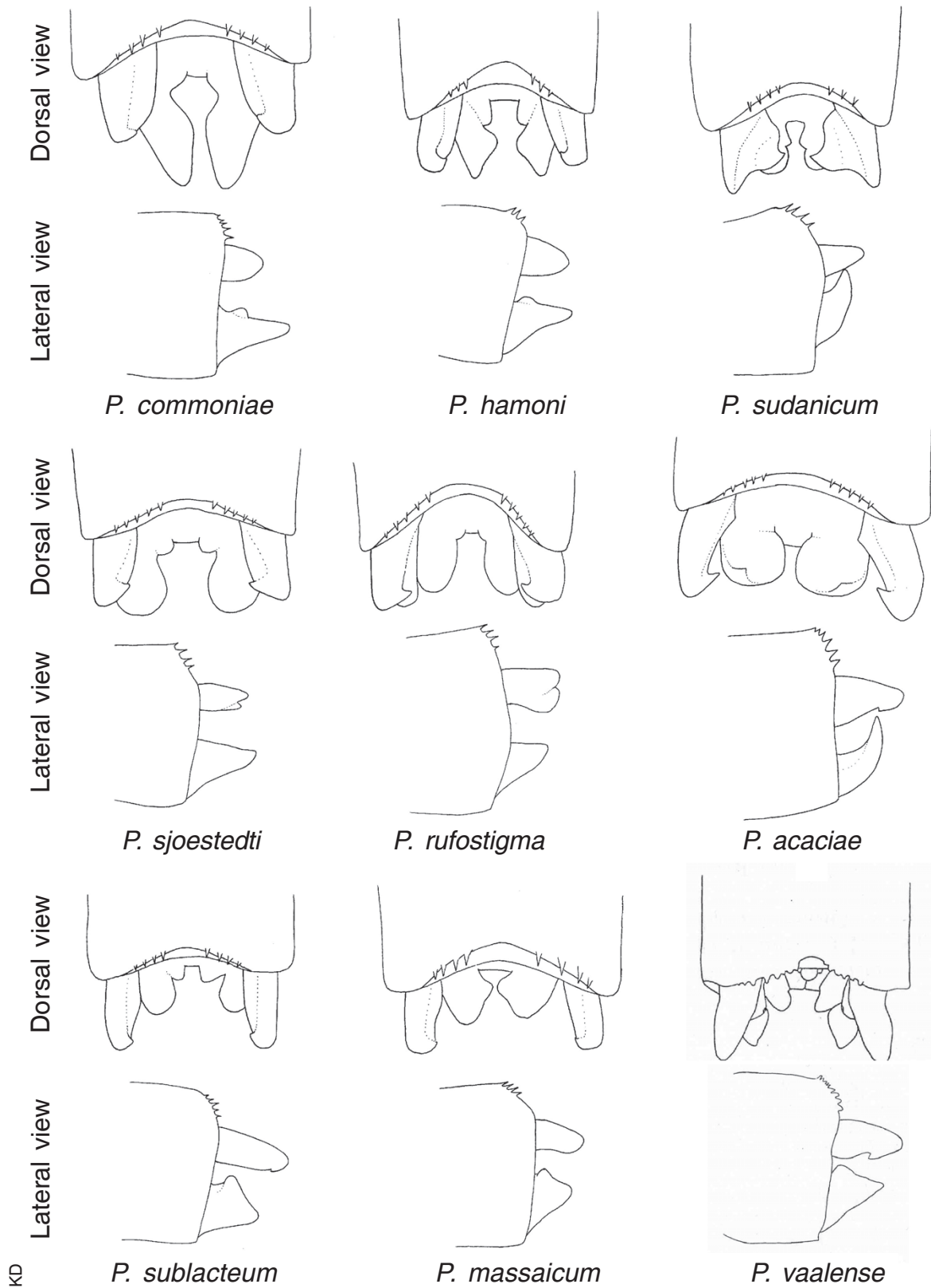


Plate 13: Shape of terminal appendages of Pseudagrion Group B (red-eyed) in dorsal and lateral views

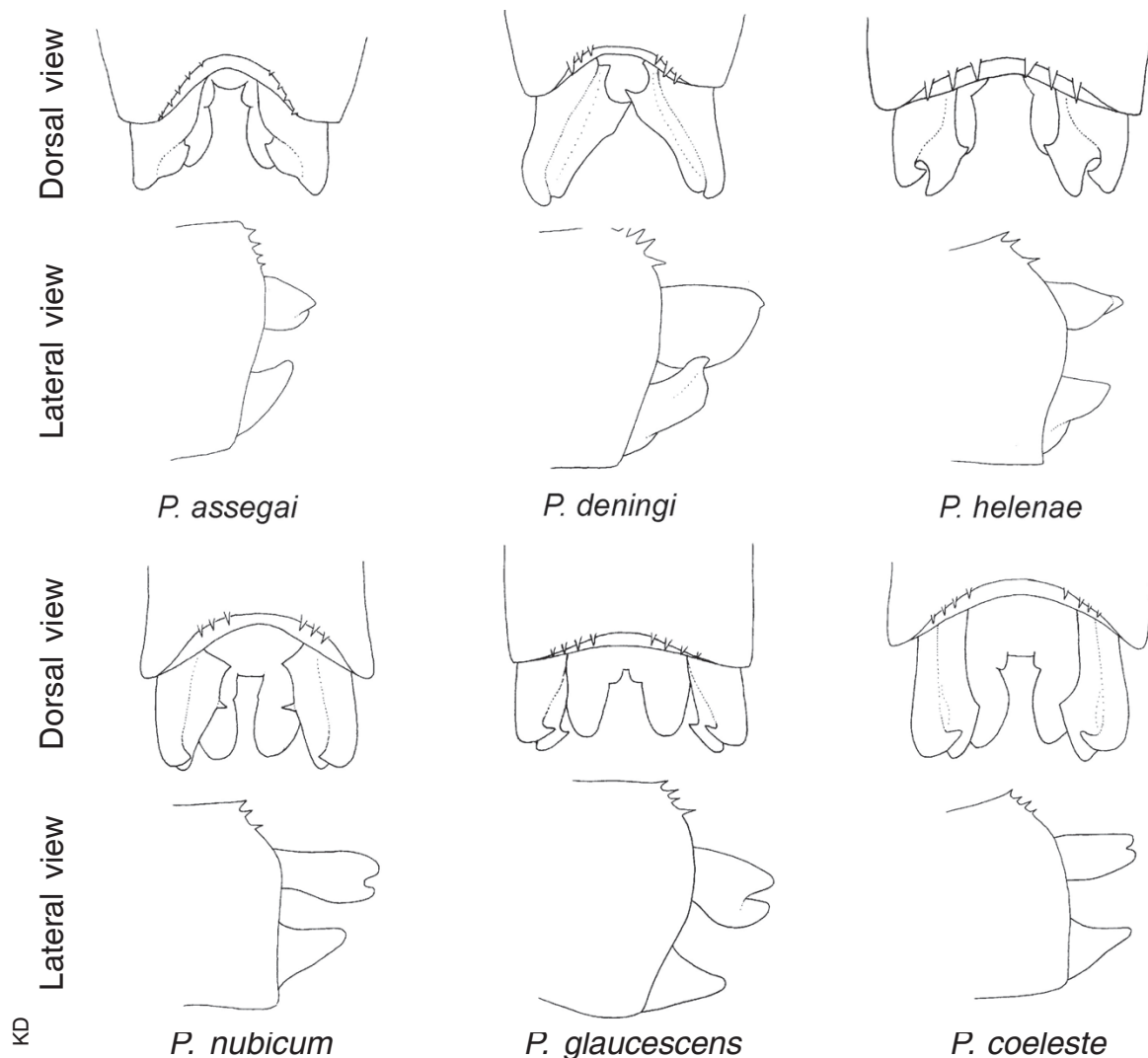


Plate 14: Shape of terminal appendages of Pseudagrion Group B (green-eyed) in dorsal and lateral views

Group B: Green-eyed

- | | | |
|----|--|--------------------|
| 15 | (6) Postocular spots absent. | <i>P. deningi</i> |
| – | Postocular spots present, blue or green. | 16 |
| 16 | (15) S2 with black spearhead (assegai) marking (Plate 15). | <i>P. assegaii</i> |
| – | S2 with black marking having two tips (cat's head, U- or Y-shaped) (Plate 15). | 17 |
| 17 | (16) Upper appendages distal with one tip in lateral view. | <i>P. helenae</i> |
| | Upper appendages distal with two tips in lateral view. | 18 |
| 18 | (17) Upper appendages longer than lower ones in ventral view. Upper appendages each with one distinct spine directed towards the opposite appendage in dorsal view. | <i>P. nubicum</i> |
| – | Upper appendages about as long as lower in ventral view, but without the spine. ... | 19 |

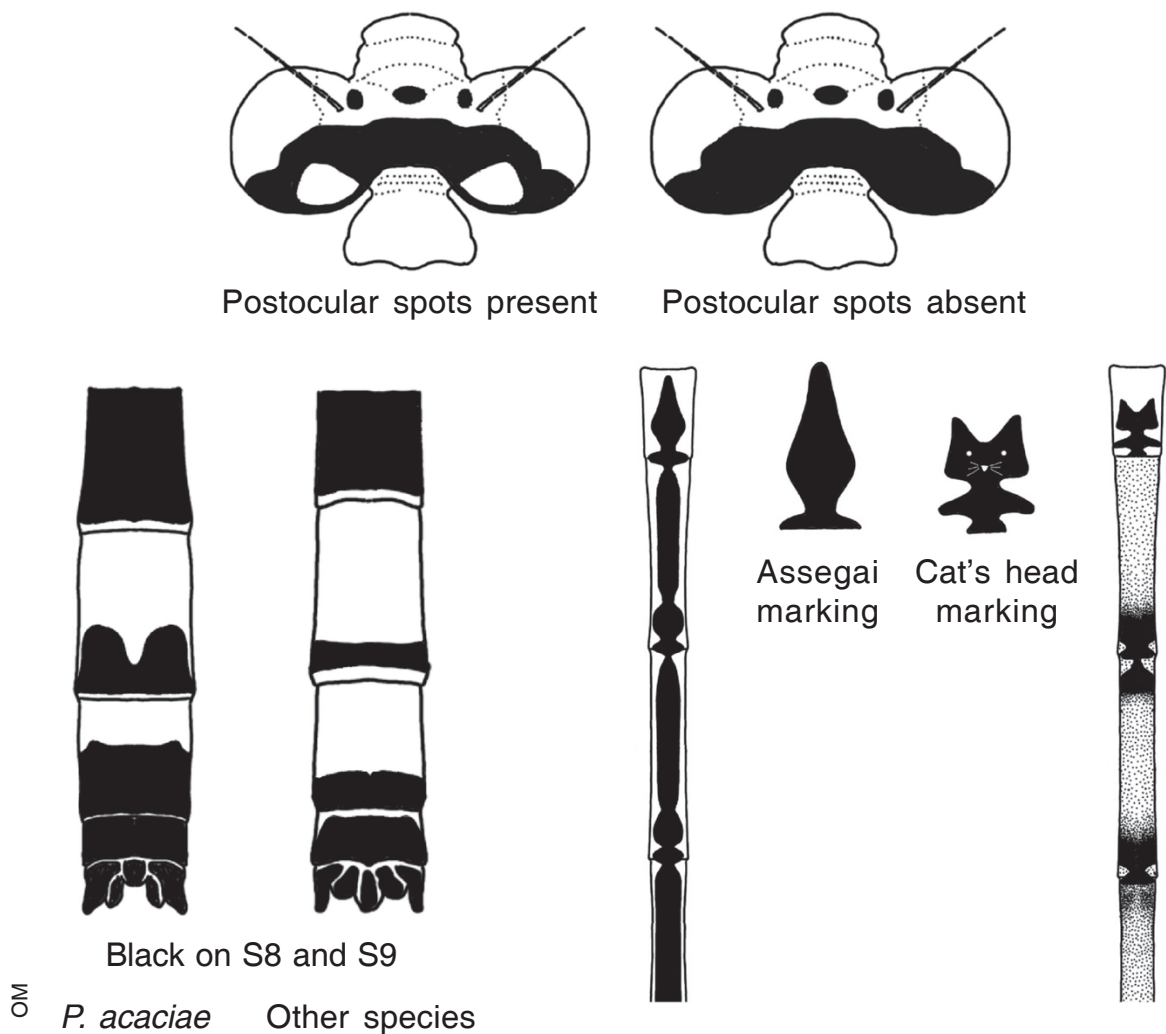


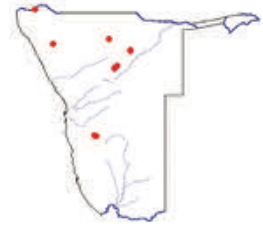
Plate 15: Drawings of some specific body markings in Pseudagrion Group B

- 19 (18) Small species, abdomen about 26 mm. In ventral view only upper tip of upper appendages bent inwards. *P. coeleste*
 – Large species, abdomen longer than 30 mm. In ventral view both tips of upper appendages bent inwards. *P. glaucescens*

Pseudagrion Group A

Group A of *Pseudagrion* consists mainly of forest species. Therefore, although it comprises more species than Group B, it is barely represented in Namibia: only two species have been recorded, although three more may occur. *Pseudagrion hageni* is known from all neighbouring countries. *P. angolense* is so far restricted to south-western Angola, but it may occur at springs running to the Kunene River. *P. fisheri* Pinhey, 1961 is endemic to the Okavango Delta, but may also be found in the panhandle.

Pseudagrion kersteni (Gerstäcker, 1869)
[Kersten's Sprite]



Identification: Adult males are marked by a light blue pruinosity, especially on the thorax. The pruinosity may also cover the face and most parts of the abdomen. Eyes are black above and green on the underside. Diagnostic is the shape of the male's appendages.

Meaning of scientific name: The species is named in honour of the German chemist and explorer, Dr Otto Kersten, who collected the type specimens of the new species at Mbaramu (northern Tanzania) during the Von Decken Expedition to Kilimanjaro in October 1862.

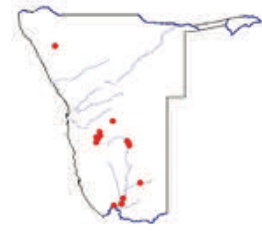
Distribution: Kersten's Sprite is distributed in sub-Saharan continental Africa and southern Arabia. In Namibia, it is restricted to isolated localities. Viable populations exist in the Baynes Mountains, at Ongongo Falls, and at three small streams in the Naukluft Mountains (Naukluft, Gororosib and Tsams Ost Rivers). Other localities are in the Otavi Mountains (Grootfontein spring, Uropapa), at the Waterberg and at Namutoni in Etosha. The flight season in Namibia is throughout the year.

Ecology and behaviour: In Namibia, the species only inhabits widely undisturbed, small streams with sedges; in Africa generally, it is more widespread.

Threats and conservation: *Pseudagrion kersteni* is nationally threatened in Namibia, since the number of populations has clearly decreased. It can be presumed that more localities existed historically, particularly in the Windhoek area. The species was last recorded in 1913 near Grootfontein and in 1993 at the Waterberg. The localities have since been destroyed by water extraction and are no longer suitable as *P. kersteni* habitats. The species was not found at Namutoni, and from the habitat its former occurrence there is doubted. Of the viable populations, those in the Naukluft and the Baynes Mountains may be secure. However, abundance at the Naukluft sites has dropped over the past few years.



***Pseudagrion salisburyense* Ris, 1921**
[Salisbury Sprite]



Identification: Adult males are marked by a dark blue pruinosity, especially on the thorax. The eyes are black above and green on the underside. The blue colour of the postocular spots as well as S8 and S9 are much brighter than the pruinosity on the thorax. Diagnostic is the shape of the male's appendages.

Meaning of scientific name: Latin, meaning "pertaining to Salisbury". Most specimens of the new species were collected between 1900 and 1905 at what was then Salisbury (now Harare) in Mashonaland, Zimbabwe.

Distribution: The species occurs from southern to eastern Africa, including Ethiopia. In Namibia, it only occurs in the subtropical parts of the country. It is known from the Tsauchab, Tsondab, Fish and Orange catchments, and at the Oanob Dam. Because there are records from southern Angola it is difficult to explain why the Salisbury Sprite does not occur in northern Namibia.

Ecology and behaviour: All records are from sections of larger running waters and streams. One locality, Oanob Dam, is a reservoir. The flight season in Namibia is likely to be throughout most of the year; records are from September to November, and February to May. There may be a winter gap between June and August.

Threats and conservation: Not threatened.



AM

***Pseudagrion fisheri* Pinhey, 1961**
[Fisher's Sprite]

Identification: The eyes are red, being orange below. The face is orange, and the postocular spots small. The prothorax is black with green antehumeral stripes. The abdomen is black, except for blue lateral spots on S9 and S10.

Meaning of scientific name: The species was named in honour of Mr A Fisher for his invaluable assistance. He was the owner of Hillwood Farm, Ikelenge, in north-western Zambia, where the type specimens were collected in 1960.

Distribution: The species is known from Angola, Zambia and Botswana. There are no records from Namibia so far, but it is likely to occur at the lower Okavango since it is found in the Okavango Delta.

Ecology and behaviour: Fisher's Sprite habits shaded, swampy streams and reedy channels.

Threats and conservation: On the IUCN Global Red List, the species is listed as "Data deficient". In Botswana, it has not been recorded for more than 25 years, despite intensive searches. It is suggested that the destruction of swamps may be a problem in this regard, as well as the spraying of insecticides for tsetse fly control in the Okavango Delta.

***Pseudagrion angolense* Selys, 1876**
[Angola Sprite]

Identification: The eyes are red, being orange below. The face is orange, while the red to orange postocular spots are large and connected to a line on the dorsum of the head. The prothorax is black with green antehumeral stripes. The second black line on the side of the thorax is short and parallel to the third. The abdomen is black, except for S8 and S9, which are blue. The best field characteristic by means of which to distinguish it from the very similar *P. hageni* is the length and course of the second black line on the side of the thorax.

Meaning of scientific name: The Latin adjective *angolense* refers to Angola.

Distribution: So far, the species is only known from three records in southern Angola. The locality of the species on which the original description is based is unknown: it is only given as "Angola". This species has often been confused with *P. hageni tropicanum*.

Ecology and behaviour: The specific habitat of the species is unknown. It is most likely to occur in permanent streams.

Threats and conservation: This species is known only from a small range area and may qualify for a threatened listing. However, since Angola is poorly explored, it

may be much more widespread than currently recorded. It is listed as “Data deficient” on the IUCN Global Red List.

Pseudagrion hageni Karsch, 1893

[Painted Sprite]

Identification: The eyes are red, being orange below. The face is orange, while the red to orange postocular spots are large and connected to a line on the dorsum of the head. The prothorax is black and has orange or green antehumeral stripes. The second black line on the side of the thorax is long, reaching the third black line obliquely. The abdomen is black, except for S8 and S9, which are blue. The best means of distinguishing it from the very similar *P. angolense* in the field is the length and course of the second black line on the side of the thorax.

Meaning of scientific name: Ferdinand Karsch named the new species after the German doyen of Odonatology, Dr Hermann August Hagen (1817–1893).

Distribution: The species is recorded from the neighbouring countries of Angola, Zambia, Botswana and South Africa, and is distributed to Uganda and Kenya. It is not recorded from Namibia and its occurrence is not very likely. The nearest records are in the upper Okavango River catchment, and at the Botswana–Zimbabwe border.

Ecology and behaviour: The species occurs in shady streams.

Threats and conservation: Not threatened.



Pseudagrion Group B

The males have terminal spines on S10. These species live in open habitats. In Namibia, Group B forms the majority of species. Of the nine red-eyed species known, *P. massaicum* and *P. sublacteum* are the most widespread sprites in Namibia. The green-eyed forms occur in five species; of these, *P. helenae* is to be expected for Namibia. The green-eyed forms are very similar in appearance to the Bluets (*Africallagma* and others) and *Aciagrion*, and may easily be mistaken for them.

Pseudagrion commoniae nigerrimum Pinhey, 1950 [Black Sprite]



Identification: The body of the male is very dark. The face, the upper half of the eyes and the head, most parts of the thorax, and the abdomen are black. The eyes are red below, and postocular spots are missing. The sides of the thorax and the area between the wings may be covered with a blue pruinosity. S8 and S9 are mainly pale blue.

Meaning of scientific name: *Commoniae* is Latin for “of a woman from the Common family”. The author of the species, Förster, dedicated it to his wife, Elise Förster née Common. Latin *nigerrimus* – “the blackest” indicates the deep black colouring of the male’s body, which distinguishes it from other members of the genus.

Distribution: From Kenya to South Africa (Kwazulu-Natal). *P. commoniae commoniae* Förster, 1902 occurs in Ethiopia and Somalia. In Namibia, the Black Sprite was recorded only once, namely at Rundu in January 1966. Another record is from Botswana, at the Chobe River rapids opposite Impalila Island.

Ecology and behaviour: No information available; most probably a riverine species.

Threats and conservation: Not threatened.



VC

***Pseudagrion hamoni* Fraser, 1955**
[Hamon's Sprite]



Identification: Males appear to be very dark. Only the eyes are reddish-brown, but are still very dark compared with the other red-eyed species. The thorax may be reddish-brown or mainly black in melanic specimens. The postocular spots are green, while S8 and S9 are blue, all becoming dark with age.

Meaning of scientific name: The species was dedicated to the French entomologist Jacques Hamon, who collected the male of a new species at Yabasso (Burkina Faso) in June 1953.

Distribution: The species occurs in Africa from the central Sahara to Namibia and South Africa (Transvaal), and as well in southern Arabia. In Namibia, it has mainly been recorded along the Okavango River; one record is from a spring in the Kunene River valley.

Ecology and behaviour: Most Namibian records are from river sections. One record is from a perennial spring, one from a highly degraded pool, and one from a sand pit. Adults were seen in July, August, October, December, February and March.

Threats and conservation: Not threatened.



AM

***Pseudagrion sudanicum rubroviride* Pinhey, 1955**
[Sudan Sprite]



Identification: In the field, males are easy to identify by the colouration of the head: it is metallic black, with red-brown eyes above and cobalt blue postocular spots. The thorax is brownish to orange above with bright blue sides in the male. S8 and S9 are blue; the rest of the abdomen is black. Diagnostic is the shape of the male appendages (ventral view), which are claw-like. These are similar to *P. acaciae*, but the latter differs in body colouration.

Meaning of scientific name: Latinised, “from Sudan”. The specimens of the new species were collected in southern Sudan in March 1913. Latin *rubr-* – “red” and *viridis* – “green”; refers to the bicolour eyes of the males.

Distribution: The species occurs from the Limpopo River to the Congo basin. In Namibia, it is restricted to the Okavango, Kwando and Zambezi Rivers. The northern subspecies, *P. sudanicum sudanicum* Le Roi, 1915, occurs from southern Sudan to The Gambia.

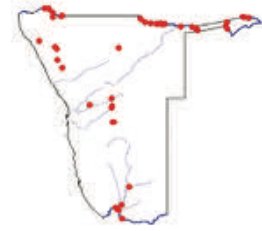
Ecology and behaviour: The species has mainly been seen at reedy banks of strong-flowing sections of rivers. Males as well as females often spend much of their time towards the open running water, whereas syntopic *Pseudagrion* species are more common at protected inlets within the reeds. Records in the flight season in Namibia are from August, December, January and March.

Threats and conservation: Not threatened.



WT

***Pseudagrion sublacteum* (Karsch, 1893)**
= *Pseudagrion pseudomassaicum* Pinhey, 1951
[Cherry-eye Sprite]



Identification: The males are unique in having a purplish colouration of the thorax. The eyes are cherry-red in the frontal half; the thorax is purplish above. The purplish pruinosity may also cover the black markings of the thorax and the vertex (dorsum of the head), including the red postocular spots. The abdomen is mostly black; S8 and S9 are blue with thin, black terminal lines.

Meaning of scientific name: The Latin *sub-lacteum* – “slightly milky” refers to the whitish, translucent wings of the type specimen, a female.

Distribution: The species occurs all over continental Africa and the Comoros. The subspecies *P. sublacteum mortoni* Schmidt, 1936 is restricted to the Levant and Arabia. In Namibia, the species occurs at the Kunene, Okavango, Kwando, Zambezi, Orange and Fish Rivers. Many records are from the western ephemeral river catchments.

Ecology and behaviour: Most habitats in Namibia are running waters. Few records are from lentic waters, e.g. the Oanob Dam. Occasionally, the adults fly at swimming pools or other temporary waters. The flight season is throughout the year, but there are no records thus far from September.

Threats and conservation: Not threatened.



***Pseudagrion acaciae* Förster, 1906**
[Acacia Sprite]

Identification: Males have red eyes and a red to orange face. The postocular spots are greenish. The thorax is brick-red above. The abdomen has a torpedo-like black marking on S3–S7, S2 has a black *U*, and S8 and S9 are mainly blue with broad black tips only. Diagnostic is the shape of the male appendages, which are easily visible from the side. The tips of the lower appendages are claw-like, pointing upwards towards the upper appendages.



Meaning of scientific name: From Latin *acaciae* – “of the Acacia”; the name is enigmatic.

Distribution: The species occurs all over Africa from Angola and Tanzania southwards to South Africa (Kwazulu-Natal). In Namibia, the species occurs at all large northern perennial rivers, i.e. the Kunene, Okavango, Kwando and Zambezi.

Ecology and behaviour: The Acacia Sprite is a riverine species with a relatively unknown biology. In Namibia, the species has been recorded in August, November and December, as well as in February to April.

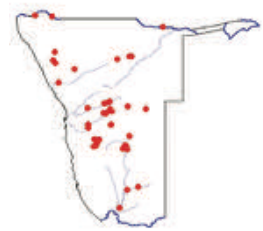
Threats and conservation: Not threatened.



ES

***Pseudagrion massaicum* Sjöstedt, 1909**
[Massai Sprite]

Identification: Head and thorax are marked by a vermillion colouration and contrast with the coral red eyes and the blue-and-green abdomen with broad black markings. The face and





the large postocular spots are vermillion. S2 carries a black Y, while S3–7 have a black torpedo marking. S8 and S9 are mostly sky blue, whereas S10 has black markings. Diagnostic features are the hatchet-shaped lower appendages, which have similarities with those of *P. vaalense* and *P. sublacteum*.

Meaning of scientific name: The Latin adjective *massaicus* points to the Massai, a tribe of cattle nomads who live in Tanzania near Mount Kilimanjaro, the type specimen locality of the species.

Distribution: The Massai Sprite occurs from equatorial Africa to the Cape, South Africa. It is widespread in the western arid regions of Namibia, but so far not recorded in Caprivi.

Ecology and behaviour: The species mostly appears in the vicinity of well-vegetated perennial lotic and lentic waters, including reservoirs. Adults are well documented to fly at swimming pools and artificial waterholes. The flight season in Namibia lasts from October to July. There are no records for August and September.

Threats and conservation: Not threatened.

Pseudagrion vaalense Chutter, 1962 [Vaal Sprite]

Identification: Face and thorax are marked by a vermillion colouration and form a contrast to the coral-red eyes and the bluish abdomen with broad black markings. S8 and S9 are mostly sky blue. The species is very similar to *P. massaicum* in colouration. However, it generally has blue between the wings. For secure identification the shape of the appendages has to be compared.





WT

Meaning of scientific name: Latin *vaalensis* – “pertaining to the Vaal River”. The new species was discovered at the Vaal River.

Distribution: The species is endemic to the Orange and Vaal River catchments. Two specimens were collected in October 1971 at Vioolsdrif on the South African side of the Orange River. So far, there is no proven record from Namibian territory, but its occurrence in Namibia is expected.

Ecology and behaviour: The habitats are large rivers and dams.

Threats and conservation: Not threatened.

Pseudagrion rufostigma Longfield, 1947 [Ruby Sprite]

Identification: In males, the eyes, face, postocular spots and thorax above are red, all marked with black. Also, the sides of the thorax are bright red. The abdomen is mostly black, with only S8, S9 and parts of S10 being light blue. The pterostigma is red, but this feature also occurs in other species.



Meaning of scientific name: The name points to the colour of the pterostigma: Latin *rufus* – “red, rufous” and Greek *stigma* – “tattoo mark”.

Distribution: The species is restricted to the upper Zambezi grasslands ecoregion in the centre of southern Africa. It occurs in Angola, Zambia, Namibia, Botswana, and Zimbabwe. The only known locality in Namibia so far is Bum Hill at the Kwando River. However, it is also expected in the lower Okavango River below Popa Falls.



Ecology and behaviour: Adults emerged from a lotic section of the Kwando River with swampy fringes. Emergence was observed in August; the flight season in Namibia stretches to at least February.

Threats and conservation: Not threatened.

***Pseudagrion sjoestedti jacksoni* Pinhey, 1961**
[Sjoestedt's Sprite]

Identification: This is a very slender species of *Pseudagrion*. The eyes are red, while the face, postocular spots and thorax above are brick-red. The abdomen is mostly black, with S8 and S9 being blue.



Meaning of scientific name: The species is dedicated to the Swedish entomologist and explorer, Yngve Sjöstedt (1866–1948), director of the Swedish Museum of Natural History. He was the first observer and collector of dragonflies in Cameroon, where this new species was collected. The taxon *jacksoni* is dedicated to the entomologist Thomas HE Jackson (1903–1968); he collected the type specimen on an expedition in Uganda in 1952.

Distribution: The subspecies *jacksoni* occurs from Uganda and the Democratic Republic of Congo to Namibia and Botswana. The subspecies *Pseudagrion sjoestedti sjoestedti* Förster, 1906 is known from East Africa; *P. sjoestedti pseudosjoestedti* Pinhey, 1964 from Mozambique and Zimbabwe; *P. sjoestedti nigeriense* Gambles, 1975 from western Africa; and *P. sjoestedti wittei* Fraser, 1949 from the Democratic Republic of Congo. In Namibia, Sjoestedt's Sprite occurs along the Okavango, Kwando and Zambezi Rivers.

Ecology and behaviour: The species mostly occurs at swampy river sections. Flight season data in Namibia are from August and September and from February to April.

Threats and conservation: Not threatened.

Green-eyed

Pseudagrion deningi Pinhey, 1961

[Dark Sprite]

Identification: Males are mostly black above; only S8 and S9 are light blue. The eyes are green at the underside and black above. The combination of black and green eye colours is diagnostic. The sides of the thorax become blue during the adult phase of the lifespan.



Meaning of scientific name: Named in honour of the entomologist RC Dening, who collected the new species at Lake Chali in northern Zambia in October 1959.

Distribution: The Dark Sprite is restricted to swampy areas of the upper Zambezi grasslands ecoregion. Until recently it has only been recorded in the Lake Bangweulu region in northern Zambia and in the Okavango Delta in Botswana. New records of its occurrence have come from Namibia, along the Okavango and Kwando Rivers.

Ecology and behaviour: The species occurs at swampy fringes of rivers. In Namibia, adult records are from August, December, February and March. The Kwando River emergence was observed in August.

Threats and conservation: Not threatened.



JK

***Pseudagrion assegai* Pinhey, 1950**
[Assegai Sprite]



Identification: Within the genus *Pseudagrion* the males of the *assegai* species are unique in having a black spearhead marking. Because of their relative small size and blue colouration with black markings, they resemble members of the genus *Africallagma*. The eyes are greenish. The body is azure blue with black markings. The males have a black assegai-shaped marking on the dorsum of S2. S3–7 each have a torpedo marking; S8 and S9 are totally blue; and S10 has a broad black X. The male appendages are diagnostic.

Meaning of scientific name: An *assegai* is the short, stabbing spear of Zulu warriors. It resembles the marking on S2 in males.

Distribution: Uganda, Zambia, Namibia, Botswana, Zimbabwe and South Africa (Transvaal). In Namibia, the species is recorded from the Kwando and Zambezi Rivers.

Ecology and behaviour: Records at Lianshulu are from shallow water fringes of a dead river arm with rich vegetation. Males commonly settle on floating leaves, e.g. of water lilies. When in flight, they fly very close to the water surface, a behaviour otherwise typical for Bluets. The flight season in Namibia is not quite clear; records are from December, March and August.

Threats and conservation: The species is locally threatened in South Africa because of water overextraction. In Namibia, it is uncommon but not threatened.



Pseudagrion helenae Balinsky, 1964

[Helen's Sprite]

Identification: The males have bluish-green eyes. The frons is olive green and the postocular spots blue. The body is azure blue with black markings; the thorax above is light blue. S2 has a black cat's head marking; S3–6 each have a torpedo marking; S7 is mostly black; S8 and S9 are totally blue; and S10 has a broad X. There are several very similar species in the southern African region. The male appendages are diagnostic.

Meaning of scientific name: The zoologist Boris Ivan Balinsky (1905–1997), Professor at the University of the Witwatersrand in Johannesburg, South Africa, dedicated the species to his daughter Helen, who assisted him in collecting odonates during his Okavango expedition in 1963–1964.

Distribution: The species occurs in Zambia, Malawi and Botswana. It is recorded from the Okavango Delta. So far, there is no record from the Namibian part of the Okavango, but it may be expected, for instance, in the Mahango Game Reserve.

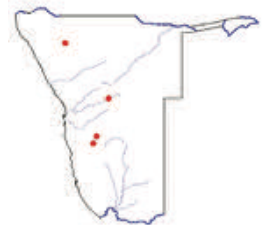
Ecology and behaviour: Helen's Sprite inhabits swamps.

Threats and conservation: The Global Red List status of the species is "Data deficient". In the Okavango Delta, habitat loss has been caused by swamp destruction. The population may also be affected by aerial spraying of insecticides for tsetse fly control in Botswana.

Pseudagrion nubicum Selys, 1871

[Nubian Sprite]

Identification: The males have a long and slender body. The eyes are greenish. The body is azure blue with black markings; only the thorax above is bluish-green. S2 carries a black cat's head or *U* marking; S3–7 each have a torpedo marking; S8 and S9 are totally blue; and S10 has a broad X.



There are several very similar species in the southern African region. The male appendages are diagnostic. In *P. nubicum*, the upper appendages are longer than the lower.

Meaning of scientific name: Latin *nubicus* – “pertaining to Nubia”, the type locality.

Distribution: It occurs from equatorial Africa to Namibia, Botswana and Zimbabwe, and northwards to Mali and Egypt. In Namibia, it has been recorded at Starkberg in Etosha, at the Sartorius von Bach Dam, and at the Tsauchab River and Bläßkranz in the Naukluft region.



Ecology and behaviour: At the Sartorius von Bach Dam and the Tsauchab River, the species was observed at well-vegetated and slow-running perennial waters. The species may disappear from sites for longer periods. At the Dam, it was seen in 2001 and in abundance in 2002, but not since. From the Naukluft Mountains, only sightings of single individuals have been recorded. The biology remains widely unknown. The flight season in Namibia includes the rainy season: records are from January, April and May.

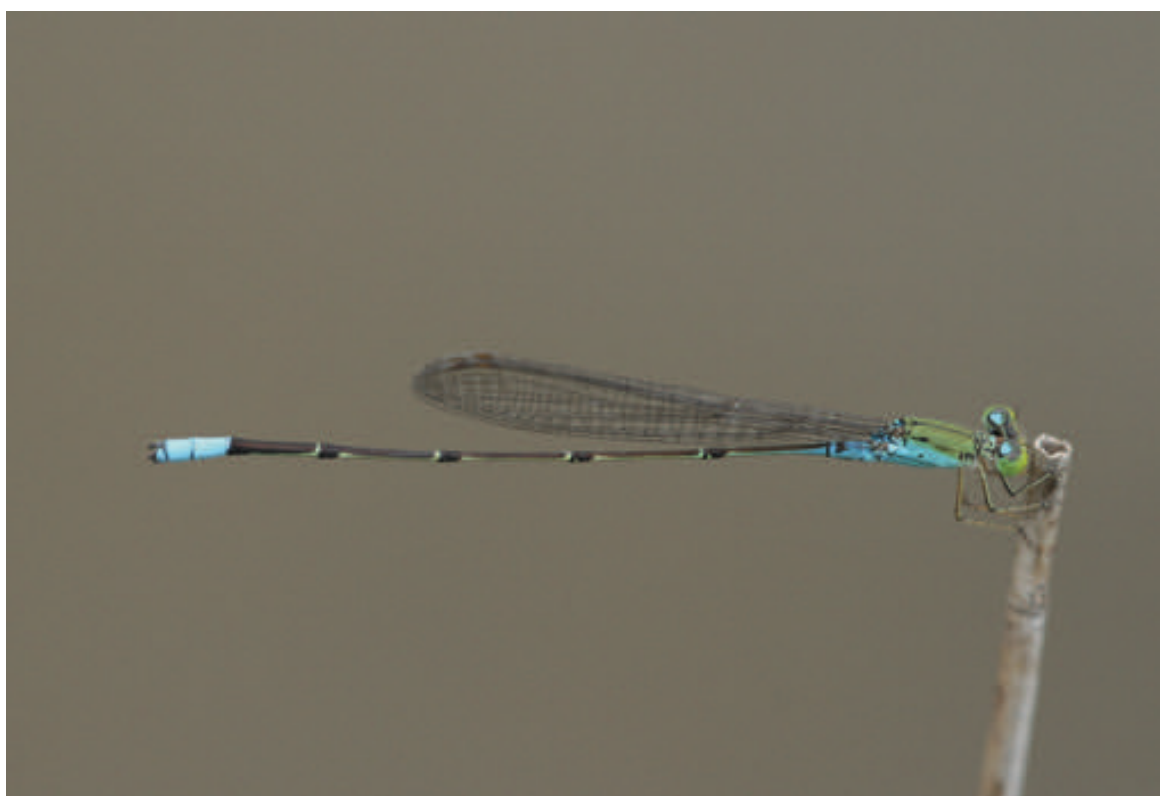
Threats and conservation: The species is rare in Namibia. Due to its unpredictable occurrence, it may qualify for “Data deficient” status on the National Red List. Globally, it is not threatened.

Pseudagrion glaucescens Selys, 1876 [Glaucous Sprite]

Identification: The males have a long and slender body. The eyes are greenish. The body is azure blue with black markings, only the thorax above is bluish green to olive green. S2 has a black cat’s head or *U* marking; S3–6 each have a torpedo marking; S7 is mostly black; S8 and S9 are totally blue; and S10 has a broad X. There are several very similar species in the southern African region. However, except for *P. nubicum*, none of them is as large as *P. glaucescens*. The male appendages are diagnostic.



Males occur in two different forms. In the form *zambeziensis*, which appears to develop during flood conditions, possibly in the shallow waters of overflowing banks, the black markings around the green antehumeral area are broad and significant. The normal form has nearly none or only very thin black markings on the back of the thorax.



Meaning of scientific name: Greek *glaukós* – “bluish-green” or “grey” and Latin *-escens* – “becoming, being weakly”; the body of the male is a pale blue-green.

Distribution: The species occurs from Sierra Leone and Kenya to Botswana and Mozambique. In Namibia, it is common along the Okavango, Kwando and Zambezi Rivers. The form *zambeziensis* has thus far only been recorded from the Zambezi flood plain.

Ecology and behaviour: A river species, most records are from sections with well-vegetated fringes. The flight season may be throughout the year; records are from August, November, December, February, March and June.

Threats and conservation: Not threatened.

Pseudagrion coeleste Longfield, 1947
[Catshead Sprite]

Identification: The males have greenish eyes. The body is azure blue with black markings; the thorax is green above. S2 has a black cat's head, Y or U marking; S3–7 each have a torpedo marking; S8 and S9 are completely blue; and S10 has a broad X. The male appendages are diagnostic.



Meaning of scientific name: From Latin *coelestis* – “celestial, concerning the sky or the heaven”, referring to the sky-blue colour of the males.



Distribution: Eastern Angola, Zambia, Namibia, Botswana and Zimbabwe. In Namibia, it has thus far only been recorded from the Okavango and Kwando Rivers.

Ecology and behaviour: The Catshead Sprite is a river species. It occurs at well-vegetated, reedy or swampy sections of rivers. Records in Namibia are from August, September, December, February and March.

Threats and conservation: Not threatened.

Aciagrion [Slims]

Slims range across tropical Africa, Asia and Australia. Of the approximately 30 species, about half occur in Africa. They are slender damselflies mostly preferring marshy habitats, and may easily be confused not only with Bluets, but also with green-eyed Sprites. Specimens vary in appearance, being pale brownish when young and showing much variation in the extent of black markings. Slims are a heterogeneous genus, which may in fact consist of two different genera, so far recognised as subgenera *Aciagrion* and *Mombagrion*. In Namibia, only one species has been encountered, namely at the Zambezi River. Another is expected because it occurs in the Okavango Delta. These two represent both subgenera.

Meaning of scientific name: Greek *akis* – “needle, splinter, dart” and *agrion* – “that which lives in the fields, wild”. This was a genus name coined by Fabricius to comprise all damselflies; later, this element was used in compound genus names to indicate that the new genus belonged to the Coenagrionidae. The name emphasises the species’ extreme slimness.

***Aciagrion (Mombagrion) heterostictum* Fraser, 1955**
[Long Slim]



Identification: This species has the longest abdomen (length about 39 mm) known in the genus. The thorax is pale green with poorly developed stripes; the abdomen is mainly black with S8 and S9 blue above. The green form is very similar to *Pseudagrion glaucescens* in colour and size, but more slender. The male's upper and lower appendages are of similar length. The distal end of the apex of S10 is extended to a bifid projection. Due to this and to its large size, it cannot be confused with *A. steeleae* (see below).

Meaning of scientific name: From Greek *hetero-* in compounds: “different(ly)” and *stiktos* – “tattooed, spotted”; refers to the pterostigma of the forewing being – according to Fraser's type description – “much larger and of different shape to that of hindwing, the former diamond-shaped and very oblique, the latter with costal side slightly shorter than the posterior side and more quadrate in shape”.

Distribution: The species occurs in Uganda, the Democratic Republic of Congo, Zambia and Namibia. In Namibia, only one male has been recorded so far, namely at the Zambezi River near Katima Mulilo, on 9 December 2005. But it may be more widespread along the Zambezi River. It has also been recorded at the Chobe River in Botswana.

Ecology and behaviour: Not much is known about the ecology of this species. The Namibian record is from a shady place directly on the banks of the Zambezi River. However, it seems to live in swamps. The flight season may be from December to March.

Threats and conservation: IUCN Global Red List status is “Data deficient”.



KG

***Aciagrion (Aciagrion) steeleae* Kimmins, 1955**
[Steele's Slim]

Identification: This is a very small species of *Aciagrion*, with an abdomen length of 26 mm. In males the thorax is blue with black markings. The abdomen is predominantly black with blue above on S8–10. In size and colour it is, therefore, most like *Africallagma*. However, species in the latter genus only have S8 and S9 blue. Also, the upper appendages of male *A. steeleae* are distinctly longer than the lower, whereas upper and lower appendages are of similar length in *Africallagma*.

Meaning of scientific name: The species is named in honour of M Steele, who collected a male of the new species at Lake Bangweulu, Zambia, in October 1946.

Distribution: The species occurs in the Okavango Delta of Botswana as well as in northern Zambia and the Democratic Republic of Congo. It has not yet been recorded in Namibia, but can be expected in the flood plain of the Okavango River below Popa Falls, e.g. in the Mahango Game Reserve. It should also be present in Caprivi.

Ecology and behaviour: It occurs chiefly in swamps or stagnant pools. Teneral can often be found in woodland.

Threats and conservation: Not threatened.

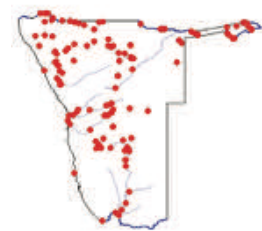
***Ischnura* Charpentier, 1840 [Bluetails]**

Bluetails, a cosmopolitan group of around 70 species, are surprisingly species-poor in tropical Africa. Indeed, only a single species occurs in tropical Africa, although others inhabit North Africa, Madagascar and Mauritius. Males are easily recognised by their dissimilar pterostigmas: black or bicoloured in the forewing, but pale in the hindwing. A typical feature of *Ischnura* is the long copulation, which may last for five hours. Females start laying eggs in the afternoon, unguarded by their mate. Eggs are inserted into living and dead plant material at and below the water surface.

Meaning of scientific name: From Greek *ischnós* – “thin, lean” and *ura* – “tail, (in insects) abdomen”. The thin tail refers to a more general feature in damselflies.

***Ischnura senegalensis* (Rambur, 1842)**
[Common Bluetail]

Identification: A very good field characteristic of the male is the black abdomen, with S8 being totally bright blue on the back. The specimens look like black matches with a blue ring at the top. Some adult females have the same features, whereas in others S8 is dark. Immature females have a conspicuously orange thorax and base of the abdomen.



A closer look will allow other specific features to be recognised. In males the pterostigma is bicoloured (pale to the wing tip) and the sides of S9 are blue. In females, the back of the thorax is uniformly black: there is no pale line or band like the males or many other damselflies have, and in both pairs of wings the pterostigma is bicoloured. Besides the special orange colour of immature females, adult females occur in different colour forms. The sides of the thorax are blue, green, olive or maroon. Adults may vary significantly in size (body length 24–33 mm), depending on the season, larval food supply, larval competition, and risk of drought.

Meaning of scientific name: The name (Latin *senegalensis* – “from Senegal”) refers to where the specimen was originally described. But, already in the first description in 1842, Rambur mentioned South Africa, India and Java as places where it could be found.

Distribution: The Common Bluetail occurs all over sub-Saharan Africa as well as in the Nile River catchment north of the Sahara, in Asia from the Levant to Japan and the Philippines, and on the western Indian Ocean islands. In Namibia, it is widespread and common in all biomes.



AM

Ecology and behaviour: This species can be found at virtually all types of fresh waters, including extremely brackish sites, large impoundments, rivers and temporary pools. However, it is not clear if it breeds in all these habitats. The adults are vagrants that may colonise even very isolated habitats. The flight season is throughout the year.

Threats and conservation: Not threatened.

Africallagma, Azuragrion and Pinheyagrion May, 2002 [Bluets]

This is a group of species that were formerly combined into one genus, *Enallagma*. Only recently were the generic relationships of the *Enallagma*-type dragonflies revised, resulting in a number of new genera in Africa, of which *Africallagma* and *Azuragrion* occur in Namibia with three species. Another species, *Pinheyagrion angolicum*, is very likely to occur in Namibia as well, although it has not yet been recorded. The three groups are treated under one heading here because all the relevant species share similar general characteristics. All four species are small (< 30 mm in length), with mainly blue and black colouration in mature males. The females may be black and green or have similar colours to the males. The males' appendages are depicted in Plate 16.

Meaning of scientific names: The base of all three names is *Enallagma*. T de Charpentier proposed a genus *Enallagma* [Greek – “change”] to comprise all European Coenagrionidae with black- and blue-coloured males, which name he wanted to be understood as “possibility of confusion”. *Africallagma* is a combination of *Enallagma* and *Africa*, from which the new taxon was separated to comprise some African species. *Azuragrion* is composed from Latin *azureus* – “blue” and Greek *agrion* – “that which lives in the fields, wild”, a widespread word element in Coenagrionidae (see e.g. *Ceriagrion* and *Pseudagrion*). *Azuragrion* got its name for the azure blue colour of males of most species. The genus *Pinheyagrion* was named after the late Dr Elliot Pinhey in recognition of his many contributions to the taxonomy of African Odonata.

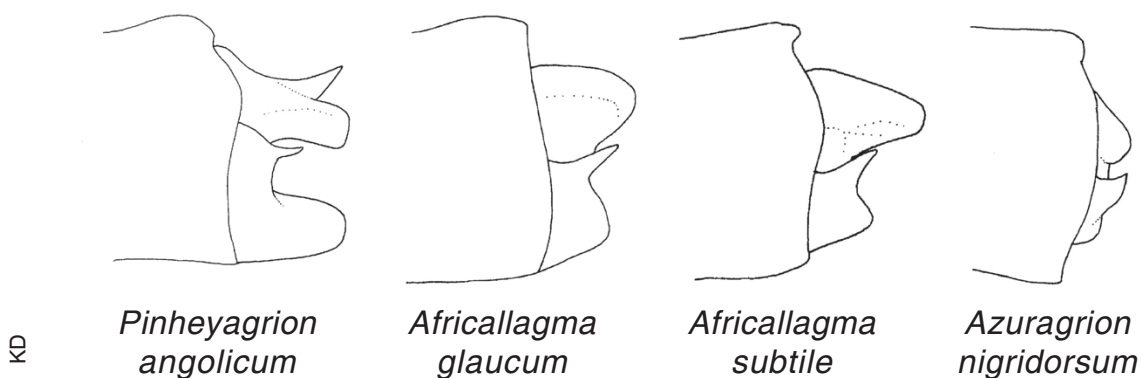


Plate 16: Appendages of Bluet males

Key to the species

- 1 Pterostigma a narrow, red-coloured rhomboid, very convex on outer edge. Labrum without black basal band. Male: only S9 blue, the others black above. *Pinheyagrion angolicum*
- Pterostigma a parallelogram, not red. Labrum without black basal band. Male: S8 and S9 blue (at least partly). 2
- 2 (1) Two thin black lines at the side of the thorax. Male: second half of S8 blue above, the first half black. Upper appendages down-turned. *Azuragrion nigradorsum*
- One thin black line at the side of the thorax. Male: S8 and S9 completely blue above. Upper appendages projecting horizontally. 3
- 3 Pterostigma black. Thorax in mature males with bright blue. ... *Africallagma glaucum*
- Pterostigma pale brown. Thorax in mature males with pale brown stripes. *Africallagma subtile*

Pinheyagrion angolicum (Pinhey, 1966)

[Angola Bluet]

Identification: This species is easily recognised by its red to pink rhomboid pterostigma. The abdomen is blue above only on S9; all other segments are black. The head is black with narrow green to blue postocular spots linked across the occiput. The thorax is bluish-green, very broadly black dorsally, with very narrow antehumerals. Abdomen length is 16–19 mm.

Meaning of scientific name: The Latin adjective *angolicus* refers to Angola as the type locality.

Distribution: Has been recorded in Angola, Botswana and Zambia. There are no records from Namibia as yet. However, its distribution in neighbouring countries makes the occurrence very likely, for instance at the Okavango River.

Ecology and behaviour: It lives amongst grasses and sedges in swamps and pools. Due to this habit and its small size, it may be mistaken for *Agriocnemis*.

Threats and conservation: If it occurs in Namibia it would probably not be threatened. Due to its small size it is likely to have been overseen.

Azuragrion nigradorsum (Selys, 1876)

[Black-tailed Bluet]

Identification: The pterostigma is pale brown, head black with a green to blue labrum, anteclypeus, genae and band across the antefrons. The narrow postocular spots are linked across the occiput. The thorax is blue, broadly black dorsally, with narrow blue-green antehumerals. The abdomen is (greenish-)blue. S8 and S9 are partly blue above, with S8 blue for about half its length and S9 for most of its length.





Distribution: Equatorial Africa to Namibia and South Africa (Kwazulu-Natal), southern Arabia and Socotra. In Namibia, it occurs in three areas: the Otavi Mountains, northern Damaraland (Sesfontein, Ongongo), and the upper Swakop River catchment near Gross Barmen.

Meaning of scientific name: From Latin *niger* – “black” and *dorsum* – “back”, because, except for the postocular spots, the antehumeral stripes and the male’s blue terminal segments, the species is almost totally black from above.

Ecology and behaviour: Almost all localities in Namibia are spring-fed ponds derived from the damming of streams, except for Ongongo, where the species occurs not only in a pool fed by the waterfall, but also in the stream. The species oviposits in submerged plants, between which the hatched larvae also live. The flight season is likely throughout the year, at least at Ongongo.

Threats and conservation: Although the species is somewhat restricted in its distribution, it does not seem to suffer from the degradation of springs, as long as spring-fed perennial ponds remain.

Africallagma glaucum (Burmeister, 1839) [Swamp Bluet]

Identification: The pterostigma is black. The head is (greenish-)blue, with blue postocular spots. The thorax is blue, being broadly black along the mid-dorsal carina and humeral suture, leaving fairly narrow antehumeral stripes. The abdomen is (greenish-)blue, with the back of S1–7 and S10 widely black. S8 and S9 are blue.



Meaning of scientific name: Latin *glaucus* – “bluish green”; the name refers to the colour of the male’s abdomen.



Distribution: It occurs from equatorial Africa to South Africa, as well as on Réunion. In Namibia, most records are from the central highlands and adjacent areas: the Otavi Mountains, the Khomas Hochland, and Naukluft area. Single individuals were recorded at Kamanjab and Tsaobis.

Ecology and behaviour: The Swamp Bluet can be found at perennial or longer-lasting temporary waters that host submerged aquatic vegetation. There are, for example, some stream populations in the Naukluft Mountains. Most records are from localities above 1,200 m above sea level. Individuals may enter the desert with strong adiabatic winds at the beginning of winter. Flight season: adult records are from October to June; there may be a winter pause.

Threats and conservation: Not threatened.

***Africallagma subtile* (Ris, 1921)**
[Pale Bluet]

Identification: This is the palest Bluet, with a pale blue and black thorax, and broad brown stripes along the mid-dorsal carina and humeral suture. The head is blue, being black and brown across the vertex. The abdomen is slender and pale blue, with segments 7–10 a deeper blue and the back of segments 1–7 black. The pterostigma is pale brown.



Meaning of scientific name: From Latin *subtilis* – “fine in texture, delicately slender”; probably so named because of the subtle body.

Distribution: The Pale Bluet ranges from Ethiopia to Namibia and Botswana. In Namibia, it has only historically been recorded in one locality in the northern regions. Only very recently was it recorded at the Okavango River near Rundu.



This small and pale species might often have been overseen, and is probably more common in northern Namibia.

Ecology and behaviour: Existing records are from well-vegetated temporary rain ponds, with dense grasses or reeds. Flight season: records of adults are from February, March and July.

Threats and conservation: Not threatened.

Gomphidae [Clubtails, Gomphids]

Gomphids are one of the largest and most widely represented dragonfly families in the world, with more than 950 currently listed species. About 40 of these occur in southern Africa. In Namibia, 18 species from 11 genera have been encountered. In the genus key below, the genus *Onychogomphus* has been added, of which one species, *O. rossii* Pinhey, 1966, is described from the upper Okavango River in Angola.

Gomphids are distinctly separate from the other anisopteran families by having eyes that do not touch each other on the head. They can usually not be confused with other dragonflies. Exceptions may be freshly emerged *Orthetrum* (Libellulidae), which are similar in colour and size to some gomphids, and to smaller *Phyllomacromia* species that are similar in colouration to *Paragomphus sabicus*, particularly in flight. Typical colours are yellow or green with black to brownish stripes or spots. The extension of dark markings and the brightness of the colours often vary within a species depending on the climate. In more arid conditions, an adult is often paler than in a humid climate. The eyes are either blue or green. In some species, females

may have green eyes, whereas in such species males have blue eyes. Many species have distinct leaf-like foliations (see Plate 17) appearing like steering gear at some abdominal segments, a characteristic they only share with *Phyllomacromia*. These foliations are often larger in the males. Otherwise, differences between the sexes are not very distinct, with colour patterns also usually being similar. Many of the African gomphids are elusive and, therefore, difficult to record. The appendages of male gomphids are particularly diverse in shape (see Plate 17).

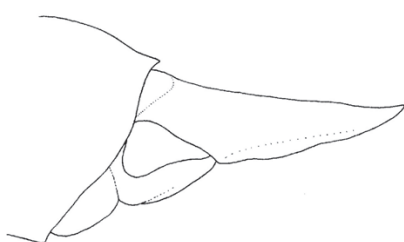
Gomphids are usually typical riverine species, the larvae living in running waters. Species of *Ictinogomphus* also regularly occur in lakes. Temporary waters are normally not colonised by clubtails, with the exception of *Paragomphus genei*, which is one of the most common odonate species in arid Namibia and develops even in temporary ponds. Due to their habitat preferences, most gomphids are restricted to the perennial rivers and their diversity is highest in the north of the country. The reproductive behaviour is not well known. Males usually do not behave territorially and do not perch at water for longer periods. As far as is known, females provoke a race of males to choose the quickest starter and fastest flier as a partner. During oviposition the female is alone; in most cases, she touches the water surface several times to release her eggs. Eggs in gomphids are often very curious in shape, e.g. bearing long flagella, as in *Lestinogomphus* or *Ictinogomphus*. These structures probably fix the eggs onto water plants to prevent them from drifting away or sinking to the ground.

Meaning of scientific name: Greek *gomphos* – “bolt for shipbuilding” evokes the shape of the male abdomen in most species of the family.

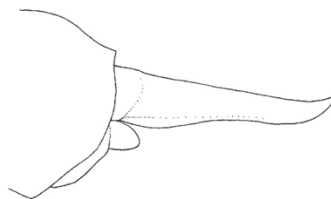
Key to the Gomphidae genera

- 1 Discoidal cells of 3–4 cells. Large, conspicuous species. 2
- Discoidal cells of 1 cell. Small to larger species, often elusive. 3
- 2 (1) S8 with foliations. *Ictinogomphus*
- S8 without foliations. *Gomphidia*
- 3 S10 longer than or about as long as it is high. 4
- S10 shorter than it is high. 6
- 4 (3) Foliations at S8 present. Hindwing base normal, with distinct anal triangle of 3–6 cells. Large species. 5
- No foliations at abdomen. Hindwing base very narrow, almost like forewing. Tiny species. *Lestinogomphus*
- 5 (4) S10 drawn out to basal blade pointing to the eyes, accommodated by sheath-like cleft on S9. Upper appendages stout, touching each other at the tip (view from above). *Ceratogomphus*
- S10 without basal blade, S9 without sheath-like cleft. Upper appendages elongate, tips widely separated (view from above). Very large species. *Phyllogomphus*

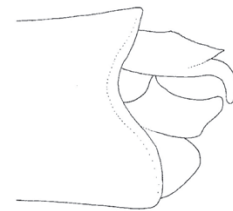
- 6 Upper appendages at maximum as long as S10. Branches of lower appendages diverge widely. Long legs; hind femur longer than width of head. 7
- Upper appendages distinctly longer than S10 (at least 1.5x). Branches of lower appendages touch or run closely parallel to each other. Short legs; hind femur shorter than width of head. 8
- 7 (6) Frons with or without poorly developed crest. S8 clubbed, S9 distinctly constricted. *Neurogomphus* and *Mastigogomphus*
- Frons with distinct crest. Upper appendages with ventral tooth near base. S8 and S9 straight. *Notogomphus*
- 8 (6) Lower appendages distinctly longer than S10. *Onychogomphus*
- Lower appendages not longer than S10. *Crenigomphus* and *Paragomphus*



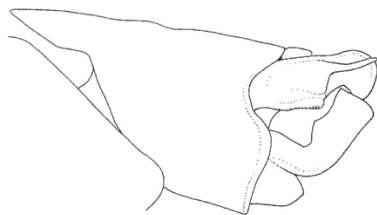
Ictinogomphus lateral



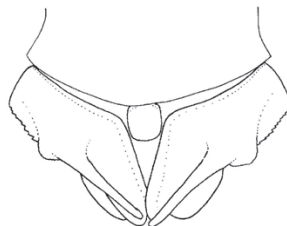
Gomphidia lateral



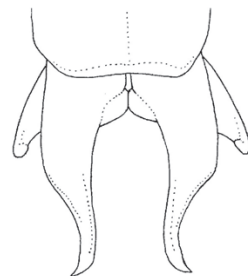
Lestinogomphus lateral



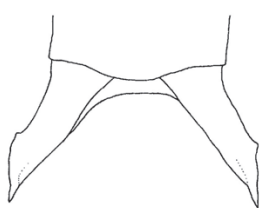
Ceratogomphus lateral



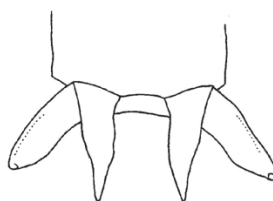
Ceratogomphus dorsal



Phyllogomphus dorsal



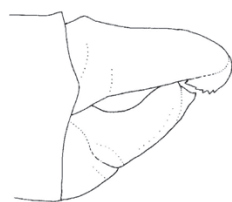
Neurogomphus dorsal



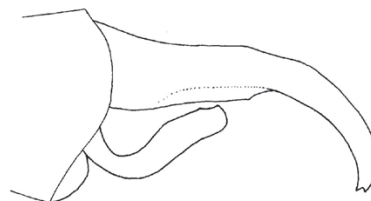
Mastigogomphus dorsal



Notogomphus dorsal



Crenigomphus lateral



Paragomphus lateral

Plate 17: Appendages of the gomphid genera males

Ictinogomphus Crowley, 1934 [Tigertails]

Tigertails range from Africa to East Asia and Australia. They are massive insects with distinctly foliated tail ends. When perching in prominent positions directly at the water, they are much more conspicuous than most other African gomphids. Unlike most other gomphids they prefer lentic waters, and usually occur at lakes or large and calm sections of rivers. Two species occur in Namibia.

Meaning of scientific name: Greek *iktinos* – “kite”. The name given to the genus, *Ictinus*, aptly described the enormous size of the adults. The genus was renamed *Ictinogomphus* because *Ictinus* had already been occupied by a fish genus.

Key to the species

- 1 Foliations of S8 at least half as deep as segment is high. Basal halves S4–6 bright yellow, apical halves (largely) black (dorsal view). *I. ferox*
- Foliations S8 about one third as deep as segment is high. Basal halves S4–6 pale greenish-yellow; apical halves S4–6 also extensively pale, with black only at the apical border of the segments. *I. dundoensis*

Ictinogomphus ferox (Rambur, 1842)

[Common Tigertail]

Identification: This is one of the largest dragonflies in Namibia. Due to the contrasting black and yellow body, the blue eyes and the distinct, large foliations at the end of the abdomen, it can hardly be confused with any other dragonfly. The adult males can regularly be observed perching on solitary twigs and stems of reeds close to the



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shore from where they start powerful flights. They are territorial at water, waiting for females, chasing intruding rivals away. A large species; length ranges between 75 and 90 mm.

Meaning of scientific name: Latin *ferox* – “intrepid, wild” is a quality useful to a predator.

Distribution: *I. ferox* occurs all over sub-Saharan Africa. In Namibia, it is common at the perennial northern rivers, but also occurs in the oshanas area. *I. ferox* is more scattered in the rest of the country southwards to Mariental, wherever larger perennial waters such as impoundments occur. There is only a single record from the Orange River to date.

Ecology and behaviour: The larvae live in lentic sections of large rivers as well as in backwaters and oxbow lakes. In Namibia, most large impoundments such as the Sartorius von Bach Dam, the Avis Dam and the Oanob Dam are also colonised. In contrast to other gomphids the larvae do not burrow. The territorial males often rule the dragonfly community of ponds, chasing after all other dragonflies, even larger Emperor dragonflies. Thus, the scientific name suits it well. In the north, the flight season is throughout the year albeit with reduced abundance in winter. Around Windhoek the flight season is shorter, from November to April.

Threats and conservation: Not threatened.

Ictinogomphus dundoensis (Pinhey, 1961)
= *Gomphidia guyi* Pinhey, 1976
[Swamp Tigertail]



Identification: The Swamp Tigertail is slightly smaller than *I. ferox*, but similar to it in its black and yellow colouration and blue eyes. The ground colour is a greenish, pale yellow compared with the bright yellow of *I. ferox*. Although it has less black on the abdomen, from a distance it appears to be darker overall than *I. ferox*. The foliations at S8 are smaller than in *I. ferox*.

Meaning of scientific name: Latin *dundoensis* – “from Dundo” (Angola); the species was described after one female specimen collected in Angola in January 1955.

Distribution: *I. dundoensis* had previously only been recorded in northern Angola, northern Zambia (in the Lake Bangweulu area) and the Okavango Delta in Botswana. In Namibia, it was recorded at Popa Falls at the Okavango River, and in abundance at the Kwando River.

Ecology and behaviour: This species is more restricted than its congeneric. A typical habitat seems to be slow-flowing braided rivers with fringes, well veg-



etated with reeds and water lilies. Nothing is known about the larvae as yet. The flight season is also not fully clear. At the Okavango it has been found in December, but at the Kwando only in February and March.

Threats and conservation: The species is given as “Data deficient” on the IUCN Global Red List. This reflects that very little is known about the species. In the Okavango Delta, it has only recently been re-recorded, after 30 years. The records in Namibia are new. The population in Namibia seems to be healthy, but mainly depends on favourable conditions in the Kwando River.

***Gomphidia* Selys, 1854 [Fingertails]**

Fingertails have an Ethiopian and Oriental distribution. The African species are very alike and several forms have been described as separate species, of which three seem to be valid. In southern Africa, only *G. quarrei* occurs. *Gomphidia* are very much like *Ictinogomphus*, but the African species of the former are somewhat smaller and more slender than *Ictinogomphus*. The most striking feature in *Gomphidia* compared with *Ictinogomphus* is the lack of foliation.

Meaning of scientific name: Probably derived from Greek *gomphos* – “bolt for shipbuilding” as a reference to the family to which it belongs, and *idios* – (inter alia) “separate, distinct”, because this genus is different from those related by some features like a lack of foliation on S8.

***Gomphidia quarrei* (Schouteden, 1934)**
[Quarré's Fingertail]



Identification: In its contrasting yellow and black colouration with blue eyes, this species is very similar to *Ictinogomphus ferox*. However, it is smaller and without foliations in both sexes. In length it measures about 70 mm.

Meaning of scientific name: The species was named in honour of the Belgian botanist Pierre Quarré, who collected the type specimen at Kambaye, Lomani (Democratic Republic of Congo).

Distribution: The species occurs from the Democratic Republic of Congo and Uganda to Botswana and northern South Africa. In Namibia, it is recorded all along the Okavango and Kwando Rivers.

Ecology and behaviour: Quarré's Fingertail is a riverine species. Most records of exuviae are from more swiftly running stretches including rapids, such as Popa Falls. In contrast, most adult individuals have been observed at the slow-flowing Kwando River. Adults can often be seen directly at the water, perched on low vegetation, facing the water. Oviposition has been observed between reeds. The flight season occurs when there is rain; records are from November, December and February.

Threats and conservation: Not threatened.



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Lestinogomphus Martin, 1911 [Fairytails]

Fairytails are endemic to tropical Africa; five species have been described. One species has been encountered in Namibia so far, although the recently described *L. silkeae* was also found in the Okavango panhandle in Botswana. Hence, it may occur in Namibia as well, and it is therefore considered here. From general appearance, both species are almost identical. Distinguishing between them requires that they be caught for closer examination.

A generic feature is the shape of the hindwings, which look almost like those of a damselfly, i.e. the base being about the same width as the forewings. Another typical feature is the shape of the abdomen, in which S10 is very long and kinked downwards. The adults usually rest in the shade of trees and shrubs and may, therefore, be overlooked.

Meaning of scientific name: Martin does not explain this name. It most probably says “gomphid resembling a lested”, due to the narrow bases of the hindwings and the extremely slim general figure of the species – on which he based the genus.

Key to the species

- 1 S10 about twice as long as high. Basal teeth on lower appendage broad-based, directed straight upward. Pale areas alongside mid-dorsal carina extend dorsally beyond tooth of carina. *L. angustus*
- S10 less than twice as long as high. Teeth of lower appendage narrow-based, thrust forwards, directed into S10. Pale areas alongside mid-dorsal carina do not extend beyond tooth of carina. *L. silkeae*

Lestinogomphus angustus Martin, 1911 [Common Fairytail]

Identification: A very small and slender gomphid that looks almost like a zygopteran. Colour is greenish-yellow with brown markings and pale blue eyes. The conspicuous downward-kinked S10 is reddish-brown in colour. The shape of the appendages is specific. It measures about 40–47 mm in length.



Meaning of scientific name: Latin *angustus* – “narrow, thin, tapering”; the name refers to the generally slender and thin stature or perhaps to the narrow bases of the hindwings.

Distribution: Widespread in most of tropical sub-Saharan Africa. In Namibia, it is restricted to the northern perennial rivers, where it is probably the most common gomphid.

Ecology and behaviour: The adults are shade-loving. For most of the day they stay in the deep shade of trees, where mating takes place. Consequently, the species occurs in high abundance where pristine riverine forest is present, e.g. at Popa



Falls on the Okavango River, or at Bum Hill on the Kwando River. The larvae occur at almost all river sites – from swift-flowing stream-channels with sandy substrates to more muddy and slow-flowing sections of rivers. The flight season begins in August, when first emergence has been observed, and lasts at least until April.

Threats and conservation: Not threatened.

***Lestinogomphus silkeae* Kipping, 2006**
[Silke's Fairytail]

Identification: Very similar to *L. angustus*, the only distinct difference being the shape of the male appendages. S10 is also less stretched than in *L. angustus* (see key).

Meaning of scientific name: Named in honour of and dedicated to the memory of the author's late wife, Silke.

Distribution: So far, the only records have been from the type specimen locality near Shakawe in the Okavango panhandle, and from a single specimen at Victoria Falls. Not yet recorded in Namibia, but it is expected to occur in the Okavango River downstream from Popa Falls in the Mahango Game Reserve.

Ecology and behaviour: Seems to be very similar to *L. angustus*.

Threats and conservation: Given as "Data deficient" on the Global IUCN Red List.

***Ceratogomphus* Selys, 1854 [Thorntails]**

Thorntails are endemic to southern Africa. A second species is confined to the Western Cape Province, South Africa. Characteristic is the anterior dorsal ridge of S10, which is drawn out to a blade-like structure. Due to this structure, S10 is often kinked downwards, like in *Lestinogomphus*. Thorntails are medium-sized to larger gomphids.

Meaning of scientific name: Greek *kerat-* – “horn” and *gomphos* – “bolt for ship-building”. The genus comprises gomphids whose tenth segments bear a very distinct horn- or blade-like structure.

***Ceratogomphus pictus* Hagen, 1854**
[Common Thorntail]



Identification: The colouration of this species is yellow with contrasting black markings. The sides of the thorax have two white fields, and the ventral parts of the sides of the abdomen are also whitish. The eyes are green. The colour is very different from the other Namibian gomphids. The blade-like structure at S10 is specific. The species measures about 50 mm in length.

Meaning of scientific name: Latin *pictus* – “painted, variegated, coloured”. The name probably refers to the yellow, white and black pattern of the species.

Distribution: The Common Thorntail is widespread, particularly in South Africa and Zimbabwe, and north to Zambia. In Namibia, it is restricted to the south and centre of the country, and only recorded from large impoundments such as the Avis, Oanob, Hardap and Naute Dams. It may have colonised the country via the Orange and Fish Rivers, although it has not yet been found in the lower Orange River.

Ecology and behaviour: The species is known from lotic and lentic waters such as rivers, streams and pools. In Namibia, however, it occurs only at impoundment



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lakes and at sections of perennial rivers downstream from dams such as the Fish River below the Hardap Dam. The flight season is from December to April.

Threats and conservation: Not threatened.

Phyllogomphus Selys, 1854 [Leaftails]

Leaftails are endemic to tropical Africa, where there are about 15 species. In southern Africa only *P. selysii* exists, which is identical to the *P. brunneus* referred to in most literature on southern African Odonata. It is a generally robust and large species. S8 has foliations, S9 does not. It also has a distinct anal loop of 4–5 cells. *Phyllogomphus* are often found away from water and may spend most of their time in treetops.

Meaning of scientific name: Greek *phyllon* – “leaf” and *gomphus* – (in compound names) “gomphid dragonfly”. The name refers to the foliations on S8.

Phyllogomphus selysii Schouteden, 1933 [Bold Leaftail]

Identification: A dark-coloured gomphid, with most of the body dark brown to black. The only pale areas are three greenish-yellow bands on the thorax, and yellow spots on the base of S2–7. However, the extent of the pale areas differ regionally. The eyes are green. The male has broad foliations at S8, which are widely reduced in the female. S10 is about as long as S9.



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Meaning of scientific name: The species is named in honour of the Belgian doyen of odonatology, Baron Michel Edmond de Selys-Longchamps (1813–1900), for his eminent authorship in the genus *Phyllogomphus*.

Distribution: The species is widespread in tropical Africa, from Cameroon and Uganda to northern South Africa. In Namibia, it occurs only at the perennial northern rivers.

Ecology and behaviour: This is an elusive species. Whereas exuviae have been recorded at many localities, not one adult was seen during excursions for the current publication. Observations from the Congo River and from East Africa suggest that the species may mainly be active at dawn and even at night, while it spends the day in treetops. Larvae can be found in sandy to muddy substrates of slow-flowing rivers. Flight may occur throughout most of the rainy season.

Threats and conservation: Not threatened.

Neurogomphus Karsch, 1890 and *Mastigomphus* Cammaerts, 2004 [Siphontails]

Siphontails are endemic to Africa. A recent revision lists 17 species, of which three belong to the subgenus/genus *Mastigomphus*. Some exuviae and two larvae clearly belonging to *Mastigomphus* were recorded at the Okavango River. Because no adult has been found so far, it is not clear which species occurs in Namibia. *Mastigomphus dissimilis* Cammaerts, 2004 is known from the Zambezi River, and the record from the Okavango may well belong to this species. However, it may even be a new species. Therefore, we only give general identification characteristics.

Both *Neurogomphus* and *Mastigomphus* have long S10s, being as long as S9 (but only half as long in *M. dissimilis*); S8 is clubbed. There is no crest developed on the forehead, giving the head a sloping appearance. All species are shy and elusive, and there are very few adult records across the board.

Meaning of scientific name: There is no indication that the Greek *neuron* is used in the sense of “vein in a wing”, as in many other insect names. The intention of selecting *Neurogomphus* is unknown.

Key to the species

- 1 Upper appendages convergent. S8 clubbed, being almost as wide as long. 2
- Upper appendages parallel. S8 only slightly clubbed. *Mastigomphus* sp.
- 2 (1) Sides of the thorax without black stripes. *N. cocytius*
- Sides of thorax with distinct black stripes. *N. zambeziensis*

Mastigogomphus sp.

Identification: *Mastigogomphus* is smaller (length about 50 mm) than the two *Neurogomphus* occurring in the southern African region. The male upper appendages are parallel in *Mastigogomphus*; S8 is only slightly wider than the other abdominal segments; and the occipital plate of the head is three times wider than it is high.



Meaning of scientific name: Greek *mastig-* – “whip, scourge” is an equivalent to Latin *flagellum*. In this subgenus/genus, the top of the male’s secondary copulatory organ bears a pair of well-developed flagella, unlike in the closely related *Neurogomphus*.

Distribution: In Namibia, *Mastigogomphus* has only been recorded at the Okavango River near Rundu, and only as a larva. The species *M. dissimilis* occurs in Malawi, Zambia and Zimbabwe, and may well be the Namibian species.

Ecology and behaviour: This is a riverine species, occurring mainly in swift-flowing sections of rivers. Emergence has been recorded in November and December. Nothing is known about the duration of the flight season.



Mastigogomphus sp. larva

Neurogomphus cocytius Cammaerts, 2004
[Kokytos Siphontail]



Identification: The most obvious feature of this species is that the thorax' yellow-green sides are almost completely free of dark markings in both sexes. The eyes are greenish. The abdomen is variable in colour, but mainly cream to yellow-coloured on the first halves of the segments and brown on the rear halves. Total length is just below 60 mm.

Meaning of scientific name: Named after the Hades' Kokytos River of Greek mythology (Latin *Cocytus*). While the Latin is used for the scientific name, the Greek appears in the English common name.

Distribution: So far, this species is only known from the Zambezi River at Victoria Falls, from the Chobe rapids at Kasane, and from the Okavango River. Namibian records are at Shamvura and at Popa Falls. The Chobe River record is also counter, being just opposite Impalila Island.

Ecology and behaviour: Not much is known about the species. It is riverine, and is mainly found at rapids or swift-flowing sections of river. The adults rest among shrubs and trees not far from the water. Larvae were found in muddy ground.

Threats and conservation: The species is given as "Data deficient" on the Global Red List.



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***Neurogomphus zambeziensis* Cammaerts, 2004**
[Zambezi Siphontail]



Identification: The Zambezi Siphontail is very similar to *N. cocytius*, but has dark stripes on the sides of the thorax, one crossing the yellow-green sides of the thorax halfway, and the second crossing the sides completely. The species is larger than *N. cocytius*; the body length is longer than 60 mm.

Meaning of scientific name: The Latinised adjective *zambeziensis* refers to the type specimen locality, the Zambezi River.

Distribution: The species is more widespread than *N. cocytius*. Records are from Victoria Falls to coastal Mozambique and to northern South Africa. It most probably also occurs in Tanzania. Based on records of exuviae it is not uncommon along the Zambezi River near Katima Mulilo, and is also found at the Chobe rapids near Kasane, opposite Impalila Island.

Ecology and behaviour: A riverine species, with most records from rapids although there are also some swamp records. The biology is widely unknown.

Threats and conservation: Insufficient information available. Marginal in Namibia.



Female

***Notogomphus* Hagen, 1857 [Longlegs]**

Longlegs are endemic to Africa. Of the 17 species that are known, three occur in southern Africa. Characteristic are the very long hind legs, which reach at least to the posterior margin of S2 when stretched.

Meaning of scientific name: The name means “gomphid from the south” [Greek *notos* – “south wind” or “south”]; the genus was based on two species from Ethiopia.

Notogomphus praetorius (Selys, 1878)
[Yellowjack Longleg]

Identification: The body is distinctly marked with a yellow line all along the dorsum of the abdomen, bordered by two black lines. The eyes are bluish. Both sexes have no foliation. The most striking characteristic is the very long hind legs reaching to the posterior edge of S4 when stretched.

Meaning of scientific name: Latin *praetorius* – “of or belonging to a *praetor*”; used as a noun it also can mean “ex-praetor”; in the Roman republic, praetors were public officers second in rank only to the consuls. For example, they were principally responsible for home affairs or acted as military commanders. Why Selys chose this name he does not explain.

Distribution: The species occurs mainly in southern Africa, from the Democratic Republic of Congo and Angola to the Eastern Cape Province, South Africa. Most records are from the eastern parts of southern Africa. There is only one historical record from Namibia (Hardap), which needs confirmation.

Ecology and behaviour: Typical habitats are wooded streams in forested areas, e.g. in Kwazulu-Natal, South Africa, or the Chimanimani Mountains in Zimbabwe. This habitat preference makes the record from the Hardap Dam in southern Namibia, where no such streams occur, hard to believe.

Threats and conservation: Status in Namibia not clear.

Crenigomphus Selys, 1897 and
Paragomphus Cowley, 1934 [Hooktails]

Paragomphus occurs from Africa to Europe and south-east Asia, with at least 30 species in Africa, whereas seven *Crenigomphus* species are restricted to Africa. The characteristics of *Crenigomphus kavangoensis*, recently found in Namibia, have caused the former separation of the two genera to become difficult. Therefore, both genera are treated together in this chapter. A typical feature of the genus is that the larvae often occur in high abundance; exuviae are, therefore, easy to find along the river margins. Three species of *Crenigomphus* and five species of *Paragomphus* have been recorded in Namibia so far, of which only *P. genei* is widespread in the country. All others are confined mainly to the perennial rivers.

Generic characteristics include the shape and size relationship of the upper and lower appendages. The upper appendages are parallel, longer than the lower ap-

pendages, and curved downward. Exceptions are *C. hartmanni* and *C. cornutus*, in which the upper appendages are only slightly longer than the lower appendages (Plate 18).

There are often foliations at S8 and S9 in both sexes, being less developed in females. Exceptions are *C. hartmanni* and *C. kavangoensis*, which have no foliation in either sex.

From the colouration the species may be divided into three major groups: (1) species having a greenish thorax with no or brownish markings; (2) species with a sand-coloured to cream-coloured thorax with brownish markings; and (3) species having a bright yellow thorax with contrasting black markings. The abdomen is usually yellowish with dark (brown to black) markings.

Meaning of scientific name: *Crenigomphus* is composed from Latin *crena* – “notch, indent, groove” and Greek *gomphos* – “bolt for shipbuilding”. The name refers to the furrowed front in this genus. *Paragomphus* is from Greek *para-* – (inter alia) “beside, nearby” and *gomphos* – “bolt for shipbuilding”. The name denotes that this genus is taxonomically close to *Gomphus* Leach, 1815.

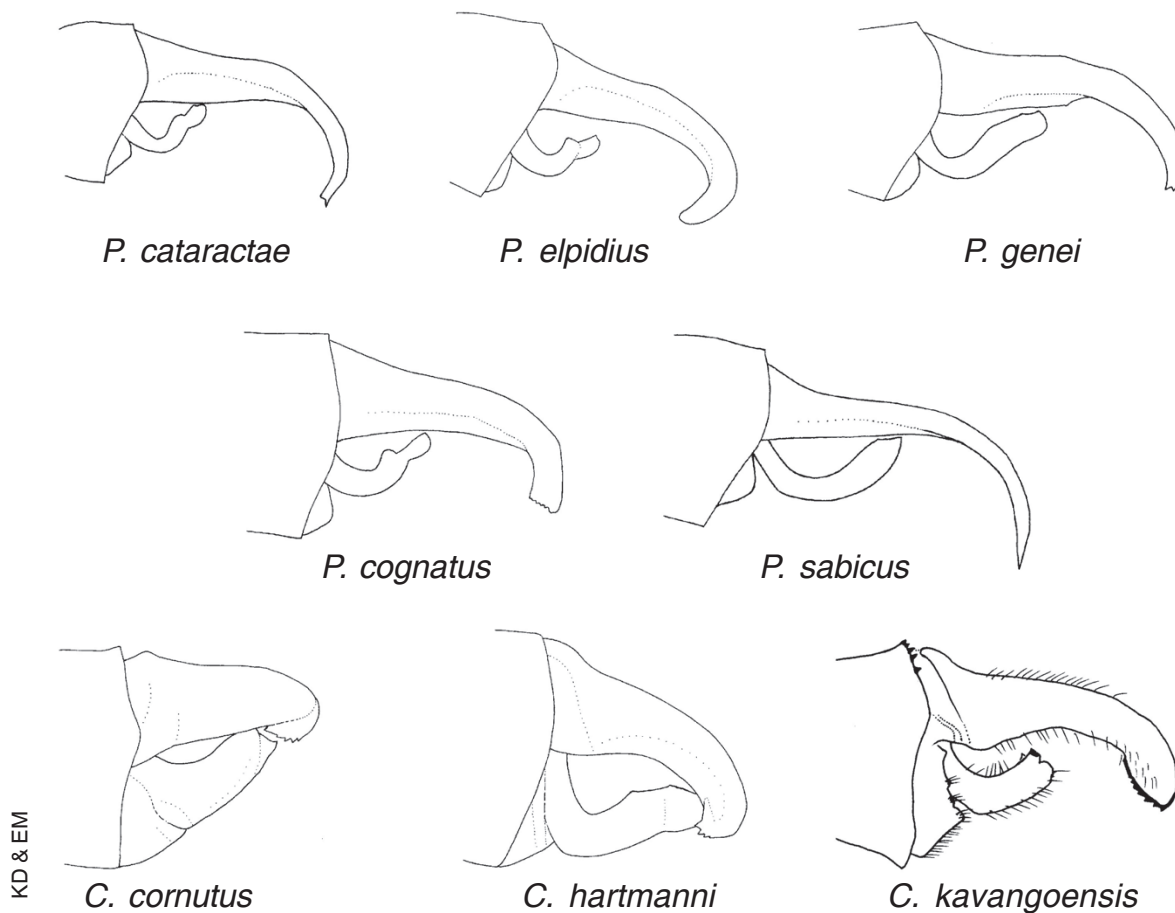


Plate 18: Appendages of *Crenigomphus* and *Paragomphus* males

Key to the species

- 1 Species with bright to pale green thorax, with brown markings or no markings. 2
- Species with yellow or cream-coloured thorax with brownish or black markings. ... 4
- 2 Thorax bright green without markings. *P. cataractae*
- Thorax bright to pale green with dark (black or brown) markings. 3
- 3 Pterostigma dark brown; thorax always bright green with dark brown markings; hamulus not hammer-shaped. *P. elpidius*
- Pterostigma pale brown; thorax mostly pale green with dull brown markings; hamulus hammer-shaped. *P. genei*
- 4 (1) No foliations at S8 and S9 in either sex. 5
- Foliations at S8 and S9 in both sexes. 6
- 5 (4) Upper appendages only slightly longer than lower appendage. Larger species – total length almost 50 mm. *C. cornutus*
- Upper appendages much longer than lower appendage. Smaller species – total length about 40 mm. *C. kavangoensis*
- 6 (4) Upper appendages of males only slightly longer than lower appendage. *C. hartmanni*
- Upper appendages of males much longer than lower appendage. 7
- 7 (6) Thorax as well as abdomen with clearly contrasting black markings. Males with prominent foliations spanning double as wide as the length of S8; body length > 50 mm. *P. sabcus*
- Only thorax with clearly contrasting markings. Males with much smaller foliations; body length < 50 mm. *P. cognatus*

Paragomphus cataractae Pinhey, 1963

[Cataract Hooktail]

Identification: *Paragomphus cataractae* is a small gomphid species. It is easy to identify due to its bright green thorax with no dark markings. *Paragomphus elpidius* and *P. genei* also have a greenish thorax, but always have brown to black markings. The male upper appendages are also very specific, ending in a distinct spine (Plate 18).



Meaning of scientific name: Latin (from Greek) *cataractae* – “of the cataract” or “of the waterfall”. In the species description, it is noted that the name is chosen for its habitat, the rapids of the Victoria Falls and Katambora, signifying its preference for fast-running waters.

Distribution: The Cararact Hooktail occurs in Angola, Namibia, Zambia and Zimbabwe. In Namibia, it has been recorded at Epupa Falls on the Kunene River, at Popa Falls on the Okavango River, and at the Zambezi River rapids at Katima Mulilo.

Ecology and behaviour: The species has only been encountered at rapids and waterfalls of large perennial rivers. Larvae dwell in sandy patches in the rapids. Only very few adults have been seen so far, which may indicate that the abundance is generally low. However, another explanation may be that the adults spend most of their life in the centre of the rapids, where they are not easy to spot. The flight season is at least from February to April.

Threats and conservation: The IUCN Global Red List status is “Near threatened”. Namibia has a special responsibility for the species because around 40% of the records and 50% of localities are from its territory. The major threat is habitat destruction due to the construction of dams at rapids for energy production.



KG

Paragomphus elpidius (Ris, 1921) [Corkscrew Hooktail]

Identification: Largest of the ‘green’ *Paragomphus*. The thorax is bright green with dark brown markings, the abdomen yellow with dark brown. The pterostigma is also dark brown to black, which clearly separates *P. elpidius* from *P. genei* (see relevant listings). Also the shape of the male appendages is specific (Plate 18).



Meaning of scientific name: Greek *elpid-* – “hope” and Greek/Latin *-ius* – “belonging to”. The name is a reference to the Cape of Good Hope region; no doubt the type locality is in Kwazulu-Natal, but for F Ris, a Swiss entomologist who had never been in southern Africa, *Cape of Good Hope* seemed near enough.



Distribution: This species occurs from the Democratic Republic of Congo and Kenya to South Africa. In Namibia, it occurs along the Kunene, Okavango, Kwando and Zambezi Rivers.

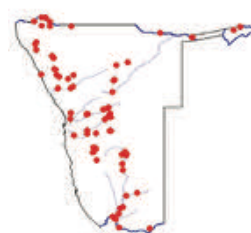
Ecology and behaviour: It occurs along large, slow-flowing rivers as well as at large open oxbow lakes in the flood plains. Most records are from October to March. Because a fresh exuvia was found in August, the flight season may include most of the year.

Threats and conservation: Not threatened.

Paragomphus genei (Selys, 1841)

= *P. hageni* (Selys, 1871)

[Common Hooktail]



Identification: In most parts of the country, *P. genei* is dull in colouration. The thorax is dull green and the markings on it are pale brownish. Specimens recorded in Caprivi differ in their brighter colouration from those in the arid parts of Namibia. In this latter region it may be confused with the co-occurring *P. elpidius*, from which *P. genei* can be distinguished by its light brown pterostigma (vs. dark brown), shorter upper appendages in the males (see Plate 18), and a hammer-shaped hamulus, which is unique to *Paragomphus*.

Meaning of scientific name: The species was dedicated to the Italian entomologist, Professor Carlo Guiseppe Genè (1780–1847), who gave Baron Edmond de Sélys-Longchamps access to the odonate collection at the Torino Natural History Museum.



Distribution: The Common Hooktail is widespread in continental Africa, and also occurs in southern Europe, the Levant, and on the Arabian peninsula and Socotra. In Namibia, it is widespread and common, particularly in the arid western parts.

Ecology and behaviour: The species occurs at a wide variety of fresh waters, ranging from large perennial rivers such as the Orange and Kunene, to smaller perennial streams, lakes and temporary waters. In perennial wetlands regularly disturbed by floods in the ephemeral rivers, *P. genei* may be the dominant dragonfly species. The larvae, being rapid burrowers (“sand swimmers”), are able to remove themselves very quickly from sight by covering themselves up with sand – a rare feature in other dragonfly larvae. Another relevant characteristic is rapid larval development, which may be completed in as few as 60 days. The species completes two or more generations per year. Adults can be observed throughout the year, even in the arid regions, where they aestivate in the dry period.

Threats and conservation: Not threatened.

Crenigomphus cornutus Pinhey, 1956 [Horned Hooktail]

Identification: The whole body is mainly sand-coloured with brownish markings. The species has no foliations at the abdomen in either sex. In the males, the upper appendages are only slightly longer than the lower ones, and also not much longer than S10. The body length is about 50 mm in females; males are slightly smaller.



Meaning of scientific name: Latin *cornutus* – “horned”; the lower appendages of the males end in three small black horns – two ventral and one dorsal, with their apices levelled off.



AM

Female

Distribution: The Horned Hooktail is endemic to southern Africa from Zambia to northern South Africa, where it occurs mainly in the Zambezi River and other eastern-flowing river systems. In Namibia, most records are from the Zambezi River. From the Okavango River only one historic record is known.

Ecology and behaviour: A riverine species that only occurs at sections of lotic water. A large population was encountered at the Zambezi River at Katima Mulilo. Surprisingly, males have never been observed, whereas females were commonly resting in shallow vegetation not far from the water. Indeed, females being more abundant at the water than males is an unusual feature in most dragonflies. The flight season is at least between December and March.

Threats and conservation: Not threatened.

***Crenigomphus kavangoensis* Suhling & Marais, 2006**
[Kavango Hooktail]

Identification: The whole body is mainly sand-coloured with brownish markings. The thorax has three cream-coloured stripes. In this colouration and in the missing abdominal foliations it resembles *Crenigomphus cornutus*, but is much smaller (about 40 mm total length). The males clearly differ from those of *C. cornutus* in having long upper appendages, which are much longer than the lower ones and also much longer than S10. The eyes of *C. kavangoensis* are light blue with a purplish shine.



Meaning of scientific name: *Kavango* (Cubango) is the name of the Namibian section of the Okavango River upstream of its confluence with the Cuito River, where the new species was found.



Distribution: So far, the species has only been recorded from the Okavango River in Namibia, where it is locally common all along the river from Nkurenkuru to Popa Falls. The species probably also occurs in Angola, and may be recorded in the Okavango panhandle in Botswana.

Ecology and behaviour: This riverine species only occurs at lotic water sections. The species has often been recorded at rather degraded sections of river banks, where several other species of dragonflies were missing. Near Tondoro, several females were observed perching in shallow shrub about 50 to 100 m from the banks. Oviposition has been observed in small side streams and in shallow water flowing rapidly over gravelly sand. Emergence takes place in December, and the flight season lasts at least until the end of March.

Threats and conservation: Not threatened. The species may even benefit from the degradation of river banks.

***Crenigomphus hartmanni* (Förster, 1898)**
[Hartmann's Hooktail]

Identification: The species is mainly yellow in colour, with more contrasting brown markings than *C. cornutus* and *C. kavangoensis*. Both sexes have small foliations. The males' upper appendages are only slightly longer than their lower appendages, and not much longer than S10.



Meaning of scientific name: The species was named in honour of Karl Hartmann from Germany, who collected the type specimen female in South Africa, in 1897.

Distribution: This species is widespread in eastern and southern Africa, southwards to the Western Cape Province, South Africa. There is one record from the



middle of the Cubango/Kavango River (upper Okavango System) in Angola, but this is somewhat questionable. In Namibia, so far it has only been encountered at the Orange River downstream from Noordoewer.

Ecology and behaviour: It is a riverine species, frequenting streams, rivers and sometimes pools with well-vegetated margins. The habitat at the Orange River, where only one exuvia and no single adult has been recorded so far, is a shallow riffle.

Threats and conservation: Not threatened.

***Paragomphus cognatus* (Rambur, 1842)**
[Rock Hooktail]

Identification: The species is similar in size to *P. genei*, but belongs to the species with a yellow thorax and black thoracic markings. It can be distinguished from the other yellow species, *P. sabicus*, by its less prominent foliations at S8 and S9. The upper appendages in the males are curved outwards (Plate 18).



Meaning of scientific name: Latin *cognatus* – “related, cognate”. MP Rambur chose this name to indicate the similarity he saw between this species and the European *Onychogomphus forcipatus unguiculatus*.

Distribution: This is a widespread species in equatorial Africa ranging south to the Cape of Good Hope, South Africa. In Namibia, only one recent record exists from the Okavango River. Historically, it occurred in the Otavi Mountains.



Ecology and behaviour: The species frequents rocky streams, rivers and river pools. The larvae typically burrow in sandy sediments. The flight season in Namibia is not clear due to few records; adults have been seen in January and March.

Threats and conservation: It seems that the species has been exterminated from the Otavi Mountains. The last records from that area were from 1919. It also seems to be rare at the Okavango River.

Paragomphus sabicus Pinhey, 1950 [Clubbed Hooktail]

Identification: *Paragomphus sabicus* is a medium-sized species, being larger than all other *Paragomphus*. The thorax and abdomen are yellow with very contrasting black markings. The males are very conspicuous due to the large foliations at S8 and S9, and the characteristic appendages (Plate 18). The body may have less black than shown in the picture below, e.g. S8 may be brownish in the anterior part, and there may be more yellow at the abdomen. From its colouration, *P. sabicus* may only be confused with *P. cognatus*, which is smaller and has fewer dark markings on the abdomen. Another similar species that may occur at the Zambezi River is *P. marginatus*, which has, however, not yet been recorded.



Meaning of scientific name: The type specimens were found in the valley of the Sabi River (Zimbabwe).

Distribution: The species occurs in the tropical parts of southern and eastern Africa north to Kenya. In Namibia, it occurs at the Okavango and Zambezi Rivers, where it is locally common.



ES

Male



ES

Female

Ecology and behaviour: The Clubbed Hooktail occurs at large rivers. The larvae, which burrow in sand, are found at sections with reeds at the river margin and swift current. Adults often rest in shrubland close to the river. In Namibia, adults can be observed during most of the rainy season; emergence starts as early as August.

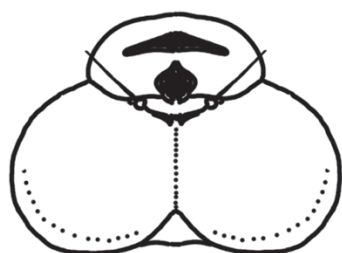
Threats and conservation: Not threatened.

Aeshnidae [Hawkers and Emperors, Aeshnids]

Aeshnids are a cosmopolitan family of large and usually conspicuous dragonflies. Characteristic are the large compound eyes, each consisting of about 25,000 ommatidia which connect on the top of the head. The discoidal cells in fore- and hindwing do not differ in shape and position, a feature shared with the gomphids, in which the compound eyes are separated. The aeshnids are typical flyers, spending most of their time in flight. Many species are crepuscular. Most species have high dispersal ability, and some are true migrants that may fly over vast distances, crossing oceans and deserts. The Afro-Oriental *Anax ephippiger* is the only dragonfly ever recorded in Iceland in the North Atlantic. Aeshnids are among the largest dragonflies in the world. There are more than 400 species listed globally, of which about 20 occur in southern Africa. The eight Namibian species belong to three genera.

Key to the Aeshnidae genera

- 1 Frons width less than one third of the head width. Upper appendages very slender and about as long as the last three abdominal segments. In males, abdomen slender with very constricted waist. Dull brownish or greenish in colour. *Gynacantha*
- Frons width more than one third of the head width. Upper appendages broad and about as long or slightly longer than the last two abdominal segments. Abdomen broader, not much narrower than thorax, with only slightly constricted waist. Most species with bright colours. 2
- 2 (1) Lateral sides of thorax uniformly green, brown or red in colour. Anal triangle absent. *Aeshna*
- Lateral sides of thorax brown with contrasting green stripes. Anal triangle present. ...
..... *Anax*



Anax



Aeshna



Gynacantha

Plate 19: Head shape of the three Aeshnidae genera

Gynacantha Rambur, 1842 [Dusk-hawkers]

Dusk-hawkers are pantropical, with over 80 species, 10 of which occur in continental Africa. All species have exceptionally large eyes. Besides flying at dusk and during rain, they may also emerge at night. The larger species fly fast and erratically in forest clearings, while smaller species hover cautiously along forest edges.

They usually rest in dense vegetation during the day. Reproduction takes place in stagnant, often seasonal, swamps and pools in dense forest or bush. Good places to find adults, therefore, are in thick undergrowth along dry stream beds and forested swamps. In Namibia, they only occur in Caprivi and have been encountered surprisingly rarely. Other aeshnids, mainly *Anax*, may also fly at dusk, but they are more robust and have less slender upper appendages. They also usually fly in open areas, while *Gynacantha* fly among dense vegetation, e.g. the crowns of trees.

Meaning of scientific name: Greek *gyne* – “woman” and *akantha* – “thorn, prickle”. The name refers to the 2–4 spines on the ventral side of S10 of this genus’s females.

Key to the species

- 1 Hindwing as long as or longer than abdomen. Abdomen and hindwing at least 50 mm. *G. villosa*
- Hindwing shorter than abdomen. Abdomen and hindwing less than 47 mm. *G. manderica*

Gynacantha manderica Grünberg, 1902 [Little Dusk-hawker]

Identification: The whole body is brownish. The length of an individual wing is less than the abdomen length and the body is generally smaller than in other *Gynacantha*. It has 13–14 antenodal cross-veins.



KG

Meaning of scientific name: The Latin adjective *manderica* refers to Manderu (Tanzania), a Catholic mission station where the female type specimen of the new species was collected in 1894.

Distribution: It occurs from Guinea and Somalia and south to South Africa, but has not yet been recorded in the Democratic Republic of Congo. In Namibia, the only records are at the Kwando River, but it ought to be more widespread in Caprivi.

Ecology and behaviour: A crepuscular species, flying at dawn often between high trees or along paths in shady forest, and therefore difficult to spot. Flight records are from December and March.

Threats and conservation: Not threatened.

***Gynacantha villosa* Grünberg, 1902**
[Brown Dusk-hawker]

Identification: It is larger than *G. manderica* and has 20–25 antenodal cross-veins.

Meaning of scientific name: Latin *villosus* – “hairy, shaggy”; the name refers to the densely haired thorax.

Distribution: From the Central African Republic and Uganda along the countries bordering the Indian Ocean south to South Africa (Kwazulu-Natal), including Zambia and Botswana. The species has not yet been recorded on Namibian territory, but has been recorded at the Chobe River rapids opposite Impalila Island and is, therefore, expected to occur in Namibia.

Ecology and behaviour: In forests; crepuscular species. Flight season unknown.

Threats and conservation: Not threatened.



VC

Aeshna Fabricius, 1775 [Hawkers]

Hawkers occur worldwide and 80 species are known, most of them American and Eurasian, whereas only five species occur in southern Africa. Only one species has been recorded in Namibia. A second species, *Aeshna rileyi*, occurs in the highlands of south-western Angola. There is a modest chance that it may also occur in north-western Namibia, e.g. in the Baynes Mountains. The species is recognised in the key below. The most obvious difference from the other aeshnids, e.g. the Emperors, is the contrasting colouration of the thorax, showing yellow-green bands between the brownish ground colours. The African Hawkets are most frequently found in the highlands and generally shun the sun.

Meaning of scientific name: Unknown. In English 17-century entomological references, *Aeschna* was a name for mayflies (Ephemeroptera), that might be derived from Greek *aîschos* – (inter alia) “ugliness of mind or body”. Fabricius chose this name, until then unemployed in the Linnean system, to comprise all non-libelluloid dragonflies.

Key to the species

- 1 Black markings on the front connected to form a *T*. *A. minuscula*
- Black markings, a spot and a semicircle on the front, not connected. *A. rileyi*

Aeshna minuscula McLachlan, 1896 [Friendly Hawker]

Identification: The eyes are green. The ground colour of the body is brown, with yellow-green stripes on the thorax and blue to green spots on the abdomen. Diagnostic is a *T*-shaped pattern on the frons in front of the eyes.



Meaning of scientific name: Latin *minusculus* – “somewhat smaller, rather small”. Compared with related species, *Aeshna minuscula* is comparatively small. However, in the species description there is only one indication of small size; therefore, the name might refer to the female’s appendages, which are remarkably short (2 mm).

Distribution: Almost endemic to South Africa, except for some Namibian records. In Namibia, historic records exist from Tsintsabis and the Otjiwarongo area. A small but reproducing population occurs in the Naukluft Mountains.

Ecology and behaviour: Occurs in small, perennial, shady streams interrupted by larger pools. The habitats are situated in highlands. Males patrol along the water-courses. Exuviae have been found in sedges at the margins of a large deep pool.

Threats and conservation: While common and widespread in South Africa, this is surely the most threatened species in Namibia. To date only one breeding locality is known and the population is so small that the individual records of the species are scattered over a number of years. Although the locality is situated in the Namib-Naukluft National Park, the running water habitat is not very well protected yet.

Anax Leach, 1845 [Emperors]

Identification: Emperors are cosmopolitan, with over 30 species. Six species occur in southern Africa, five of which are in Namibia. All are large to very large and powerful, with lengths from 60 up to 120 mm, and wingspans of up to 130 mm. *A. tristis* is among the world’s biggest dragonflies. They may be seen patrolling endlessly over sunny waters, hunting flying termites at dusk, or lurking in forests far from water during the dry season. All are excellent flyers that may enter the desert from distant breeding habitats. All Emperors have a plain-coloured thorax, being green or brownish-red (brownish in *A. ephippiger*) without distinct stripes.

Meaning of scientific name: Greek – “Lord of the House”. The genus might be named after the dominating behaviour at water of *A. imperator*, which was the only known species when the genus was established.

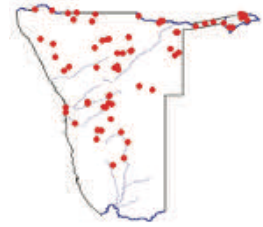
Key to the species

- 1 Abdominal segments (S) 4–8 with only one lateral keel. Pale brownish to green colouration, with blue ‘saddle’ on S2, which can be absent in females. ...*A. ephippiger*
- S4–8 with two lateral keels. Bright colours: reddish-brown, green or blue. 2
- 2 (1) Abdomen red or reddish-brown. Frons without dark markings. 3
- Abdomen black or mainly blue or green. Frons with dark basal markings. 4
- 3 (2) Both sexes with dark brown subcostal basal ray on both wings. ...*A. bangweuluensis*
- Both sexes without dark brown subcostal basal ray on both wings. *A. speratus*

- 4 (2) Frons with a broad black discoidal cell. Abdomen mainly black with green spots, half of S3 yellow. Male: Abdomen at least 75 mm. Female: Abdomen at least 65 mm, with upper appendages short, elliptical. *A. tristis*
- Frons with a rounded black marking. Abdomen mainly blue in males and greenish-brown in females. Upper appendages foliate in females. *A. imperator*

***Anax ephippiger* (Burmeister, 1839)**
[Vagrant Emperor]

Identification: This is the smallest *Anax* (length 60–70 mm), with much paler colours than the larger congeners; sand-coloured or greenish to brown. A blue “saddle” on the abdomen occurs in fully coloured males; in females and younger individuals it is pale or even absent. A dark mid-dorsal line runs all along the abdomen (as in *A. imperator*). The upper appendages in males have a real tip, whereas in the other species they are rounded.



Meaning of scientific name:
 From Greek *ephippion* – “saddle” and Latin *-ger* – “bearing”, pointing to a saddle-like blue mark on S2.

Distribution: It occurs all over Africa as well as in southern Europe, western Asia and India, and on the Indian Ocean islands. It migrates regularly into central Europe. In Namibia, records are scattered all over the country. It enters the arid areas seasonally.

Ecology and behaviour: A migrant in which long-distance dispersal is an obligate part of the life cycle. The species oviposits in all kinds of fresh waters and breeds successfully in temporary pools. Oviposition occurs in the tandem position with the male coupled to the female. Eggs are laid into plant material or wet soil. The great majority of Namibian records from this species are



ES

from the rainy season because it usually appears with the rains. However, there are a few records from the dry season.

Threats and conservation: Not threatened.

***Anax speratus* Hagen, 1867**
[Orange Emperor]



Identification: This is a very robust *Anax*, being the second largest in Namibia. The whole body, including the eyes, is orange-red to reddish-brown in colour in males; females have a green thorax. The female's eyes are dorsally brown and ventrally yellow. Both sexes have a yellow to orange face. The wings are hyaline. Due to their conspicuous colouration the males cannot be confused with other syntopic *Anax*, whereas the females are more similar to their *A. imperator* counterparts (see under *A. imperator*). A second reddish and very similar Emperor as regards both sexes, *A. bangweulensis*, colonises swamps and, at least in Namibia, does not co-occur with *A. speratus*. Length is about 75–85 mm.

Meaning of scientific name: Latin *speratus* – “the one being hoped for”. This name refers to the Cape of Good Hope, where it was first collected.



ES



Ovipositing female

Distribution: It occurs from the Cape, South Africa, to Ethiopia, Somalia and the Arabian peninsula. In Namibia, it is restricted to a few isolated localities, the majority of records being from the Naukluft and Tsaris Mountains.

Ecology and behaviour: Occurs in streams; in Namibia, usually small streams and some pools created by springs. The adult males persistently patrol along the stream. Females oviposit in the bases of rushes and sedges at the margins, sometimes being guarded by a male hovering nearby. The larvae usually live in the lentic parts, i.e. pools in the stream. The flight season seems to be throughout the year.

Threats and conservation: This globally common species is very local in Namibia and the major population in the Naukluft area is widely isolated from other populations of the species, i.e. by a minimum of 900 km. Although not yet threatened, degradation of spring habitats in the Naukluft may cause major reductions in the population.

***Anax bangweuluensis* Kimmins, 1955**
[Swamp Emperor]

Identification: This species is also reddish and, therefore, similar in colour to the Orange Emperor in both sexes but smaller. Because these two species are not syntopic, i.e. A.



bangweuluensis occurs in swamps and *A. speratus* in streams, identification features for both species are not important.

Meaning of scientific name: The Latin adjective *bangweuluensis* – “from Lake Bangweulu” points to the type specimen locality in northern Zambia.

Distribution: This rare species is only known from the Lake Bangweulu area in Zambia, the Okavango Delta in Botswana, and some parts of Namibia. The Namibian records from the Kwando River and the Okavango panhandle still need confirmation because only flying adults were seen, but not caught.

Ecology and behaviour: Not much is known about the species. It occurs at swampy river courses and small running water channels between reeds, being typical habitats for the Okavango Delta.

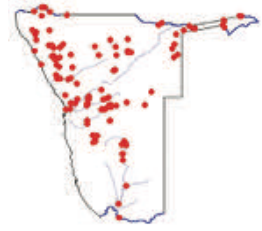
Threats and conservation: IUCN Global and Regional Southern African Red List status is “Data deficient”. The species has only been encountered at Lake Bangweulu and in the Okavango Delta.

In Namibia, the species appears to be rare. Closer examination of the distribution in Caprivi, particularly in the Linyanti Swamps, would allow better assessment of the species’ status.



JK

***Anax imperator* Leach, 1815**
[Blue Emperor]



Identification: Blue Emperor males have a blue abdomen with a dark mid-dorsal line and a green thorax; eyes are blue on top and green below. Females generally have a similar colour pattern with a bright green thorax, but the blue on the abdomen is dull and the dark, black to brown markings are much broader, so that the abdomen appears more brownish; eyes are green with yellow anterior margins. Wings in both sexes can be amber-coloured. Length is about 70–80 mm.

Meaning of scientific name: Latin *imperator* – “emperor” probably refers to the dominating behaviour of the species at the waterside.

Distribution: The species is widespread, occurring all over Africa, in Europe north to Scandinavia, and in western Asia. The form south of the Sahara is often regarded as the subspecies *A. i. mauricianus* Rambur, 1842. In Namibia it is the most widespread Emperor, being common in all the country’s biomes.

Ecology and behaviour: It can be observed at all kinds of habitats in Namibia. However, there is only scant evidence for successful breeding in rain pools and other temporary waters of short duration, although individuals may often be seen at such habitats. Males patrol endlessly along the margins of ponds and running waters in search of females. Oviposition often occurs in rotten parts of plants, e.g. stems of reeds and sedges swimming on the water surface. The larval period seems to be



Male feeding on a skimmer

21



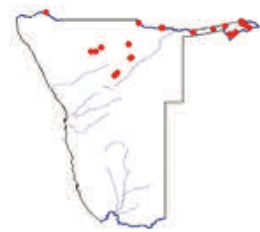
Ovipositing female

some months at least, meaning that development is only possible in perennial or longer-lasting temporary waters. The flight season occurs throughout the year, although densities are much lower during winter in the highlands.

Threats and conservation: Not threatened.

***Anax tristis* Hagen, 1867**
[Black Emperor]

Identification: This is biggest dragonfly in Namibia, with a length of up to 120 mm and a wingspan of up to 135 mm. The thorax and eyes are green; the abdomen is black with yellow dorsal spots. S2 has a brown butterfly-like marking dorsally (if one sees this enormous insect one may think it is in fact a butterfly sitting on its abdomen). Both sexes are similar in colour. The male has a longer abdomen than the female, being conspicuous in flight.



Meaning of scientific name: Latin *tristis* – “depressed, gloomy” refers to the mainly black colour of the species as if it were clad for mourning. The description is based on a female specimen with a darkened body and whose colouration was not well preserved.

Distribution: It occurs in equatorial to southern Africa, and also on Madagascar, the Comoros and in southern Arabia. In Namibia, it occurs northwards in a line from the Kunene River via Etosha to the Waterberg, but may fly more southwards. It is most common in Caprivi.



Ecology and behaviour: The major habitat seems to be temporary waters. Several records are from rain and flood-plain pools in the Caprivi. More southern records are mainly from farm dams. Most records of adults are from November to March, but single records exist from May, July and August.

Threats and conservation: Not threatened.

Macromiidae [Cruisers]

Macromiidae are represented by one genus in Africa, *Phyllomacromia* Selys, 1878. African Cruisers were formerly classified in *Macromia*, a huge predominantly Nearctic and Oriental genus. *Phyllomacromia* is endemic to Africa with about 40 species, one of which is a Madagascan species. In life, these are very attractive dragonflies with long, clubbed abdomens, spidery legs and bright green eyes. All are bronzy-brown to black, conspicuously marked with yellow. All species are fast, long-range fliers that seldom settle, and may be very hard to catch. If they rest, they usually do so in a hanging position in branches of trees. The females lay their eggs unguarded, touching the water surface by dipping movements in flight. The mating system of this group is unknown.

Meaning of scientific name: The name *Macromia* means “large-shouldered” [Greek *makros* – “long, tall, large”, *ômos* – “shoulder” and *-ios* – “equipped with”], referring to the robust thorax. In the genus *Phyllomacromia* (Greek *phyllon* – “leaf”), the downside edges of S8 in males are extended laterally into rounded foliages.

Key to the Macromiidae genera

- 1 Thorax without or with one yellow stripe on the sides. S3 yellow in the basal half. Large species, up to 70 mm in length. *P. contumax*
- Thorax with three distinct lateral stripes. S3 in the basal half not continuously yellow. Smaller species, up to 60 mm in length. 2
- 2 (1) Face yellow with a red or blue-black half-moon on the frons. The S10 in males with twin spines dorsally. Upper appendage and genital lobe all yellow. ... *P. kimminsi*
- Face (clypeus and front of the frons) reddish-brown to dark metallic blue and without blue-black half-moon. 3
- 3 (2) Pterostigma red or reddish-brown. In males, S10 with a broad dorsal peak with one spine. Small foliations. *P. picta*
- Pterostigma black. S10 flat, without dorsal peak. In males, S10 without a broad dorsal peak and without a spine. Large triangular foliations. *P. overlaeti*

Phyllomacromia contumax Selys, 1879 = *Phyllomacromia bifasciata* (Martin, 1912) [Two-banded Cruiser]



Identification: A large species, up to 70 mm in length. The thorax is brownish with a metallic green shine and no yellow stripes. A yellow saddle on S2 is conspicuous, as is another yellow spot shared by S7 and S8. Otherwise mainly black with small yellow rings. In males, the distal end of S10 is convex and without spines. The upper appendages are dark brown.

Meaning of scientific name: Latin *contumax* – “wilful, obstinate, stubborn, not fitting in” might have been chosen as a name because of certain peculiarities it has, making the species difficult to classify taxonomically.

Distribution: The species occurs in most of sub-Saharan Africa from Senegal and Kenya to South Africa (Kwazulu-Natal). In Namibia, it is restricted to the northern perennial rivers; records are from the Kunene, Okavango, Kwando and Zambezi Rivers. One record of a vagrant is from the town centre of Otjiwarongo.



JK

Ecology and behaviour: A running-water species. Larvae live among detritus or muddy substrates at the fringes of sections of running water. During the day, the males often cruise over the river; in the evening, adults can be seen hunting on clearings sometimes high above the ground. The flight season coincides with most of the rainy season, with records being from December and February to April.

Threats and conservation: Not threatened.

Note: This species is usually listed as *Phyllomacromia bifasciata* in earlier literature.

Phyllomacromia kimminsi (Fraser, 1954)

[Kimmins's Cruiser]

Identification: This species is similar to *P. picta* in size and in having green eyes and a black-and-yellow body colouration. The face is orange-yellow, with a red or blue-black half-moon on the frons. The abdomen is dark with yellow markings on S1–8, and traces of yellow on S9–10. Males have a broad dorsal peak with two spines on S10.

Meaning of scientific name: The species is dedicated to Dr Douglas Eric Kimmins, entomologist at the British Museum of Natural History.

Distribution: The species mainly ranges from Uganda and Kenya to West Africa. On the southern subcontinent it has only been recorded in the Maunachira River system in the north-eastern Okavango Delta, and at Ikelenge near the Zambezi River. There are no records from Namibia as yet, but it may occur here.

Ecology and behaviour: Kimmins's Cruiser is a poorly known species. It occurs at rivers in bush and forest. Little is known as regards its flight season: to date the species has only been recorded in December.

Threats and conservation: The species has not been encountered in the Delta for 30 years. The IUCN Regional Southern African Red List status is "Data deficient".

Phyllomacromia picta (Hagen, 1871)

[Darting Cruiser]

Identification: The abdomen of this species has black-and-yellow rings and the thorax has three yellow stripes on its sides. The eyes are metallic green. It is distinctly smaller than *P. contumax* (length to 60 mm). This species is most similar to *P. overlaeti*, but can be distinguished from it by its much smaller foliations and a broad dorsal peak with one spine on S10 in males.



Meaning of scientific name: Latin *pictus* – “painted, variegated, coloured”; the name probably refers to the black marks in the yellow abdominal rings.



Distribution: Equatorial Africa to the Cape of Good Hope, South Africa. The most common of the Cruisers in Namibia, it occurs along all the perennial rivers, including the Orange. There is even a population in the centre of the country at the Oanob Dam.

Ecology and behaviour: A riverine species, which also breeds in larger lentic waters such as lakes. Adults are often seen hunting in forest gaps and over shrubland several metres high. Like all Cruisers, this species is a typical flyer that usually rests in a hanging position, but it can also be seen perching in a horizontal position on twigs like a gomphid.

Threats and conservation: Not threatened.

Phyllomacromia overlaeti (Schouteden, 1934)
 = *P. paludosa* Pinhey, 1976
 [Clubbed Cruiser]



Identification: This species is very similar to *P. picta* in colour and size, and in flight it is particularly difficult to distinguish them from each other. However, the Clubbed Cruiser has much larger, triangular foliations, and lacks the spine and peak on S10. The pterostigma is black.

Meaning of scientific name: The species was named in honour of the Belgian entomologist FG Overlaet, who collected the type specimen at Kapanga (Democratic Republic of Congo).



CS

Distribution: From Uganda to Angola and Botswana. It was only recently recorded in Namibia, at the Okavango, Kwando and Zambezi Rivers. Records also exist from Chobe, opposite Impalila Island.

Ecology and behaviour:

A running-water species, but not much is known about its ecology. A larva was caught on sandy ground in a moderately flowing section of the Kwando River. Adults were seen flying with *P. picta* and showing similar behaviour.

Threats and conservation: Insufficient information.

Note: The species is listed as *P. paludosa* in earlier literature.

Libellulidae [Libellulids]

Together with the Gomphidae, Libellulidae are the largest family of anisopteran dragonflies, representing about 950 species globally. With about 60 species in more than 20 genera, they are by far the largest family of odonates in Namibia, making up almost 50% of all dragonfly species. The genera *Trithemis* and *Orthetrum* have at least a dozen species each in Namibia.

The reason is that many species are well adapted to arid conditions in having short development times, not needing vegetation for egg deposition, and being extremely good flyers that are able to reach even very isolated water bodies in the desert. Some species are true migrants, e.g. *Pantala flavescens*, *Tramea basilaris* and *Sympetrum fonscolombii*, which regularly enter the most arid parts of the

country with the onset of the rainy season by flying in over vast distances from more humid landscapes.

Libellulids can be observed at almost all types of freshwater habitats and even some brackish waters. They are particularly dominant at temporary waters because it takes less than two months for the larvae of several species to develop from the egg to emergence. On the other hand, there are also those that are adapted to flowing water, e.g. the species of the genera *Zygonyx*, *Zygonoides* and *Olpogastra*. Others, like *Rhyothemis*, *Hemistigma* and *Chalcostephia*, comprise mainly swamp species.

All libellulids have in common that the discoidal cells in the fore- and hindwing are similar in shape – a feature they share with Macromiidae. The libellulids differ from the latter family by the smooth-edged rear margins of their eyes, whereas Macromiidae have a small incision in that margin. Libellulids vary in length from about 20 to almost 60 mm.

Most species show distinct sexual dimorphism. Whereas the females are often brownish, males have brighter colours. The males of different species are particularly diverse in colouration, being red, yellow and/or black. Several species develop a layer of wax that may cover major parts of the body. This usually blue pruinosity appears to be a protection against strong solar radiation. It is common in the genera *Orthetrum*, *Trithemis*, *Palpopleura* and in some others. Some species have dark-coloured wings or have at least dark wing spots. Others may have yellowish hyaline areas in the wings or red wing veins. Running-water species, in particular, are black and yellow in both sexes; in this they resemble other riverine dragonflies like gomphids and macromiids.

As diverse as the colouration is the reproductive behaviour of libellulids. Often, males are highly territorial and show antagonistic behaviour towards rivals. Colours and specific behaviours are displayed as signals to repel other males as well as to attract females. For instance, males of *Palpopleura* and *Rhyothemis* display their dark wings to chase away competitors. By contrast, *Nesiothemis* males display their dark faces and by doing so, they fly in narrow circles directing their face towards their adversaries, which appears like a dance (hence the English name *Dancing Skimmers*). After mating, the females may lay their eggs alone or guarded by the males. Mate guarding may be without body contact or in tandem, as explained earlier (see Chapter on reproductive behaviour).

Meaning of scientific name: The family name Libellulidae is derived from the genus name *Libellula*. By using this name the Swedish naturalist Carl Linnaeus summed up all Odonata in his classic book *Systema Naturae*. The tenth edition of that publication (1758) constitutes the starting point of modern animal classification. The name is a diminutive of *libella*, which, among other things, denotes a

spirit level, a carpenter's tool, which was T-shaped in ancient and medieval times. However, the French naturalist Guillaume Rondelet (1505–1566) had already chosen this name for the hammerhead shark (*Libella marina* – “*libella* from the sea”) because of its similarity to that tool, and later transferred to zygopterous larvae (*Libella fluviatilis* – “*libella* belonging to the rivers”). From the 17th century onwards, adult Odonata were also named thus by scientists.

Key to the Libellulidae genera

- 1 Pterostigma bicolored, being distally pale (mostly white) and proximally dark. 2
- Pterostigma plain (bordering veins may have another colour). 5

Species with bicoloured pterostigma, some with dark wing patches: Brachythemis, Parazyxomma, Chalcostephia, Hemistigma, Palpopleura

- 2 (1) Frons metallic green, contrasting with bright yellow face. *Chalcostephia*
- Frons not metallic green and no combination with yellow. 3
- 3 Wings completely hyaline, without dark pattern or large yellow area. Female *Brachythemis* and *Parazyxomma*
- Wings with dark pattern or yellow areas. 4
- 4 (3) Abdomen black or red, without blue pruinosity. All wings either with dark bands or a large yellow patch. Male *Brachythemis* and *Parazyxomma*
- Abdomen with blue pruinosity. Wings with irregular black patterns or at least a yellow streak along the costa of the forewing, about two cells deep. *Hemistigma* and *Palpopleura*
- 5 Both sexes with large dark brown or black patterns at least on the base of the hindwing, but may also cover most areas of all wings. 5
- No large dark patterns on the base of the hindwings, but may have light brownish patch in the wing or a yellow wing base. 8

Species with large, dark brown to black wing patches: Brachythemis, Rhyothemis, Palpopleura, Tramea, Urothemis

- 6 Wings with large black areas iridising in the sunlight, which cover at least one third of the hindwing. Abdomen black and stout. *Rhyothemis*
- Large brownish patch, which may be bordered with yellow, on the base of the hindwing. 7
- 7 Last Ax in forewing incomplete. Abdomen slender; black pattern only on S8 to S10. Males with red abdomen and brown thorax. *Tramea*
- Last Ax in forewing complete. Abdomen broad, with mid-dorsal black pattern on most segments. Thorax and abdomen bright red or blue in mature males. ... *Urothemis*
- 8 (1) Last Ax in forewing complete. 9
- Last Ax in forewing incomplete. 13

Species with last Ax in forewing complete: Aethriamantha, Urothemis, Orthetrum, Nesciothemis, Aethiothemis. Note: A few Blue Trithemis, typically T. dorsalis but rarely others, also have the last Ax complete

- 9 (8) Forewing with 6 Ax; two brown streaks in yellow patch of the hindwings; body of male bright red. *Aethriamantha*
- Forewing with more than 8 Ax. Body yellow with black or blue pruinosity, never bright red. 10
- 10 (9) Forewing with 8–11 Ax. Body orange, developing rich blue pruinosity in males. ... *Aethiothemis*
- Forewing with 12–21 Ax. Body yellow to greenish or brownish, with pale or dark pruinosity in males. 11
- 11 (10) Frons metallic blue. *Trithemis* (part)
- Frons not metallic blue. 12
- 12 (11) Female and immature males with distinct cream-coloured mid-line along the back of the thorax. Mature male with dark purplish eyes contrasting with the whitish-blue pruinosity on the thorax and the first 4–6 abdominal segments; remaining segments black. *Nesciothemis*
- Female and immature males without distinct cream-coloured mid-line along the back of the thorax. Pruinosity in mature males not whitish blue; eyes green or blue. *Orthetrum*

Species having first Ax in forewing incomplete: Acisoma, Diplacodes, Sympetrum, Bradynopyga, Trithemis, Olpogastra, Zygonoides, Zygonyx, Pantala, Tholymis, Crocothemis

- 14 (13) Abdomen conspicuously swollen in basal half, then slender. *Acisoma*
- Abdomen not of that shape. 15
- 15 (14) Body with grey-olive and brown camouflage pattern. *Bradynopyga*
- Body without such camouflage pattern. 16
- 16 (15) Abdomen red to violet or brownish. 17
- Abdomen without any red, black, blue or yellow-black. 22
- 17 (16) Pterostigma in forewing longer than in hindwing. Flies most times of the day. ... *Pantala*
- Pterostigma in forewing and hindwing of similar length. Does not fly most times of the day. 18
- 18 (17) Mature males red with brown and white panels in hindwings. Females pale without much black pattern. Rests in deep shade during the day, flying at dusk and dawn. *Tholymis*
- Mature males without brown and white panels in hindwings. Females with black patterns on abdomen. Species usually not active at dusk and dawn. 19

19	(18) Forewing with 6.5–7.5 Ax.	20
–	Forewing with > 8.5 Ax (in a few cases, 7.5 have been reported).	21
20	(19) Black mid-dorsal pattern on all abdominal segments. Abdomen mostly yellow. Thorax red.	<i>Diplacodes</i>
–	Black pattern at maximum on S8 to S10. Males with bright red abdomen. Thorax brownish.	<i>Sympetrum</i>
21	(19) Number of cells in discoidal field in forewing increases towards the edge of the wing. Abdomen usually broad. Resting position with wings relatively straight.	<i>Crocothemis</i>
–	Three (sometimes four) cells in discoidal field over its entire length. If the abdomen is broad, the species is purplish in colour, not red. Resting position with wings dropped.	<i>Trithemis</i>
22	(18) Smaller species; body length < 45 mm; wingspan < 70 mm.	23
–	Large species; body length > 50 mm; wingspan > 80 mm.	24
23	(22) Blue pruinosity on thorax. Abdomen blue or black, sometimes with yellow streaks. Body length at most > 35 mm.	<i>Trithemis</i>
–	Without any blue pruinosity. Abdomen entirely black or black with yellow rings. Body length at most < 30 mm.	<i>Diplacodes</i>
24	(22) S2 and S3 ventrally distinctly swollen, more than three times as thick as the slender following segments. Yellow-spotted thorax, with greenish-black markings. ...	<i>Olpogastra</i>
–	S2 and S3 not swollen ventrally and following segments not slender; dorsoventrally slightly compressed.	25
25	(24) Abdomen with tapered “waist” at S3 and S4; following segments wider. Sides of thorax a metallic greenish-black. Pterostigma long, > 4 mm.	<i>Zygonoides</i>
–	Abdomen without such “waist”. Sides of thorax black with yellow or covered with blue pruinosity. Pterostigma short, < 3 mm. Individuals fly most times of the day. <i>Zygonyx</i>	

***Chalcostephia* Kirby, 1889 [Inspectors]**

This genus consists of a single species, being an African endemic, although it is very widespread over most of sub-Saharan Africa. The males have a forked process at the underside of S1, not far away from the genitalia – a feature which is unique in odonates. For a description of other characteristics, see below.

Meaning of scientific name: Greek *chalkos* – “copper, bronze”; *stephos* – “crown, wreath, garland”; and Latin *-ius* – “equipped with”. In the only species of the genus the upper part of the clypeus is copper-green, which makes the species look as though it is wearing a crown. The previously occupied name was *coronata* – Latin for “the crowned one”.

Chalcostephia flavifrons Kirby, 1889

[Inspector]

Identification: Adults are immediately identified by the green metallic frons contrasting to the pale yellow parts of the face below. The pterostigma is bicoloured, having a pale centre, which is also unique in libellulids. The abdomen is black with greenish-yellow spots, becoming pale blue in maturity. In size and body shape the species resembles *Hemistigma albipunctum*, which often co-occurs in the same habitat.



Meaning of scientific name: Latin *flavifrons* – “with a yellow front”. The first words in WF Kirby’s description are “Face yellow”.

Distribution: The species is widespread in tropical continental Africa and Madagascar. In Namibia, it occurs at the Kwando and the lower Okavango Rivers.

Ecology and behaviour: The Inspector inhabits swamps. Adults mostly perch in the shade of trees. In Namibia, the species was recorded in November, December and March.

Threats and conservation: Not threatened.



***Brachythemis* Brauer, 1868 and *Parazyxomma* Pinhey, 1961 [Groundlings]**

The genus *Brachythemis* consists of two Asian and three African species. The African *B. leucosticta* also occurs in southern Europe and western Asia. The genus *Parazyxomma* consists of a single species, which is an African endemic although very widespread over most of tropical Africa. It is listed here under *Brachythemis* because both genera are very similar and *P. flavicans* may be so close to *Brachythemis* that it should be included in it. In particular, the larvae are extremely similar to *Brachythemis* in respect of all morphological features, while the slight morphological differences between adults may mainly derive from the crepuscular flight behaviour of *P. flavicans*. Therefore, it is very possible that *flavicans* will be included in *Brachythemis* in future. For this reason the two genera are treated together in this chapter. Both comprise small libellulid species that differ in body colouration and wing markings. The body colour of mature males can be red or black; wings may bear black bands or large yellow to orange-red spots, or may even be hyaline. Characteristic for all members of both genera are the big head and the short, broad abdomen.

Meaning of scientific name: Greek *brachýs* – “short” refers to the short abdomen of the adult; Greek *themis* – “law as established by custom” as well as referring to the Greek Goddess of Order, was first used as an element in dragonfly names by Hermann August Hagen in 1861. Today, this element is widespread in the Libellulidae, e.g. in *Brachythemis*, *Nesciothemis*, *Rhyothemis* and *Trithemis*.

A species first described as *Zyxomma flavicans* was put in a genus of its own in 1961. Greek *para* – (inter alia) “beside, nearby” refers to the systematic position related to *Zyxomma*. The name *Zyxomma* itself is derived from Greek *zeuxis* – “yoking, bridging” and *omma* – “eye”, and aptly describes the head with its conspicuously large, broadly contiguous eyes.

Key to the *Brachythemis* and *Parazyxomma* species

- | | | |
|---|--|---|
| 1 | All wings with black or brownish band between nodus and pterostigma. | 2 |
| – | Wings without such band. | 3 |
| 2 | (1) Black wing band. | <i>B. leucosticta</i> , adult male |
| – | Pale brownish wing band. | <i>P. flavicans</i> , adult male |
| 3 | (1) Wing bases marked with broad area of amber or orange-red. Frons with median black markings. | <i>B. lacustris</i> , male |
| – | Wings without broad areas of amber or orange-red. | 4 |
| 4 | (3) Forewing with 6.5 to 7.5 Ax. | 5 |
| – | Forewing with 9.5 Ax or more. | <i>P. flavicans</i> , female and teneral male |

- 5 (4) Frons with continuous basal band. *B. leucosticta*, female and teneral male
 – Frons without continuous basal band; basal band completely missing or narrowed at sides. 5
- 6 (5) Wing bases with amber streaks. *B. wilsoni*, male and female
 – Wing bases without amber streaks. *B. lacustris*, female

Brachythemis lacustris (Kirby, 1889)

[Red Groundling]

Identification: Adult males have a bright red body and broad amber wing bases in hind- and forewings. In these features there is only one similar species among the Namibian dragonflies: the widespread *Trithemis kirbyi*. However, *B. lacustris* has a short, stout abdomen, while that of *T. kirbyi* is long and slender. Quite often, *B. lacustris* males and females sit close together in large groups along rivers.



Meaning of scientific name: Latin *lacustris* – “pertaining to lakes”. The name is misleading because the species only occurs at rivers.

Distribution: The species occurs in tropical continental Africa. In Namibia, it is often very common at the perennial rivers in the north. At the Kwando River the species density is very low.

Ecology and behaviour: The species inhabits perennial rivers. Males and females usually stay together near the banks in large aggregations. Reproductive behaviour starts in the late afternoon, when males become territorial at sites with floating or emerging plants. When a female crosses his territory, the male starts his court-



ship display by hovering above an oviposition site, e.g. the floating plant, and turning the abdomen down in flight. Copulation lasts only seconds; afterwards, the female attaches the eggs to the plants, guarded by the hovering male.

It may be that, in Namibia, the flight season is throughout the year, but most records are from November to April; very few are from the other months.

Threats and conservation: Not threatened.

***Brachythemis wilsoni* Pinhey, 1952**
[Swamp Groundling, Wilson's Groundling]

Identification: The males are dull red. The wing markings consist of amber basal streaks on the wings only. In both sexes the species is the smallest representative in the southern African region.

Meaning of scientific name: Named in honour of Mr CE Wilson, who collected the first specimens of this new species in southern Sudan in 1950.

Distribution: The species occurs in Sudan, Nigeria, Uganda, the Democratic Republic of Congo and Botswana. To date, there are no records from Namibia. In Botswana, the species is rare and confined to the Okavango Delta – where it was only recently re-recorded, after 30 years.

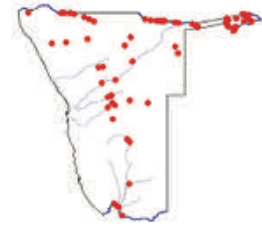
Ecology and behaviour: In Botswana, the species lives at swampy river margins and backswamps with rich vegetation, where adults are recorded from December to March.

Threats and conservation: Globally the species is not threatened, although the status of the very isolated population in the Okavango Delta is not clear.



Female

***Brachythemis leucosticta* (Burmeister, 1839)**
[Banded Groundling]



Identification: *Brachythemis leucosticta* males have distinct dark wing bands. In Namibian odonates, dark wing bands only occur twice: in the males of *B. leucosticta* and *P. flavicans*.

In southern Africa there is only another one which have a blue pruinosity on the abdomen, namely the male of *Tetrathemis pollenii*, which occurs at the Zambezi River in Victoria Falls, only 80 km downstream from Namibia. In adult *B. leucosticta* males the abdomen is black, while in younger males and females it is yellow with three well-developed bands on the back – as in female *P. flavicans*. *B. lacustris* females have a thick median black line only.

Meaning of scientific name: Greek *leukós* – “white, light, bright, clear” and *stiktós* – “marked (with)” refer to the mainly whitish pterostigma or wing marking of the adult male.

Distribution: The Banded Groundling occurs in continental Africa, southern Europe and western Asia. In Namibia, it is widespread and locally common in the north, particularly along the large northern perennial Kunene, Okavango, Kwando and Zambezi Rivers, as well as in the Cuvelai wetlands, the Etosha Pan and Tsumkwe. Large populations occur at dams and reservoirs such as Omatjenne, Omatako, Sartorius von Bach, Friedenau, Avis, Otjivero, Oanob, Hardap and Naute, where the species was frequently found at waters. In the south, the species occurs at the Fish and Orange Rivers.



AM



AM

Immature male

Ecology and behaviour: The species occurs at large rivers and lakes, in arid parts of Namibia, and – especially – at large impoundments. Males and females typically sit on the ground near the water's edge. They often occur in large numbers. A very special behaviour otherwise only known from birds such as the cattle egret has been observed in this species: the specimens accompany herds of large mammals. They fly close to the ground between the legs of antelope or cattle. In so doing they are able to catch insects disturbed by the mammals. They often also follow humans in the same way. The flight season spans throughout the year. The species is most common between November and April; no records exist thus far for July.

Threats and conservation: Not threatened.

***Parazyxomma flavicans* (Martin, 1908)**
[Twilight Groundling, Banded Duskdarter]

Identification: Characteristic is the large head, having a typically broad reflection pattern of the eyes in living specimens of both sexes, and a short, broad abdomen. Adult males have brownish wing bands, but not as dark and well contrasted as those in *Brachythemis leucosticta* males. The species is usually only active at dusk and dawn. The females, too, are very similar in both species. The best feature by means of which to identify female specimens is the number of Ax veins in the forewing: 9.5 or more in *P. flavicans* and 6.5—7.5 in *Brachythemis leucosticta*. The species is usually only active at dusk and dawn.





Meaning of scientific name: *Flavicans* is a Latin present participle, derived from *flavus* – “yellow”, so one might translate this as “being somewhat yellow”. In *Parazyxomma* the name can only mean the mostly (dark) yellow colour of the head and thorax.

Distribution: The range is from Senegal and Uganda to Namibia, Botswana and South Africa (Kwazulu-Natal). In Namibia, the species is recorded from the Okavango, Kwando and Zambezi Rivers.

Ecology and behaviour: Adults are crepuscular and prefer flying along reeds at dawn. This species is regarded as a typical “flier”. At the Zambezi it has been seen flying in the centre of the river. During the day adults can be found in the deep shade, sitting on twigs of bushes or trees, but not in a hanging position like other libellulids which are active at twilight, namely *Tholymis tillarga*. Larvae were sampled in an oxbow. To date, adults have been recorded in September, December, February and March. Emergence seems to begin in September.

Threats and conservation: Not threatened.

***Hemistigma* Kirby, 1889 [Pied-spots]**

Two species belong to *Hemistigma*: one is confined to continental Africa, and the other to Madagascar. Compared with the related genus, *Palpopleura*, adults have a slender and cylindrical abdomen. Features similar to the latter are the bicoloured black-and-white pterostigma, conspicuous yellow and black wing markings, blue pruinosity in males and elder females, and the shape of the larva.

Meaning of scientific name: Greek *hemi*- – “half”; *stigma* – “tattoo mark”. In this genus, half of the pterostigma is a pale colour, while the other half is black.

***Hemistigma albipunctum* (Rambur, 1842)**
[Pied-spot]



Identification: In the forewings both sexes have a yellow or black-and-yellow line parallel to front of the wing (in the sub-costal space). The pterostigma is white in the inner half, black in the outer half. Females in particular may have brown wing tips. The face is metallic dark blue above and yellow below. The body is yellowish with black markings, often covered with a pale blue pruinosity.

Meaning of scientific name: Latin *albus* – “white”; *punctum* – “dot, spot”; refers to the conspicuous white half of the pterostigma.

Distribution: The Pied-spot is widespread in sub-Saharan Africa. In Namibia, the species is common along the Okavango, Kwando and Chobe Rivers. It is also known from single localities at the Kunene and Zambezi Rivers, from the wetland below the Sartorius von Bach Dam, and an historic record is from Sissekab.

Ecology and behaviour: The Pied-spot occurs mainly at swamps or well-vegetated ponds. The flight season in northern Namibia may be throughout the year: records are from November to May, and from August and September. At the Sartorius von Bach Dam, the species is on the wing only in April and May.

Threats and conservation: Not threatened.



JK

Male with maximum pruinosity



GS

Male partly covered with pruinosity



AM

Female with dark wing tips

Palpopleura Rambur, 1842 [Widows]

The genus *Palpopleura* occurs in Africa and Asia, and comprises seven species in total. Six of these live in Africa and on Madagascar, while the seventh occurs in southern and south-east Asia. Four species have been recorded in southern Africa. Widows are small to very small libellulids with short, broad abdomens and often conspicuously dark spots on the wings. Their body is yellow in colour with black markings. In adult males, the abdomen is covered by a light blue pruinosity. The species are easily distinguishable by their wing patterns. In all species the fore margin of the wing is kinked between base and nodus, which is a unique feature. The pterostigma is usually bicoloured, being half white and half black. In some cases, however, the white part may be greatly reduced.

Meaning of scientific name: Whether Latin *palpare* – “stroke” is the correct interpretation of the first element of the name seems dubious. The second word element, *pleurá*, is Greek for “rib, side (of things and places)”. It is suggested that *pleurá* is used here as an equivalent to Latin *costa*, because Rambur points to special features of the anterior margin of the wings being characteristic for the genus.

Key to the *Palpopleura* species

- 1 Base of forewings hyaline, without spots. Forewing with yellow streak near the costa and a small blackish streak at the level of the subcosta. *P. deceptor*
– Base of forewings with amber or black basal spots. 2
- 2 (1) Face, sides of thorax and legs pale yellow. Wing markings restricted to the basal half of the wings and a small spot at the nodus. *P. jucunda*
– Face, sides of thorax and legs reddish- to blackish-brown. Wing markings in both halves of the wings. 3
- 3 (2) In the forewing, the black covers the whole wing area from base to pterostigma. ...
..... *P. lucia*
– In the forewing, the black area is distinctly smaller at the level of the nodus. *P. portia*

Palpopleura deceptor (Calvert, 1899) [Deceptive Widow]

Identification: Mature males have a yellowish thorax with dark markings, which becomes completely blue pruinose in older specimens. The abdomen is covered with blue pruinosity while the last three segments stay mainly black. The face is creamy white. In females and younger males the broad abdomen is yellow with three rows of black streaks. In contrast to the other Widows, *P. deceptor* has very little colour in the wings; there are mainly dark streaks along the front margin of the forewing. In this feature *P. deceptor* resembles *H. albipunctum*; however, the latter has a slender abdomen.





Meaning of scientific name: Latin *deceptor* – “deceiver”; the species may be mistaken for *Hemistigma albipunctum* due to the similar wing patterns.

Distribution: The range is from The Gambia and Somalia to northern South Africa. In Namibia, the records are scattered in the northern half of the country and are mostly based on the observations of single individuals.

Ecology and behaviour: The Deceptive Widow occurs at shallow pans with low reeds or grasses. The flight season in Namibia may be from February to July.

Threats and conservation: Not threatened.

***Palpopleura jucunda jucunda* Rambur, 1842**
[Yellow-veined Widow]



Identification: In both sexes the frontal half of the wing bases is marked with black. In males there is a black area at the level of the nodus as well. The pterostigma is bicoloured yellow and black. Males have a pruinose blue abdomen. In females and younger males the body is black with yellow spots. The face, sides of the thorax and legs are pale yellow in both sexes.

Meaning of scientific name: Latin *iucundus* – “pleasing, appealing”.

Distribution: The species occurs from Liberia and southern Sudan to Namibia and Botswana. The subspecies *P. j. radiata* Pinhey, 1982 is known from Ethiopia and Sudan. In Namibia, *P. j. jucunda* is mostly recorded from the Okavango River. Historical records were from Kaokoveld and the Waterberg region. More recent records are from the Baynes Mountains, a spring near Swartboisdriest, near Arandis, Ongongo, Palmwag, and below the Sartorius von Bach Dam.



ES

Male



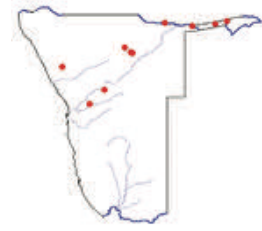
ES

Female

Ecology and behaviour: In Namibia the Yellow-veined Widow occurs at streams and spring-fed ponds with abundant vegetation. The adults are mostly seen at habitats with dense rushes. The flight season seems to be throughout the year; records are from all months except August and November.

Threats and conservation: Not threatened.

***Palpopleura lucia* (Drury, 1773)**
[Black-winged Widow]



Identification: In males, the forewings are totally black to the level of the nodus. In the hindwing the frontal part is dark to the nodus, too. There is no hyaline gap in the basal half.

Also, in adult males, the back of the thorax is black not pruinose blue. To date, there is no known feature to distinguish between the females of *P. lucia* and *P. portia*.

Meaning of scientific name: Like almost all names that Drury gave to dragonflies, *lucia* is a female name from classical antiquity. There was a famous Lucia who ended her life as a martyr in the times of the Roman Emperor Diocletianus. She is of importance in folklore, e.g. in Sweden.

Distribution: The species ranges from Liberia and southern Sudan to Namibia and Botswana. Most Namibian records are from the Okavango River.

Ecology and behaviour: The Black-winged Widow occurs at swamps. The flight season in Namibia is not well known, but it has been observed in September, December and March.

Threats and conservation: Not threatened.



AM

***Palpopleura portia* (Drury, 1773)**
[Shadow-bridge Widow]



Identification: In males, the wings are black to the level of the nodus, with a hyaline gap in the basal half; the pattern resembles the silhouette of a bridge. In adult males, the back of the thorax is pruinose blue with a black median line. To date, there is no known feature to distinguish between the females of *P. lucia* and *P. portia*.

Meaning of scientific name: Like *lucia* in *P. lucia*, *portia* is a name by Drury from classical antiquity. Its classical form would be *Porcia*, i.e. a female member of the *Porcii* – a clan to which the Roman Cato the Elder also belonged.

Distribution: The species is distributed from Senegal and Sudan to South Africa, including the Comoros and Madagascar. In Namibia, records are from the Otavi Mountains and the Waterberg.

Ecology and behaviour: The Shadow-bridge Widow occurs at unshaded ponds with vegetation. The flight season in Namibia is not well known: records are from January, February and May.

Threats and conservation: Not threatened.

Note: The species results from a recent split of the two subspecies of *Palpopleura lucia*. Formerly, it was often reported as *Palpopleura lucia portia*.



AM

Rhyothemis Hagen, 1867 [Flutterers]

This dragonfly genus comprises about 20 species, occurring from Africa to Asia, Australia and the Pacific islands. Six species are distributed in continental Africa and Madagascar, of which three occur in southern Africa. All members of *Rhyothemis* are medium-sized species with a totally black body and broad wings, having conspicuous dark wing patterns in both sexes. The adults resemble butterflies in flight.

Meaning of scientific name: Greek *rhyónai* – “having flown” and *-themis* – which is part of many names in libellulid dragonflies, supposed as “to have an order” within the species-rich relatives. When Hagen chose this name in 1867, he was probably inspired by geology: rhyolite, which was described only a little earlier, is a magmatic stone interspersed with many other minerals, which thus shows many differently coloured irregular patterns. This is also true for the patterns most of the species of this genus show on their wings.

Key to the *Rhyothemis* species

- 1 Dark wing spots reaching the level of the pterostigma. *R. fenestrina*
 - Dark wing spots not reaching the level of the pterostigma. 2
- 2 Basal half of the forewing dark with yellow markings. *R. mariposa*
 - Basal half of the forewing hyaline. *R. semihyalina*

Rhyothemis fenestrina (Rambur, 1842) [Black-winged Flutterer]

Identification: In Africa, the species is unique in having a dark colouration of all wings in both sexes, reaching to the pterostigma. The wing colour is brownish-black, with several hyaline windows reaching to the level of the pterostigma. Dependent on the angle of light the wings glisten in different rainbow colours and the wing windows become golden. The body is black, as in all *Rhyothemis* species, and the eyes are brownish.



Meaning of scientific name: From Latin *fenestra* – “window, opening” and *-inus* – “pertaining to”. Rambur mentions the hyaline parts of the hindwings in dark surroundings.

Distribution: From Sierra Leone and Uganda to the Okavango Delta. In Namibia, the species occurs in the Okavango, Kwando and Zambezi River flood plains.

Ecology and behaviour: Habitats are swamps and well-vegetated oxbows of flood plains. Adults often form swarms at the top of trees. In Namibia, the flight season lasts from September to March.

Threats and conservation: Not threatened.



***Rhyothemis mariposa* Ris, 1913**
[Butterfly Flutterer]

Identification: The species has a black wing pattern with broad golden spots in forewing and hindwing reaching to the nodus, i.e. halfway to the tip of the wing. The body is black and the eyes are brownish.

Meaning of scientific name: From Spanish *mariposa* – “butterfly”.

Distribution: The species occurs in Angola and Zambia. It is not clear whether it has ever been recorded in Namibia. Historic sources indicate that the type specimens are from Namibia, but it is more likely that the locality was in southern Angola. It is possible, therefore, that the species also occurs in northern Namibia. As stated, however, there are no records.

Ecology and behaviour: Not much is known about the ecology of the Butterfly Flutterer. In Zambia it occurs in swampy areas.

Threats and conservation: The status in Namibia is unknown. Therefore, it would be appropriate to enter it on the National Red List as fit the IUCN category “Data deficient”. Globally, the species is not threatened.



SG

Rhyothemis semihyalina (Desjardins, 1832) [Phantom Flutterer]

Identification: Compared to the two other *Rhyothemis* species, this one has the least amount of dark in the wings. Both sexes have only the basal half of the hindwing black, with a metallic sheen from violet to green. The rest of the characteristics are like the other species.

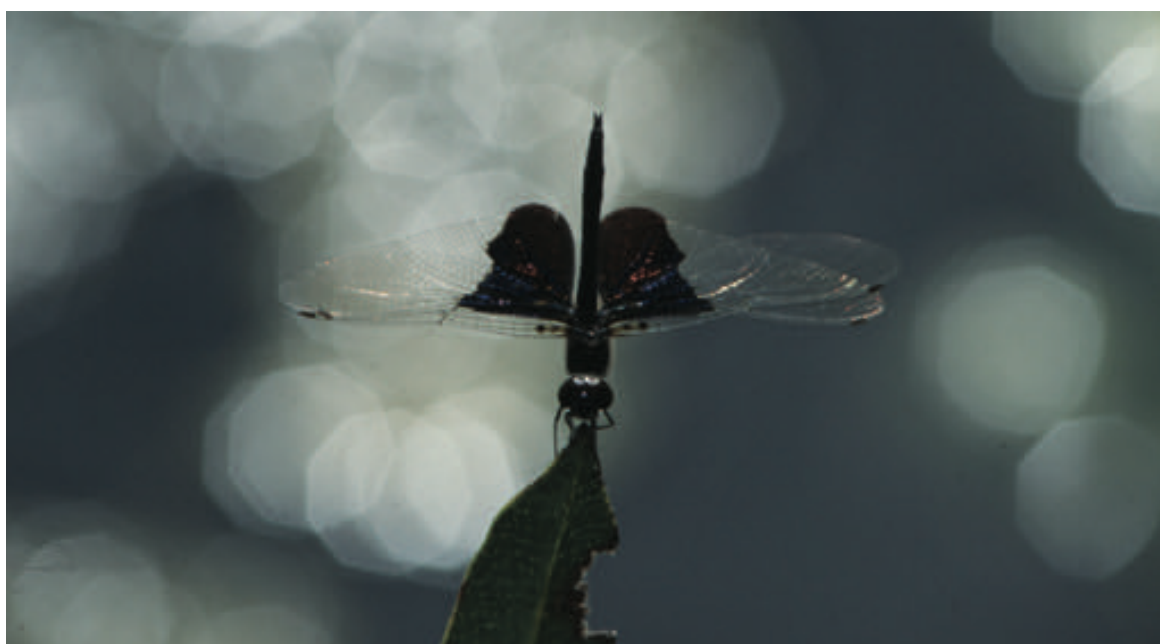


Meaning of scientific name: From Latin *semi-* – “half” and *hyalinus* – “transparent”. The name aptly describes the characteristic hindwings.

Distribution: The species is widespread in continental Africa south of the Sahara. It also occurs on Madagascar, the Comoros, the Mascarene Islands, the Seychelles and Socotra, as well as in southern Arabia. A relict population exists in northern Algeria. In Namibia, the species occurs in the Okavango, Kwando, Chobe and Zambezi River flood plains. It is also recorded from the Onesi Dam, the Otavi Mountains, Damaraland, and at the Sartorius von Bach, Daan Viljoen and Hardap Dams.

Ecology and behaviour: The Phantom Flutterer occurs at waters with vegetation and mats of floating algae. In Namibia, the flight season lasts from October to April.

Threats and conservation: Not threatened.



AM

***Tramea* Hagen, 1861 [Gliders]**

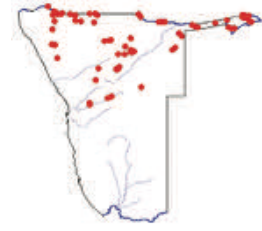
The genus comprises about 20 species worldwide and is distributed in the Americas, Africa, Asia, and Australia as well as on many ocean islands. Two species occur in Africa. Gliders are large libellulids with long legs and with long, broad wings that narrow to the tips. They have characteristic dark markings on the base of the broad hindwing. The adults are strong flyers. Pairs perform a conspicuous tandem flight. For oviposition the tandem splits up and the female touches the water with the tip of her abdomen to release a clutch of eggs, while the male hovers above her. Afterwards he grasps her again continuing the tandem flight. At bigger ponds they repeatedly lay eggs, but are often disturbed by rival males cruising above the water. At small ponds, pairs oviposit only once and depart from the site in tandem. During tandem flight, the female grasps the male's abdomen by the second and third pair of legs, probably to stabilise the tandem formation in flight.

Meaning of scientific name: In 1848, Herman Hagen announced the publication of the genus under the unwieldy denomination *Trapezostigma* [Greek *trapézion* – “trapezium” and *stigma* – “tattoo mark”] as a hint to the trapezoid pterostigma. But in the actual description of the genus in 1861, he shortened the name to *Tramea*, thus making it not only easier to use, but also adding a pun with Latin *trameare* – “pass through”, which suits these vagrant species well.

Key to the *Tramea* species

- 1 Hindwing with dark red-brown or brown basal spots, surrounded by a yellow area. ...
.....*T. basilaris*
- Hindwing with a dark red-brown basal band, without any yellow area. *T. limbata*

***Tramea basilaris* (Palisot de Beauvois, 1807)**
[Keyhole Glider]



Identification: Adult males have a blood-red body and brown basal wing spots in their hindwings, surrounded by yellow. By contrast, *T. limbata* only has a red-brown basal band, without yellow. In body shape, size and flight, *T. basilaris* resembles *Pantala flavescens*, although the latter is more orange or orange-brown and has no basal wing spots.

Meaning of scientific name: Greek *basis* – “base, pediment” and Latin *-aris* – “concerning” refer to the conspicuous markings on the base in each hindwing.

Distribution: In sub-Saharan Africa, *T. basilaris* is common. It also occurs on Madagascar and in different forms east to Vietnam and Japan. The species is widespread in northern Namibia, with several records in Caprivi, Etosha, Kaokoveld, along the Okavango, and in the Cuvelai system, Otavi Mountains and Waterberg. The southernmost records in Namibia so far are from the Gobabis district, Gross Barmen and Tsaobis.

Ecology and behaviour: The Keyhole Glider is a migrant species that often accompanies large swarms of *Pantala flavescens*. It colonises unshaded temporary waters. However, in comparison with *P. flavescens*, *T. basilaris* needs well-vegetated



freshwater habitats for breeding. The rarity of these habitats in central Namibia might be the reason why there are nearly no records here of successful reproduction. In Namibia, the flight season aligns with the rains, with records from November to March.

Threats and conservation: Not threatened.

***Tramea limbata* (Desjardins, 1832)**
[Ferruginous Glider, Voyaging Glider]

Identification: Adults are easy to identify with their dark red body and broad wings with a narrow brown band at the base of the hindwing, reaching to the posterior end of the wing. The males fly continuously for long periods. In flight, the pattern of the dark red body and the narrow brown wing base is unique.



Meaning of scientific name: Latin *limbus* – “braiding” and *-atus* – “equipped with” refer to the brown band at the base of the hindwings.

Distribution: The species ranges from sub-Saharan Africa to Polynesia and Australia. It is a dominant species on the western Indian Ocean islands, but occurs only locally on continental Africa. In Namibia, it has been recorded twice: once near Kamanjab, and once at Katima Mulilo. A breeding population is not known.



AM

Ecology and behaviour: On the western Indian Ocean islands, the species mainly breeds in most open, unshaded waters. Eggs are deposited on algae mats. In grass-like swampy habitats larvae can be observed in great numbers. The larvae, similar in size to *Pantala flavescens*, are dominant predators in the vegetated parts of ponds, whereas the latter prefer the non-vegetated areas. Although the habitat preferences should be similar for continental Africa, at most localities observations of the species have been single events. In Namibia, records of adults are from November and April.

Threats and conservation: Not threatened.

Note: African populations were sometimes considered as *Tramea continentalis* Selys, 1878, with a specific or subspecific rank.

Urothemis Brauer, 1868 [Baskers]

In Africa the genus *Urothemis* is represented by four species. Two species that are widespread on the continent, *Urothemis assignata* and *U. edwardsi*, also occur in Namibia. They are medium-sized species with a thick body, a low number of Ax with the last one complete, and large basal spots in the hindwings. These two species differ in appearance because of their body colouration, one being blue and the other blood-red. A related species is the Pygmy Basker, *Aethriamanta rezia*.

At water, males behave as fliers, resting only occasionally. For feeding, they behave as perchers, mostly perching from the leafless twigs of bushes and trees and starting rapidly to short feeding flights. During oviposition the male guards his mate in tandem. The eggs are laid in the dancing flight known from the widespread *Sympetrum fonscolombii* or *Pantala flavescens*.

Meaning of scientific name: Greek *ura* – “tail” and *-themis* – “law as established by custom”, and Goddess of Order. *Themis* was first used as an element in dragonfly names by Hagen in 1861; since then it has been in use for libellulids and related genera. The full name probably refers to the elongated vulvar scale in the females, which extends the length of S9.

Key to the *Urothemis* species

- 1 Abdomen blood-red or blue: mature males. 2
- Abdomen yellow with dark pattern: females and young males. 3
- 2 (1) Frons red. Thorax and abdomen blood-red. Base of hindwing reddish brown.
..... *U. assignata*
- Frons blue-black. Thorax and abdomen blackish with blue pruinosity. Base of hindwing
black. *U. edwardsii*
- 3 (1) Narrow dark dorsal band on S4-6; wider on S7-9. *U. assignata*
- Broad dark dorsal band on S4-10. *U. edwardsii*

Urothemis assignata (Selys, 1872)

[Red Basker]

Identification: Adult males have a blood-red body and a small brown basal wing spot in the hindwing. Other reddish species with dark basal wing spots belong to *Tramea*, with *T. limbata* having a red-brown basal band, and *T. basilaris* having yellow markings in and around the dark spot. Immature males and females have a yellow abdomen with dark dorsal bands that are narrow on S4–6 and wider on S7–9.



Meaning of scientific name: Latin *assignata* – “that which is arranged nearby, the assigned”. By this name, Selys wanted to give a clear taxonomical reference to *Urothemis signata* (Rambur, 1842) where *signata* in Latin means “that with a sign”.

Distribution: The species is widespread in sub-Saharan Africa and Madagascar. In Namibia, only two localities are known, both being isolated from each other: from the stream below the Sartorius von Bach Dam, and a spring in the vicinity of the Naukluft Mountains. The nearest record outside Namibia is from the Okavango Delta, where the species also seems to be rare.

Ecology and behaviour: The Red Basker occurs in Namibia at well-vegetated slow-flowing waters. The flight season in Namibia lasts from October to May.

Threats and conservation: Not threatened.



Urothemis edwardsii (Selys, 1849)

[Blue Basker]



Identification: Adult males are easy to identify because there is no other dragonfly with a blue body that has a black basal wing spot on the hindwing. The females are yellow, and also have the wing spot. There are black median markings on the back of each segment of the abdomen in both sexes, which otherwise occur only in *Aethiothemis*.

Meaning of scientific name: The species was dedicated to the French zoologist Henri Milne Edwards (1800–1885) of the Jardin des Plantes de Paris, who sent the material collected in Algeria that included the new species.

Distribution: It occurs from South Africa (Kwazulu-Natal) to Mauritania and Somalia, on the Comoros and in southern Arabia, while an isolated relic population remains in Algeria. In Namibia, it is common along the Okavango, Kwando and Chobe Rivers and from the seasonal rainwater pans (oshanas). In central Namibia there are records from some reservoirs such as the Sartorius von Bach Dam. The southernmost record in Namibia is from the Hardap Dam.

Ecology and behaviour: The Blue Basker occurs mostly at well-vegetated, swampy lentic or lotic waters. Males and females can be seen perching close to the water, often on shrubs. In Namibia, its flight season is from October to May.

Threats and conservation: Not threatened.



Aethriamanta Kirby, 1889 [Pygmy Baskers]

Worldwide, the genus *Aethriamanta* includes six species. These occur in tropical parts of Africa, Asia and Australia. The genus includes small species with a broad body, a very small number (six) of Ax in the forewing, the last one being complete; sparse venation; and a basal spot in the hindwings. In Africa and Madagascar, there is only one species. The blood-red colouration is typical for several species, but there is also a pale blue one, *A. gracilis*, in Indonesia and Malaysia.

Meaning of scientific name: Unknown. The first part of the name certainly seems to be Greek *aithria* – “clear sky”, but as for the second part, there seems to be no Greek word that resembles it. Kirby may have taken the stem of the Latin adjective *amans* – “loving”, and added the ending *-a* to indicate the feminine gender.

Aethriamanta rezia Kirby, 1889 [African Pygmy Basker]

Identification: The Pygmy Basker is a small dragonfly species with a broad abdomen. The adult male is blood-red and has amber basal spots in the hindwings. Despite the much larger *Urothemis assignata* there is no other red-bodied libellulid dragonfly in the southern African region with the last Ax in the forewing complete.

Meaning of scientific name: Rezia is the daughter of a caliph in Carl Maria von Weber’s opera *Oberon*, the story of which goes back to a medieval romance concerning the Knight Huon de Bordeaux.



Distribution: The species occurs in tropical continental Africa and on Madagascar. In Namibia, it occurs along the Okavango, Kwando, Linyanti and Chobe Rivers, and is also found at temporary rain pools in Caprivi.

Ecology and behaviour: *Aethriamanta rezia* occurs mainly at swampy sections of tropical rivers. In Namibia, it is on the wing from October to April. Males behave as perchers at water.

After copulation, the male guides the female in tandem to the oviposition site, where he releases her. Adults often behave as perchers, mostly sitting on the leafless twigs of bushes and trees and starting rapidly to short feeding flights.

Threats and conservation: Habitat loss is reported in Botswana due to the decline of floodwater.

Aethiothemis Martin, 1908 [Gorgeous Skimmers]

This genus is endemic to tropical continental Africa and comprises between five and nine species, which are not clearly categorised due to taxonomical problems. Most species are not well studied and have rarely been recorded. Therefore, characteristic features easily visible in the field are not known so far.

Meaning of scientific name: The name is not explained in the first description, but it seems evident that it refers to the Ethiopian faunal region (Greek *aithiopes* – “the burnt faces”), from where the genus was described. The rest of the name, *-themis* (Greek *themis* – “law as established by custom” or Goddess of Order) is used as an equivalent for “libellulid genus”.

Aethiothemis discrepans Lieftinck, 1969 [Southern Gorgeous Skimmer]



The species is medium-sized to small. The general body colouration is yellow marked with black. It resembles a smaller *Orthetrum* in several features, such as the last antenodal vein in the forewing being complete, a broad abdomen pruinose light blue in males, and a yellow pterostigma. A good characteristic for field observations is the black median line along the back of the abdomen.

Meaning of scientific name: The name (Latin *discrepans* – “not in accordance, different, not agreeing”) was chosen because the specimens of new species agreed with neither of the descriptions for *A. solitaria* and *A. mediofasciata*.

Distribution: The species occurs from the Democratic Republic of Congo, Angola, Malawi and Zambia, to Namibia and Botswana. In Namibia, all records are from the Okavango River, mainly downstream of Divundu.



JK

Male with maximum pruinosity



AM

Immature male



Female

Ecology and behaviour: The species occurs at swampy sections of the Okavango River. In Namibia, it is on the wing during the rainy season; records are from December and from February to April.

Threats and conservation: Not threatened.

Note: It has been suggested that this species is synonymous to *A. solitaria*; therefore, its name may change.

***Nesciothemis* Longfield, 1955 [Dancing Skimmers]**

Nesciothemis is a small genus endemic to Africa and southern Arabia, with five species in total. In Namibia, only one species occurs. Another species, *Nesciothemis minor*, has been reported from the Okavango Delta in Botswana. Dancing Skimmers resemble *Orthetrum* in general appearance. Diagnostic characteristics of *Nesciothemis* are a very distinct and broad pale stripe along the middle of the thorax, which is visible in females and immature males. *Nesciothemis* males in Namibia develop a whitish blue pruinosity and have dark eyes; other species of the genus are red. The two species in this region differ mainly in the shape of the penis and the secondary genitalia; the macroscopic differences between the species are sophisticated, particularly because the Namibian *N. farinosa* do not follow the typical colour patterns (see below). The record of *N. minor* is somewhat strange because the species otherwise only occurs in western Africa. It has only been

Meaning of scientific name: In 1955 Cynthia Longfield wrote: “The new name is a pure invention, formed from the ‘themis’ at the end of the names of the nearest generic relations, together with the verb *nescio*- ‘not to know’.”

1 Labrum black, often with paler edge. Tibiae in mature males without pale streak. *N. farinosa*
 – Labrum pale. Tibiae black with pale streak. *N. minor*

A close-up photograph of a dragonfly perched on a light-colored, textured reed stem. The dragonfly has a dark, segmented body, long thin legs, and large, transparent wings with visible veins. Its head is turned slightly to the left. The background is a plain, light-colored surface.

Male



Female

Distribution: The species is widespread and locally abundant in Africa from South Africa (Kwazulu-Natal) to Egypt, as well as in southern Arabia. In Namibia, it occurs along the northern perennial Kunene, Okavango, Kwando and Zambezi Rivers. There are also records from isolated springs namely at Ongongo, Palmwag and Aub Canyon. The species is also present in the Otavi Mountains, as evidenced by recent records of exuviae.

Ecology and behaviour: This species is most common at rivers and perennial streams where higher reeds can be found. The males defend small territories among the reeds. By this they show a characteristically antagonistic behaviour: a male will fly in very narrow circles around a rival, trying to present him with his black head, which contrasts with his whitish-blue thorax. The larvae live among detritus in dense stands of reeds. The flight season in the north-east is mainly between November and May, whereas Damaraland records are only between February and July.

Threats and conservation: Not threatened.

Orthetrum Newman, 1833 [Skimmers]

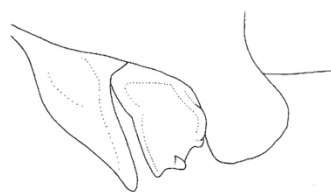
The genus *Orthetrum* comprises about 80 species, which are widespread over Africa, Europe, Asia and Australia. The ground colour of Skimmers is yellow to brownish or greenish, with more or less intense black markings. In mature *Orthetrum* males and sometimes in old females these colours are hidden under a blue cover of wax (pruinosity) that develops with aging. Therefore, males of most species look similar and are difficult to distinguish by colour patterns alone. Only a few species have characteristics that allow easy identification by the naked eye. Therefore, males should in most cases rather be caught and their secondary genitalia compared with the drawings on Plate 20 (use a hand lens, magnification 10x). Exceptions are *O. chrysostigma* and *O. caffrum*, in which the cream-coloured stripes on the thorax are usually visible, and *O. trinacria*, which cannot be mistaken due to its large size, slender abdomen and very dark blue pruinosity that appears almost black. By contrast, the females are often easier to identify. A key to females is presented below. In most cases, females have distinctly visible markings. Immature males often resemble females, except for *O. guineense*.

In *Orthetrum* the copulation duration within even one species varies considerably, lasting from some seconds while in flight to more than an hour when resting. The female lays eggs by touching the water surface with a series of dips while in flight. The larvae are very hairy and are covered with fine mud. They live on muddy ground.

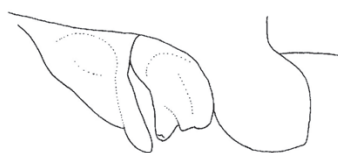
Meaning of scientific name: The genus *Orthetrum* got this name because of its straight (Greek *orthon*) abdomen (Greek *etron*). When Newman discovered the genus in 1833, he did not know species of different shapes.

Key to the *Orthetrum* species (for identifying males, see Plate 20)

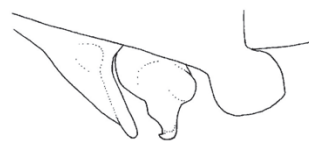
- 1 Abdomen long and slender, longer than the hindwing. Large species – 50–60 mm. Abdomen whitish-yellow with black. Mature males become very dark, almost black.
..... *O. trinacria*
- Abdomen shorter than hindwing. Most species smaller. Abdomen brownish or yellow. Mature males not blackish. 2
- 2 (1) Sides of the thorax brownish with one or two distinct cream-coloured stripes. Abdomen with very few black markings, at most having fine black lines. 3
- Sides of the thorax without distinct cream-coloured stripes; mainly yellow or greenish in colour. Abdomen with more extensive black markings, at least with black edges. .. 4
- 3 (2) One cream-coloured stripe on each side of the thorax. *O. chrysostigma*
- Two cream-coloured stripes on each side of the thorax. *O. caffrum*
- 4 (2) S4–7 with uninterrupted yellow or brownish fields or streaks on both sides of mid-dorsal carina, except for some black at the distal ends of segments. 5
- S4–7 broadly black dorsally. 9



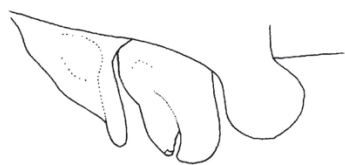
O. trinacria



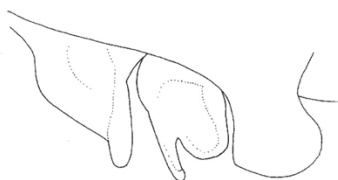
O. chrysostigma



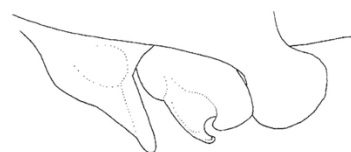
O. cafferum



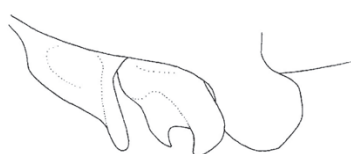
O. hintzi



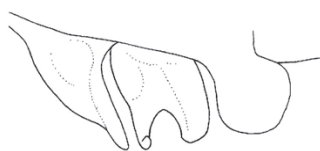
O. abbotti



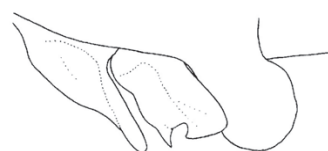
O. robustum



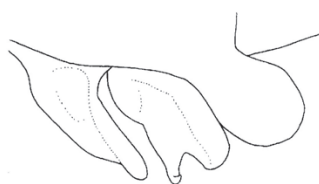
O. machadoi



O. guineense



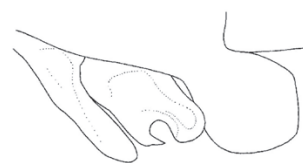
O. icteromelas



O. julia falsum



O. brachiale



O. stemmale

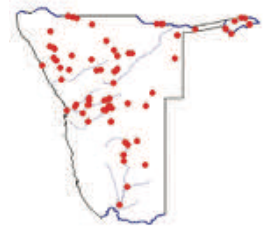
KD

Plate 20: Secondary genitalia of Orthetrum males (in lateral view)

- 5 (4) Broad black band between dorsal and lateral part of thorax (humeral area). Broad black edging of abdomen being as broad as dorsal yellow field along each segment.
..... *O. hintzi*
- Humeral only thin black lines or no black. Thin or no black edging of abdomen. 6
- 6 (5) S9 mainly black with very little yellow. 7
- S9 mainly yellow with very little black. 8
- 7 (6) Thorax bright yellow, covered by bright blue pruinosity in older males. Very small species (body length < 40 mm). *O. abbotti*
- Thorax brown, with little pruinosity in males. Large species (body length > 50 mm).
..... *O. robustum*
- 8 Abdominal segments almost completely yellow (with black distal patch in males).
..... *O. guineense*
- Abdominal segments pale brown with broader black on S10. *O. machadoi*

- 9 (4) Broad uninterrupted black mid-dorsal pattern along S5–8. *O. icteromelas*
- No such black mid-dorsal pattern; abdomen appears yellow-black ringed. 10
- 10 (9) Pterostigma pale brown. Upper appendages dark. *O. brachiale*
- Pterostigma dark (but not in freshly emerged individuals). Upper appendages often pale to white. 11
- 11 (10) Two cell rows above Rspl. *O. julia falsum*
- One cell row above Rspl. *O. stemmale*

***Orthetrum trinacria* (Selys, 1841)**
[Long Skimmer, Slender Skimmer]



Identification: This is a large species with a long and slender abdomen. The latter feature makes it different from all other Namibian *Orthetrum*. In mature males the pruinosity is very dark; in flight, the males look almost black. The eyes are a rich blue. The pterostigma is pale. By contrast, females and immature males are mainly yellow to light yellow on the abdomen, strongly contrasted with black markings. Size: 51–57 mm.

Meaning of scientific name: *Trinacria*, meaning something like “that with the three capes”, is an ancient poetic name for Sicily, the type specimen locality of the species.

Distribution: This species is widespread over most of Africa except for the tropical rainforest. It also occurs in southern Europe and in Arabia. In Namibia, *O. trinacria* is not as common as *O. chrysostigma*, but is at least as widespread. In contrast to



the latter, *O. trinacria* has regularly been recorded in Caprivi and along the Okavango River.

Ecology and behaviour: The Long Skimmer colonises a wide range of different habitats, from oxbow lakes and oshanas in the north to perennial sections of the ephemeral rivers and large impoundments. The larvae develop successfully in temporary waters. However, the species prefers larger water bodies, e.g. reservoirs and large oxbows. It also occurs at brackish waters.

Threats and conservation: Not threatened.

***Orthetrum caffrum* (Burmeister, 1839)**
[Two-striped Skimmer]



Identification: The most obvious feature of this species are the two distinct, cream-coloured stripes on the sides of the thorax in both sexes, often visible even in mature males. Another pale line lies between the wings, contrasting with the dark thorax of males and the brown thorax of females. The ground colour is brown, with very few black markings. The pterostigma is pale and short. Body length: 40–45 mm.

Meaning of scientific name: The type specimens are from Durban (SA), which at the time of the description was known as *Port Natal* in a region called *Caffraria*.

Distribution: From the Cape of Good Hope in South Africa to Sudan and southern Arabia as well as Madagascar. The records in Namibia are scattered in the north of the country. Historic records are from Damaraland and the Otavi Mountains. The

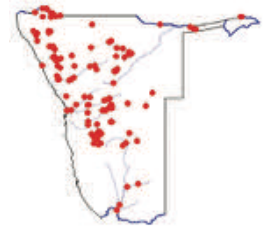


only recent observations are downstream from the Okavango River flood plain, at Popa Falls. Because the species is more widespread in South Africa, e.g. at the Orange River, it may also occur in southern Namibia.

Ecology and behaviour: Emergence in Namibia was observed from a vegetation-rich temporary pond in the Mahango Game Reserve. In South Africa, the species also colonises slow-flowing rivers and perennial ponds. In north-eastern Namibia, the flight season lasts from at least January to March, but is probably longer.

Threats and conservation: Not threatened.

***Orthetrum chrysostigma* (Burmeister, 1839)**
[Epaulette Skimmer]



Identification: The Epaulette Skimmer is named after the single cream-coloured stripe on each side of the thorax. In fully mature males, this stripe is covered by pruinosity, but is often still visible. The ground colour is brownish with a small black pattern. The pterostigma is pale and short. Size: 40–45 mm.

Meaning of scientific name: From Greek *chrysos* – “gold” and *stigma* – “tattoo mark”, referring to the “golden” colour of the pterostigma.

Distribution: A widespread species in most parts of Africa, it also occurs on the Arabian peninsula and the southernmost parts of Europe. The Epaulette Skimmer is the most widespread and common *Orthetrum* species in the arid parts of Namibia. By contrast, there are few records from the Okavango River and Caprivi.



ES

Ecology and behaviour: In the desert and the dry savannah areas it occurs in all types of habitat, from wetlands in the ephemeral rivers to perennial springs. It is one of the few species that can be seen in large numbers at waters that are almost completely overgrown by vegetation such as rushes. Well hidden, the females often oviposit amongst dense vegetation. Over open water, the male usually guards them. The species is well suited to occur in temporary waters because the duration of larval development from egg to emergence is less than 50 days. Due to this rapid development it can produce several generations per year in perennial waters. Newly created habitats are usually rapidly colonised. The flight season is throughout the year. At higher altitudes, however, the populations in winter are smaller. By contrast, the only records from the Okavango River are from July.

Threats and conservation: Not threatened.

***Orthetrum hintzi* Schmidt, 1951**
[Hintz's Skimmer]

Identification: Not much larger than *O. abbotti*, but differs from the latter in the broad black edging along abdominal segments and broad black lines separating the sides and the upper parts of the thorax. However, in mature males, these patterns are obscured by the blue pruinosity and only the shape of the secondary genitalia is diagnostic. Size: 35–43 mm.

Meaning of scientific name: The species was named in honour of the German engineer Eugen Hintz (1860–1932), who collected odonates in Portuguese Guinea (Guinea-Bissau) in 1926–1927, including the type specimen series.



VC

Distribution: From Senegal and Kenya to South Africa (Kwazulu-Natal). The Hintz's Skimmer has only been recorded historically in Namibia; the only locality is close to the Angolan border near Oshikango. Since there are no recent records, the occurrence in Namibia needs confirmation. However, since the species occurs in Angola, the presence in northern Namibia is likely.

Ecology and behaviour: The habitat is described as grassy edges of streams and rivers.

Threats and conservation: Not threatened.

***Orthetrum guineense* Ris, 1910**
[Guinea Skimmer]

Identification: This species has few distinguishing features. It is similar to *O. machadoi*. The shape of the male genitalia is diagnostic. Size: 39–44 mm.



Meaning of scientific name: The Latin adjective *guineense* means “originating from Guinea”. The description of the new taxon based on a large series from different regions around the Gulf of Guinea.

Distribution: From Sierra Leone and Somalia to Namibia and South Africa (Kwazulu-Natal). The Guinea Skimmer has only been recorded historically in Namibia; the only locality is close to the Angolan border near Oshikango. Since there are no recent records, the occurrence in Namibia needs confirmation. However, since the species is originally described from Angola, the occurrence in Namibia is likely. There is also a record from the Kalahari Gemsbok Park in South Africa. Thus, the species may also be expected in the Namibian Kalahari.

Ecology and behaviour: Not much is known about the ecology of this species. The only record in Namibia is from April.

Threats and conservation: Not threatened globally; status in Namibia is unknown.

***Orthetrum machadoi* Longfield, 1955**
[Machado's Skimmer]

Identification: This species is one of the smaller *Orthetrum* in the southern African region. The specimens along the northern rivers are particularly small, while those occurring in the interior of the country are larger on average. The ground colour is dark ochreous with few dark patterns; in particular, the sides of the thorax are almost without dark markings. Mature males are covered by a blue pruinosity that appears somewhat dirty. The face is whitish (like in other *Orthetrum*) and contrasts with the dark green eyes. Size: 37–45 mm; specimens from the Kwando River are < 40 mm, while those from Otavi Mountains and the Sartorius von Bach Dam are = 40 mm.





JK

Meaning of scientific name: The species is dedicated to Dr António de Barros Machado, who enabled Cynthia Longfield to study the large collection of Odonata in the Museu do Dundo, Angola.

Distribution: It occurs in wide parts of southern Africa, from northern Angola and Zambia southwards to South Africa (Kwazulu-Natal). In Namibia, Machado's Skimmer is common at the north-eastern rivers, but has also been recorded at the Kunene River. A few records are from isolated localities in the Otavi Mountains and the Sartorius von Bach Dam near Okahandja.

Ecology and behaviour: The main habitat seems to be in flood plains, with backswamps and pans well vegetated with sedges or reeds, but it also occurs at well-vegetated perennial ponds. Adults have often been seen perching in forests, away from the water. The flight season is throughout the rainy season, i.e. from November to April.

Threats and conservation: Not threatened.

Orthetrum abbotti Calvert, 1892 [Little Skimmer]

Identification: This is on average the smallest and least robust *Orthetrum* in the southern African region. Therefore, in general appearance, it resembles the smaller, blue-coloured libellulids such as *Trithemis* or *Aethiothemis*. The thorax is yellow in females and





VC

immature males. In males, small parts of the thorax are often not covered by wax, leading to a discrete contrast between the yellow ground colour and the intense blue pruinosity. Size: 33–38 mm.

Meaning of scientific name:

The species is dedicated to the American explorer and naturalist Dr William Louis Abbott (1866–1948), who collected a pair of the new species at Kilimanjaro.

Distribution: Occurs all over sub-Saharan Africa. In Namibia, the species has been recorded only at a few localities. It has been observed at the Ongongo Falls near Sesfontein and at Palmwag. Other records are from the Otavi Mountains, from the

Waterberg and from the Sartorius von Bach Dam near Okahandja.

Ecology and behaviour: All Namibian records are from perennial habitats, most being springs. All habitats have in common that they are well vegetated to almost overgrown with vegetation. The species seems to tolerate the springs being heavily altered, e.g. by water extraction or damming, as long as some flowing water remains. Records of adults are from October to February.

Threats and conservation: Not threatened.

***Orthetrum robustum* Balinsky, 1965**
[Robust Skimmer]

Identification: Together with *O. trinacria*, this is the largest *Orthetrum* in the southern African region. However, in contrast to *O. trinacria*, *O. robustum* is robust, not slender, and its abdomen is shorter than the hindwing. The thorax is brownish and only develops a very thin pruinosity with aging, hence appearing mainly dark brown. The pruinosity of the male abdomen is pale blue. Size: 50–58 mm.





Meaning of scientific name: Latin *robustus* – “robust, strong, vigorous”; this species is one of the larger within the genus.

Distribution: *Orthetrum robustum* has only been encountered in southern African countries. Most records are from Botswana, Namibia and Zambia. A few records are also from South Africa and, therefore, it is likely to occur in Mozambique. In Namibia, the Robust Skimmer is restricted to Caprivi, with records from the Popa Falls downstream from the Okavango River, as well as from the Kwando and Zambezi Rivers.

Ecology and behaviour: Most records are from oxbows and backswamps of rivers. The flight season is from December to April.

Threats and conservation: Not threatened.

***Orthetrum icteromelas cinctifrons* Pinhey, 1970**
[Spectacled Skimmer]

Identification: The Spectacled Skimmer has distinct black dorsal abdominal patterns occupying much space along the middle line of the abdomen, a pattern that does not occur in other Namibian species (see photo). There are also black stripes on the thorax. The ground colour is yellow on the thorax and abdomen, which contrasts sharply with the black patterns. The pterostigma is pale. The eyes are dark blue. Even males completely covered by pruinosity can easily be identified by the dark marking on the face that forms the infinity symbol (or a tilted 8). Size: 39–45 mm.





FS

Male with abdomen not fully pruinose



FS

Note the infinity marking on the frons of this male

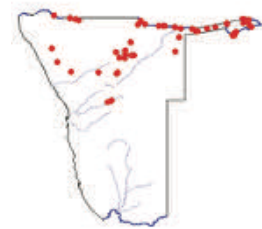
Meaning of scientific name: The name *icteromelas* is derived from Greek *ikteros* – “jaundice” and *melas* – “black, dark”, referring to the distinctive checkerboard black-and-yellow patterning of the abdomen in females and teneral. The name *cinctifrons* is derived from Latin *cinctus* – “surrounded, enclosed” and *frons* – “forehead, front”, and evokes the two specular dark rings on the frons of the males.

Distribution: The species occurs from Uganda to Botswana and South Africa (Kwazulu-Natal). The nominate form, *O. i. icteromelas* Ris, 1910, is known from Madagascar only. In Namibia, all records are from the Kwando and the Okavango Rivers.

Ecology and behaviour: Habitats are backswamps and well-vegetated oxbows. The flight season is from August to April.

Threats and conservation: Not threatened.

***Orthetrum brachiale* (Palisot de Beauvois, 1817)**
[Strong Skimmer, River Skimmer]



Identification: A robust species with a greenish thorax and dark metallic green eyes. In these characteristics the males resemble those of *O. julia falsum* and *O. stemmale*. Compared with *O. julia*, immature males of *O. brachiale* have fewer black markings on the abdomen, and the black patterns on S3–5 are less than half the length of the respective segment. The pterostigma and subcostal veins are pale, whereas both



are dark in *O. julia* and *O. stemmale*. *O. brachiale* co-occurs with *O. julia* in the region around the Otavi Mountains and the Waterberg. In the latter environment, the two species can be told apart by the colour of their pterostigmas, which are dark in *O. julia* and pale in *O. brachiale*. Only at the Chobe rapids may all three species co-occur. In that location, the shape of the secondary genitalia should be compared for secure identification. Size: 43–50 mm.

Meaning of scientific name: Latin *brachiale* – “bracelet”; the slightly inflated abdominal bases might have led to the name, because it may look as if the dragonfly wears something like a ring there.

Distribution: From South Africa (Kwazulu-Natal) and Namibia to The Gambia and Somalia, as well as on the Comoros, Madagascar and the Mascarene Islands. In Namibia, the species is widespread and common in the north, particularly along the Okavango River and in the western Caprivi. Southernmost records are along a line from Palmwag in the west to the Sartorius von Bach Dam in central Namibia.

Ecology and behaviour: In the north it occurs at almost all kinds of freshwater habitats, including rivers and backswamps, at temporary rainwater pools in the flood plains of large rivers, at oshanas, and at farm dams. There are also records from perennial springs in Damaraland and the Otavi Mountains, and from wetlands below large impoundments such as the Sartorius von Bach Dam. The flight season seems to be mainly from November to May, but single records also exist from July.

Threats and conservation: Not threatened.

Orthetrum julia falsum Longfield, 1955 [Julia Skimmer]



Identification: The Julia Skimmer has an olive-green thorax with black stripes. In older males the thorax develops into a dark green and is gradually covered by pruinosity. The abdomen is mainly black, with yellow spots on S2 to S6. The black pattern on S3–5 is at least half the length of the respective segment; the posterior segments are completely black. The pterostigma is black or, sometimes, dark brownish. The eyes are a dark metallic green. Most similar are *O. brachiale* and *O. stemmale*. In contrast to these, *O. julia* has only one cell row above Rspl in the wings. The length of this species ranges from about 38 to 48 mm.

Meaning of scientific name: Latin *julia* originally meant “female member of the *Iulii* clan”, to whom the famous dictator Julius Caesar also belonged. Kirby does not reveal which Julia he had in mind when he named the species. Latin *falsus* – “false, deceptive, delusive”, aptly reflects the problems associated with identifying some of the widespread African members of this genus.

Distribution: This species occurs from southern to north-eastern continental sub-Saharan Africa; a single record is from Yemen. There are three subspecies. *O. julia falsum* occurs mainly in the eastern and southern parts of Africa, whereas *O. julia julia* Kirby, 1890 mainly occurs in the western half of Africa. The subspecies *O. julia capicola* Kimmins, 1957 is confined to the region around the Cape of Good Hope in South Africa. In Namibia, *O. julia falsum* is restricted to isolated locations, usually mountain ranges, with permanent running water habitats. Records are from the Otavi Mountains, the Waterberg, and the vicinity of the Paresis Mountains, and from several localities at the Tsaris and Naukluft Mountains.

Ecology and behaviour: In Namibia, the Julia Skimmer is restricted to perennial streams and small springs. All habitats are usually shady. It colonises even very small springs in the deep shade, e.g. at the Waterberg, where no other odonates are found. The larvae need about 60 days from egg to emergence, which may not be sufficient for survival in most of the temporary waters in Namibia. The flight season is throughout the year.

Threats and conservation: Not threatened. In Namibia, however, the species is restricted to a few isolated locations. Water extraction from springs may threaten the species.



***Orthetrum stemmale* (Burmeister, 1839)**

[Tough Skimmer]

Identification: This species is similar to *O. brachiale* and *O. julia* and can only be distinguished with certainty from those species by the shape of the secondary genitalia. Size: Large, up to 50 mm.



Meaning of scientific name: Greek/Latin *stemma* – “wreath, garland” and Latin *-alis* “belonging to, concerning”. The species has a wreath-like marking, consisting of a yellow spot on the superior surface of the frons surrounded by black.

Distribution: The species occurs in most countries in sub-Saharan Africa. In Namibia, it has only been found in the flood plains of the Zambezi and the Chobe Rivers.

Ecology and behaviour: *O. stemmale* has been observed mainly at larger ponds, usually with water lilies, and at oxbows lakes. All records are from February and March.

Threats and conservation: Not threatened.



JK

Acisoma Ris, 1908 [Pintails]

The dragonfly genus *Acisoma* constitutes two species only, one being widespread in Africa and Asia, the other being scarce in the humid parts of continental Africa. Pintails are small libellulids with a short abdomen that is very inflated at the base and thins to the tip. The other generic characteristics are a combination of mostly venational features. The Broad Pintail, *Acisoma trifidum* Kirby, 1889, was found at the Chimpopo River in southern Angola. Therefore, it is also a candidate for the Namibian checklist. The adults are about the same size as in *A. panorpoides*; similarly, the base of the abdomen is very thick, but it tapers gradually to the end rather than being sharply contracted in the middle.

Meaning of scientific name: The genus name refers to the special shape of the abdomen, where the first segments are inflated while the last ones taper off. The name is derived from Greek *akis* – “needle, splinter, dart” and *sôma* – “body”.

Acisoma panorpoides ascalaphoides Rambur, 1842 [Grizzled Pintail]

Identification: The most striking characteristic of this small libellulid is the very swollen base (S1–4) of the short abdomen, becoming sharply narrowed in S5. The head is pale with blue eyes, while the thorax and abdomen are light blue and marked with black in adult males, but brownish-yellow in females.



Meaning of scientific name: The Greek *-oides* – “looking like” occurs in both the species and subspecies names. In the first species name, reference is made to the similarity of the abdomen to that of the mecopteran genus *Panorpa* (Scorpion flies), the name of which is derived from Greek *pan* – “totally” and *orpe* – “elephant-goat”. The species name refers to the special form of the male abdomen, which is curved like a scorpion’s tail. The origin of the subgenus may relate to a similarity to the neuropteran genus *Ascalaphus*.

Distribution: The species is distributed across tropical Africa, including Madagascar, ranging from Egypt to Sinai and southern Arabia. In Namibia, it has been recorded at the Okavango, Kwando, Chobe and Zambezi Rivers. The southernmost and very isolated locality is the Sartorius von Bach Dam, where the species was regularly recorded between 2003 and 2006 in the wetland below the dam.

The second subspecies, *A. p. panorpoides* Rambur, 1842, occurs in the Oriental region.

Ecology and behaviour: It mainly lives at well-vegetated habitats, e.g. shallow swamps. Adults preferably perch on the floating leaves of water lilies and lotus plants. The flight season in Namibia may be throughout the year; the records are



from June, August, November and December, as well as from February to April. No winter records exist from the Sartorius von Bach Dam.

Threats and conservation: Not threatened.

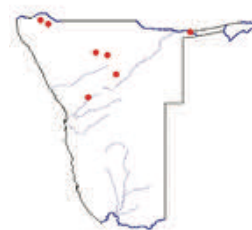
Bradinopyga Kirby, 1893 [Rock-dwellers]

The genus comprises two species in Africa and one on the Indian subcontinent. Adults are moderate to large libellulids with a camouflage colouration of the body in black, brownish-grey and whitish-grey. Despite the equatorial African *B. strachani*, whose adult males have a deep red abdomen, there are no differences in the colouration of the sexes. Adults perch on rocks and walls, where they are well camouflaged by their body pattern. The genus typically breeds in open rock pools filled by rainwater or flooding. In the southern African region the genus is represented by one species.

Meaning of scientific name: Greek *bradinos* – “taper, slender, slim” and *pyge* – “rump, buttocks”, probably point to the shape of the last abdominal segments.

Bradinopyga cornuta Ris, 1911 [Horned Rock-dweller]

Identification: In the cryptic colouration the species is unique among the Namibian dragonflies. Beside the generic characteristics described above, in adults the frons ends in two small, horn-like processes. Normally, the wings have narrow brown tips. The adults settle on rocks, where they are hardly visible.





Meaning of scientific name: Latin *cornutus* – “horned” refers to the specific shape of the frons.

Distribution: The species occurs from Kenya and Cameroon to South Africa (Kwazulu-Natal). In Namibia, the records are scattered in the northern half of the country, and are based mostly on observation of small populations. The southernmost records are from the Waterberg and the Erongo Mountains.

Ecology and behaviour: The species breeds in small rock pools that lack vegetation. Because this type of habitat is common in Namibia, the rare occurrence of the species is noteworthy. Most of the temporary rock-pool habitats are situated in the beds of the ephemeral rivers and streams, and are, therefore, heavily disturbed by floods. It is assumed that, in Namibia, *B. cornuta* prefers temporary rock pools that are filled by rainfall only. Due to the topography and the relatively high predictability of rainfall on the Waterberg plateau, a stable population seems to exist there. The flight season in Namibia lasts from at least January to April. One record is from October.

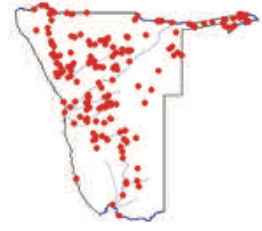
Threats and conservation: Not threatened.

Pantala Hagen, 1861 [Wanderers]

The genus *Pantala* consists of two species. One seems to be the most widespread species in the world since migrants occur over oceans and in deserts, while the other is widespread in the tropical Americas. Beside wing venation, characteristic are the large round head and the long, broad wings.

Meaning of scientific name: The name, composed of Greek *pant-* – “all-” and *ale* – “wandering” or “roaming without home or hope of rest”, describes the cosmopolitan distribution and vagrant behaviour of the species.

***Pantala flavescens* (Fabricius, 1798)**
[Global Wanderer]



Identification: The adults are large libellulids, and spend most of the daylight hours on the wing – often appearing in large numbers after rain. Both sexes generally have an orange body. The wings are large, and the base or hindwing widened. Orange wing tips are often clearly visible in both sexes. The pterostigma is reddish and somewhat smaller in the hindwings.

Meaning of scientific name: Latin *flavescens* – “becoming yellow, yellowish” refers to the colouration of females and most males.

Distribution: The Globe Wanderer seems to be the most widespread dragonfly worldwide. It is well known from all the continents except Europe, where it is known in single cases only, and Antarctica. It is a migrant species, colonising a broad spectrum of habitats from ephemeral desert pools to waters on small, isolated tropical islands. It occurs throughout Namibia.

Ecology and behaviour: The Global Wanderer breeds specifically in rain pools and other habitats of short duration, but oviposits in whatever kind of fresh waters are available. Adults often occur in huge aggregations, flying with the rain fronts. They also often show reproductive behaviour at waters just formed by rainfall. The female lays her eggs by touching the water surface with the tip of her abdomen, flying in tandem or on her own. In Namibia, the species mainly appears in the rainy season: most records are between October and May with a few in June and



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July, but no records are from August or September. The Globe Wanderer enters the country regularly with the rain-bearing winds of the Intertropical Convergence Zone. The species may complete several generations within one year, and larval development takes less than 40 days.

Threats and conservation: Not threatened.

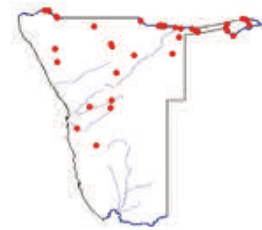
***Tholymis* Hagen, 1867 [Twisters]**

Two species belong to this genus. One, *T. tillarga*, is widespread in the Old World tropics; the other, *T. citrina*, is its counterpart in the New World tropics. Both are strong-flying insects, being active at dusk and dawn. Besides wing venation characteristics, generic features are the enlarged eyes and the broad hindwings with their cloudy patches in the centre.

Meaning of scientific name: The name looks like a Greek word, but it is not. It might be composed of parts of Greek *thorax* and *lygaios* – “shadowed” and “murky” and *themis* – “law as established by custom” or Goddess of Order, as Hagen states.

***Tholymis tillarga* (Fabricius, 1798) [Old World Twister]**

Identification: Unique for dragonflies are the cloudy patches in the centre of the hindwings. In males there are two patches: one brown, the other milky-white. Females only have the brown patches. In size and general appearance *Tholymis tillarga* resembles *Pantala flavescens* in body colouration, body size and the broad hindwings. The body is slender, being orange-red in males and olive-green to yellowish in females. Adults appear at water at dusk and dawn. They also tend to be active during reduced daylight and humid occasions, e.g. after rainfall or during soft rain.



Meaning of scientific name: Unknown. All that can be said is that it must be a proper name, as in the first century of its use, *tillarga* was spelled with a capital *T*.

Distribution: The species occurs in nearly all parts of the Old World tropics. It is widespread on the continents, in tropical Africa, southern and eastern Asia, and northern Australia. Beside this, many tropical islands have been colonised, including nearly all tropical Indian and Pacific Ocean islands. In Namibia, the species is widespread and locally very abundant at the Okavango, Kwando and Zambezi Rivers. It also occurs at the Kunene River and has been recorded at several localities in the arid parts southwards to the Tsauchab River catchment.

Ecology and behaviour: The species is a migrant with permanent presence in the humid parts of the tropics. It was encountered in enormous numbers, particularly in the Okavango flood plain in the Mahango Game Reserve. The species has



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surely been overlooked at many localities due to its crepuscular behaviour. Adults are chiefly active at dusk and dawn. Males fly continuously within limited areas along the water, and hover over floating plant material. Copulation is in flight and lasts about 15 seconds. A female lays her eggs by making a series of downward swoops from alternate directions (hence the common name, Twister) onto the swimming plant material. The female is equipped with an egg basket that helps to deposit eggs in groups of 4–13 in an oval order. The eggs quickly adhere to the wet plant surface. The flight season in Namibia is synonymous with the rainy season. Adults occur between November and April.

Threats and conservation: Not threatened.

***Diplacodes* Kirby, 1889 [Perchers]**

The genus *Diplacodes* occurs throughout the warmer regions of the Old World. It includes four principally African and five Indo-Australian species. All breed in standing, often temporary, waters and are good dispersers. Three species occur in Namibia. Most *Diplacodes* are small-sized species with a generally black body. The genus also includes a medium-sized species, *Diplacodes luminans*, which used to constitute a genus of its own, *Philonomon*. In Africa, the latter species is unique in the red-and-yellow colouration that contrasts sharply with the black markings in the mature male. The other Perchers are remarkably smaller and do not have any red colouration. In *D. lefebvreii* and *D. deminuta*, the body of adult males is totally black. Females as well as juvenile males bear yellow spots.

Meaning of scientific name: From *Diplac-odes* – “*Diplax*-like”. *Diplax* is a name that has for a long time been used for the genus *Sympetrum*. The Greek *diplax* – “having two areas” refers to the prothorax forming a reclining *B* in *Sympetrum*.

Key to the *Diplacodes* species

- 1 Adomen all black, without pale markings (mature males). 2
- Abdomen black with distinct pale spots. 3
- 2 (1) Face black. Patch at base of hindwing dark brown. Pt brownish yellow.
..... *D. lefebvreii*
- Face yellow. Patch at base of hindwing yellow or absent. Pt whitish. ... *D. deminuta*
- 3 (1) Base of hindwing with large orange spot reaching to discoidal cell. Undersides of
S5–8 with pale lateral spots. Face and base of abdomen red in mature males.
..... *D. luminans*
- Base of hindwing clear or with small yellow spot. Undersides of S5–8 without pale
lateral spots. 4
- 4 (3) Pt 2.5–4.0 mm; S8 with distinct pale spot about as half as long as segment.
..... *D. lefebvreii*
- Pt about 2.0 mm; S8 at most with small or indistinct pale spot. *D. deminuta*

***Diplacodes deminuta* Lieftinck, 1969**
= *Diplacodes okavangoensis* Pinhey, 1976
[Little Percher]



Identification: The thorax and abdomen in mature males is all black, while the face is a creamy white. In females and younger males the body is black with yellow spots. In general, adults of *D. deminuta* are



smaller (hindwing length 15–21 mm) than those of *D. lefebvrii* (hindwing length 20–28 mm). *D. deminuta* males never have a dark brown patch at the base of the hindwing or a tinge of brown near the pterostigma.

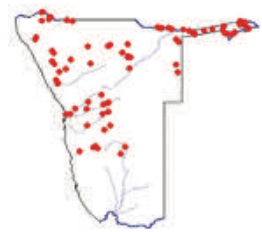
Meaning of scientific name: Latin *deminutus* – “diminished, small” refers to its being a rather small species.

Distribution: The Little Percher occurs from Liberia and southern Sudan to Namibia and Botswana. In Namibia, it has only been recorded at swampy areas along the Kwando and lower Okavango Rivers.

Ecology and behaviour: It occurs at backswamps of rivers, where it usually co-occurs with the Black Percher. The flight season in Namibia is not well known; adults have been observed in September, December and March.

Threats and conservation: Not threatened.

***Diplacodes lefebvrii* (Rambur, 1842)**
[Black Percher]



Identification: The face, thorax and abdomen are all black in mature males. They also have small blackish spots at the base of the hindwings. Several males have a brown tinge near the pterostigma. Old individuals tend to get a thin bluish pruinosity. In females and younger males the body is black with yellow spots. There is often a wide variation in body size within the males of a population. The females do not vary so much, but are usually smaller than the males.



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Meaning of scientific name: The species is dedicated to the French entomologist Alexandre Lefebvre (1779–1868), who collected four females of the new species during an expedition in Egypt in 1828–1829.

Distribution: The Black Percher is common throughout Africa and the Indian Ocean islands, and also occurs in southern Europe and the Middle East to India. In Namibia, the species is widespread and locally common.

Ecology and behaviour: Occurs at waters with grass-like vegetation and mats of floating algae. Males perch on algal mats, on the bare ground, or very low in the vegetation. They take off rapidly and fly very low over water. Therefore, they are not easy to catch with an insect net. Copulation wheels often sit on floating algae. After the wheel breaks up, the female takes off and lays her eggs with rapid dipping movements on floating algae. The flight season is throughout the year.

Threats and conservation: Not threatened.

Diplacodes luminans (Karsch, 1893)
= *Philonomon luminans* Karsch, 1893
[Luminous Percher, Barbet Percher]



Identification: In Africa, the male is unique compared with other libellulids in its red-and-yellow colouration sharply contrasted by black markings. It is about the same size as the red *Sympetrum fonscolombii*. The female has a characteristic pattern of three thick black stripes on the sides of the thorax, the middle one being much shorter. This pattern does not appear in *Sympetrum*, *Orthetrum* or *Trithemis* females in southern Africa, which



have similar body size. A second characteristic is the low number of antenodal cross-veins in the forewing (6.5–7.5 Ax). This characteristic is shared with *S. fonscolombii*, where the female has significantly fewer black markings on the body, and has black legs with a yellow streak. Both sexes in *D. luminans* have black legs without the yellow streak.

Meaning of scientific name: Latin *luminans* – “illuminating, lighting up”. Ferdinand Karsch reports many shining yellow parts to be seen on each of his three specimens. As he does not mention the conspicuous red first abdominal segments, his specimens most probably were teneral or in bad condition.

Distribution: From The Gambia and Somalia to Namibia, South Africa (Kwazulu-Natal) and the Comoros. In Namibia, it is widespread in the north, particularly in Caprivi. It usually reaches the more arid parts of the country with the onset of rain. In the latter areas the records are more scattered. It has regularly been observed in the Swakop River catchment. The southernmost records are in the Tsauchab River catchment.

Ecology and behaviour: The Luminous Percher is a migratory species with permanent occurrence in the humid north. There it lives mainly in swamps and oshanas. In the more central parts of the country, the species breed in temporary waters and sections of streams. The males perch from vegetation at the shore, often at heights of about 0.5 m. After heavy rainfall *D. luminans* is also found in the flooded parts of the savanna. During egg-laying, the female is guarded by the male. The eggs are placed in the water in shallow and vegetated places, often at grasslands that have just have been flooded by rain. The flight season in Namibia is mainly the rainy period, with most records being from December to March. Single records were from April, May, August and October.

Threats and conservation: Not threatened.

Sympetrum Newman, 1833 [Darters]

The genus *Sympetrum* has a species-rich occurrence in North America, Europe and Asia. There are only two species in Africa south of the Sahara, both of which also occur in Namibia. *Sympetrum fonscolombii* is a migrant, breeding in temporary pools. It is widespread in most parts of Africa, whereas *S. navasi* is very localised to swamp and large river habitats. Darters are small- to medium-sized dragonflies. The males have a red abdomen. In both species the female is guarded in tandem by her mate when she lays her eggs by touching the water surface in flight. Characteristic features of the genus are the low number of antenodal veins (6.5–7.5 or even 8.5 in the forewing). It is currently under discussion whether the two species belong to the genus *Sympetrum*, since they may belong to two completely different genera. Hence, the genus names of both species may change.

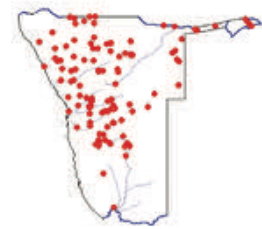
Meaning of scientific name: The name is composed of the Greek *sym-piézein* – “to compress” and *êtron* – “abdomen”. Newman, the author of the genus, believed erroneously that a laterally compressed abdomen was characteristic of the genus.

Key to the *Sympetrum* species

- 1 Male. 2
- Female. 3
- 2 (1) Wing venation red on basal half. Thorax brownish with yellow fields and black markings. *S. fonscolombii*
- Wing venation completely black. Thorax completely brown. *S. navasi*
- 3 (1) Wing venation yellow on basal half. *S. fonscolombii*
- Wing venation completely brown. *S. navasi*

Sympetrum fonscolombii (Selys, 1840) [Red-veined Darter]

Identification: The male’s abdomen is scarlet and the thorax laterally red with a yellow or greenish-yellow spot. The hindwings are marked with a yellow basal spot. The pterostigma is yellow in both sexes. Other species with a red body, broader abdomen and yellow basal wing spots are *Crocothemis erythraea*, *C. sanguinolenta* and *Trithemis kirbyi*.



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Meaning of scientific name: Named in honour of the French entomologist ELJH Boyer de Fonscolombe (1772–1853), who described the species for the first time, but under a name that was occupied by another species.

Distribution: The species is widespread in Africa, Europe and western Asia. In Namibia, it is widespread and common in most parts of the country.

Ecology and behaviour: *Sympetrum fonscolombii* is a migrant species that enters the arid parts of Namibia during the rainy season. It colonises all types of freshwater habitats. Development from egg to emergence takes less than 50 days and may be completed in as little as 35 days. The larvae are well adapted to dwell in rain pools of short duration. Due to its rapid growth, the species may complete several generations within a year. During egg-laying, the female is usually guarded by the male in tandem. With a dancing flight of the tandem, the female touches the water surface. Usually, the eggs are placed in open-water habitats with sparse vegetation. In Namibia, the Red-veined Darter is common between January and May, being less frequently observed during the rest of the year. There are only single records from August and September.

Threats and conservation: Not threatened.

Sympetrum navasi Lacroix, 1921
[Swamp Darter]

Identification: In both sexes the thorax and abdomen are red. In adult males the abdomen is blood-red, with little black. Wing venation is uniformly black in males and brown in females.



Meaning of scientific name: Dedicated to the Spanish Jesuit and entomologist Longinos Navás (1858–1938).

Distribution: The species occurs in tropical continental Africa from The Gambia and Kenya to Botswana. In Namibia, most records are from the flood plains in Caprivi.

Ecology and behaviour: The Swamp Darter lives at swamps and large, slow-flowing rivers. Adults have been observed perching at the waterside of reeds in oxbows and dead channels of rivers. They are therefore easier to spot from a boat. The flight season in Namibia is not well known; observations are from November and December only.

Threats and conservation: Not threatened.

Trithemis Brauer, 1868 [Dropwings]

Worldwide, the genus *Trithemis* includes about 50 species in Africa, southern Europe and Asia. The diversity of the genus is highest in Africa, with 38 species. Thirteen species have been recorded in Namibia.

Trithemis species vary widely in colour. From the colour of mature males, two major groups are usually distinguished. The ‘red’ group comprises species that have red to purplish males, while males in the ‘blue’ group are black with yellow, and develop a blue pruinosity during maturity.

The following keys include two candidates that may occur in Namibia, *Trithemis brydeni* from Zambia and the Okavango Delta in Botswana, and *T. dorsalis*, which occurs in southern Angola (upper Okavango River), Zambia and South Africa.

Meaning of scientific name: Greek *tri-* – “three” most probably refers to the tri-lobed prothorax in the genus, whereas *thémis* – “law as established by custom” or the Greek Goddess of Order is part of many names in libellulid dragonflies.

Key to the *Trithemis* species males

- 1 S4–7 black with short longitudinal streaks or pruinose blue. Body of adult males blue, sometimes black. 2
- S4–5 (usually 4–7) red to yellow, occasionally purplish–red pruinosity. Body of adult males mainly orange, red or violet. 9

Blue species

- 2 (1) Frons above steely blue. Thorax bright yellow, covered with light blue pruinosity in mature males. Abdomen never blue pruinose. 3
- Frons above with violet or purple sheen. Thorax ochreous, greyish brown, black or pruinose dark blue. Abdomen in most species fully covered by pruinosity when mature. 4

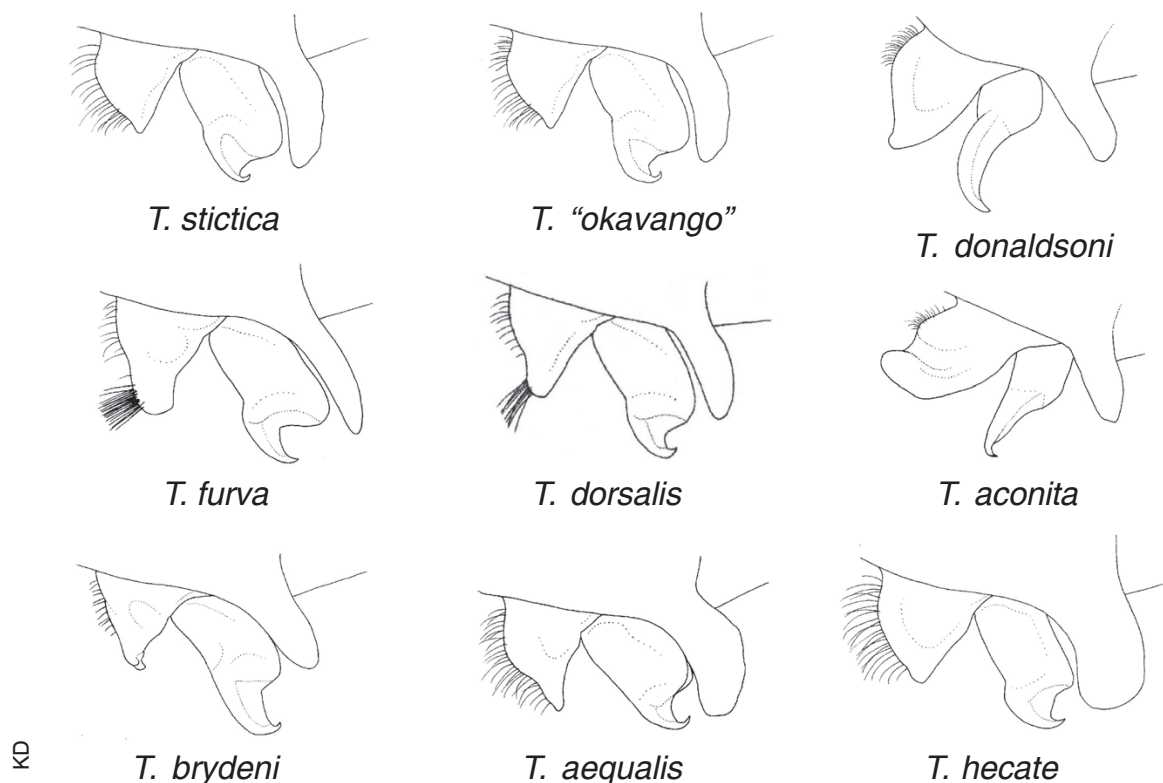
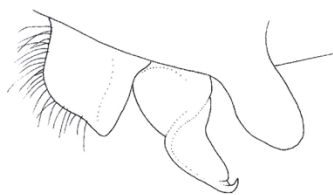


Plate 21: Secondary genitalia of 'blue' *Trithemis* males

- 3 (2) Eyes turquoise dorsally. Compare secondary genitalia for safe identification.
.....*T. stictica*
- Eyes brownish dorsally but becoming partly turquoise with age. Compare secondary genitalia for safe identification. *Trithemis* spec. nov.
- 4 (2) Hook of the hamule elongated, being longer than broad at its base. 4
- Hook of the hamule not elongated, being shorter than broad at its base. 5
- 5 (4) Abdomen dorsoventrally flattened and bright blue pruinosity. 6
- Abdomen slender, not dorsoventrally flattened, and very dark blue to black. 8
- 6 (5) Hamulus elongated and at a right angle to the body or projecting slightly to the front. In mature males, the whole body has a light blue pruinosity. *T. donaldsoni*
- Hamulus not elongated and not at a right angle to the body. 7
- 7 (6) Last Ax in forewing normally complete. Pterostigma normally uniform dark.
..... *T. dorsalis*
- Last Ax in forewing normally incomplete. Pterostigma normally dark at the front of the wing, with yellow line in the posterior part. *T. furva*
- 8 (6) Hamulus elongated and projecting backwards, away from hamule. Mature males have dark blue pruinosity. Narrow yellow streaks often visible on abdomen.
.....*T. aconita*
- Hamulus not elongated and not at a right angle to the body. 9

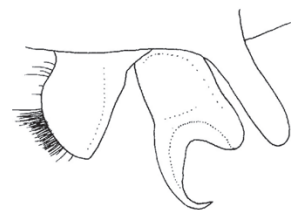
- 9 (8) Thorax black without any pruinosity in mature males; bright pale yellow in immature males. Genital lobe short; hamule distinctly tower above genital lobe. *T. brydeni*
- Thorax in mature males with dark blue pruinosity. Genital lobe long, reaching the level of the hook of the hamule. 9
- 10 (9) Thorax dark brown, here and there deepening to blackish; dorsum and sides with thin dusting of fine dark blue pruinosity (in another source described as reddish-purple pruinosity). *T. aequalis*
- Thorax with rich, dark blue pruinosity. Very slender abdomen, being almost completely black. Forewing with 8.5 (sometimes 9.5) Ax. Genital lobe broad and rectangular. *T. hecate*



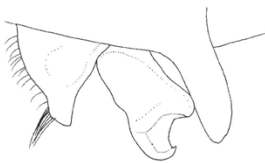
T. kirbyi



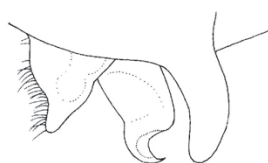
T. annulata



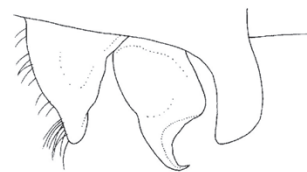
T. weneri



T. pluvialis



T. arteriosa



T. monardi

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Plate 22: Secondary genitalia of 'red' *Trithemis* males

Red species

- 11 (1) Frons all red. Forewing with very broad orange-yellow patch at the base, reaching halfway to the pterostigma. Sides of thorax tinged with pink. *T. kirbyi*
- Frons not all red. Forewing without very broad orange-yellow patch at the base. .. 12
- 12 (11) Frons above dull metallic violet. Body wine-red to violet. *T. annulata*
- Frons brownish with black basal band. 13
- 13 (12) S10 with red colour and black pattern. Setae on the hook of hamule not shorter than those on the base of the hamule. 14
- S10 almost completely black. Setae on the hook of hamule distinctly shorter than those on the base of the hamule. 15
- 14 (13) Posterior half of S9 and S10 black. Hamule with long, sickle-shaped hook. Slender abdomen. *T. weneri*
- Posterior half of S9 and S10 only with mid-dorsal black stripe. Hamule with short, strongly curved hook. *T. pluvialis*

- 15 (13) Orange area on the base of the hindwing does not reach beyond discoidal cell. No brown fillings of the orange cells. No distinct hair-tuft at the top of the anterior lamina. *T. arteriosa*
 – Orange area on the base of the hindwing reach beyond discoidal cell. Cells in the area filled with brown. A distinct hair-tuft at the top of the anterior lamina. ... *T. monardi*

Key to the *Trithemis* species females

- 1 S4–7 black with yellow lateral streaks. 2
 – S4–7 (at least S4–5) mainly yellow to reddish-brown. 10
- 2 (1) S4–7 with two yellow streaks each side. 3
 – S4–7 with one yellow streak each side. 5
- 3 (2) Frons above mainly metallic blue. *T. aconita*
 – Frons yellow with narrow dark metallic basal band. 4
- 4 (3) Basal dark violet band of the frons reaches the eyes. *T. aequalis*
 – Basal blue-black band of the frons does not reach the eyes. *T. donaldsoni*
- 5 (2) Forewings with 8.5 (sometimes 9.5) Ax. S4–5 slender. *T. hecate*
 – Forewings with 10.5 Ax or more. S4–5 broad. 6
- 6 (5) Frons above mainly black with blue-green sheen. *T. stictica* and *T. spec. nov.*
 – Frons with narrow blue-black basal band. 7
- 7 (6) Last Ax in forewing normally complete. Femur of mid- and hindleg with yellow external line. *T. dorsalis*
 – Last Ax in forewing normally incomplete. Femur of mid- and hindleg externally all black. 8
- 8 (7) Frontal edge of mesepimeron black. *T. brydeni*
 – Frontal edge of mesepimeron not black. *T. furva*
- 9 (1) S8 on each side with one pale stripe or longitudinal patch. Vertex without conical lobes. 10
 – More than one pale stripe at each side of S8: segment either black with two pale stripes, or pale with two black stripes. Vertex with two conical lobes. Anal field of hindwing often with an isolated yellow spot. *T. kirbyi*
- 10 (9) S9 with pale dorsolateral band. 11
 – S9 without pale dorsolateral band (all black or black with a pale dorsal carina). 13
- 11 (10) Pterostigma mainly black. *T. pluvialis*
 – Pterostigma pale brown or reddish brown. 12
- 12 (11) Pale dorsolateral band at S9 broad and long. *T. annulata*
 – Pale dorsolateral band at S9 narrow and short, not reaching the end of the segment. ...
 *T. werneri*
- 13 (10) Labium with black median band. Yellow area on the base of the hindwing not reaching beyond discoidal cell. *T. arteriosa*
 – Labium without black markings. Yellow area on the base of the hindwing reaching beyond discoidal cell. *T. monardi*

The ‘blue’ *Trithemis*

Trithemis stictica (Burmeister, 1839)

[Jaunty Dropwing]

Identification: The colouration of the males of this species is unique in its contrast between a steely blue-green frons, bright turquoise eyes, a light blue pruinose thorax and a black abdomen with yellow lines. In immature males and in females, the thorax is mainly yellow with black markings. Both sexes often have a yellow wash in the centre of their hindwings, which is otherwise uncommon in the “blue” *Trithemis*. The length is about 35 to 38 mm.



Meaning of scientific name: Greek *stiktos* – “pricked, tattooed, marked, dappled” and *-ikos* – “belonging to”; the name might be an allusion to the drop-like yellow spots on the sides of the thorax in the type specimen, which had the blue pruinosity only on its dorsum. A yellow spot in the hindwing, which is a characteristic feature in most individuals, is not mentioned in the first description.

Distribution: Occurs from Ivory Coast and Somalia to the Cape of Good Hope, South Africa as well as on Madagascar. In Namibia, the Jaunty Dropwing has been found at only five localities, four being in the Naukluft Mountains and one in the neighbouring Tsaris Mountains.

Ecology and behaviour: Occurs at small, perennial streams. Some of the sites are very shady, getting full sun only for short periods of the day. Males perch on twigs or stems of other vegetation often over pools in the streams. At the most shady



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site, the males were observed perching in the tops of overhanging trees, flying over the water every now and then in search of females. Larvae develop rapidly in about 70 days from egg to emergence. However, growth is not fast enough to allow development in temporary waters, which restricts the species to perennial ones. The flight season is throughout the year.

Threats and conservation: Generally, *T. stictica* is widespread in Africa and, therefore, not threatened globally. In Namibia, however, it has a very small extent of occurrence (less than 250 km²) and an even smaller area of occupancy (< 50 km²), with only five known reproducing populations. The areas where it occurs are highly isolated by distances of > 1,000 km from the main range of the species, so that re-colonisation from there is unlikely. In Namibia, therefore, it qualifies for “Endangered” status.

Trithemis sp. nov. undescribed [Okavango Dropwing]

Identification: The adults are very similar to those of *Trithemis stictica*: both sexes have a blue-green frons, the males have a bluish thorax, and a yellow-and-black abdomen. In live specimens of *T. stictica*, the eyes are dorsally turquoise, whereas in the new species they are mostly brownish-violet (but may become partly turquoise with aging). The species is smaller and less robust than *T. stictica*, with the length reaching 34 mm at maximum. For accurate identification, the shape of the secondary genitalia can be compared. In Namibia, the two species do not co-occur.



Distribution: As far as is known, the species is confined to the Okavango and Kwando River systems in Namibia, Botswana and Angola. In Namibia, it is common and widespread along the Okavango and Kwando Rivers.

Ecology and behaviour: It occurs at rivers, mainly in swampy sections, such as the backswamps in the Mahango Game Reserve or in the Linyanti swamps. The flight season lasts from August to April.

Threats and conservation: Although the species is restricted to only a few rivers, it is not threatened. The populations are large and viable and obviously do not suffer from deforestation.

Note: Molecular genetic comparisons of specimens identified as *Trithemis stictica* from the Okavango River with specimens of *T. stictica* of the Naukluft area and with specimens from Kenya lead one to the assumption that the Okavango population is a different species. Only recently, morphological structures of the male genitalia have also been identified that allow the species to be distinct. All records of *T. stictica* hitherto published from Caprivi and from the Okavango Delta belong to the new taxon.

Trithemis donaldsoni (Calvert, 1899)

[Denim Dropwing, Donaldson's Dropwing]

Identification: In adult males, the thorax and abdomen are completely covered by a light blue pruinosity. All other blue *Trithemis* are darker in colour. The species rather resembles some *Orthetrum* species, but the blue colour is never as pronounced as in *T. donaldsoni*. The posterior hamule is distinct (see Plate 21). Size: 43 mm.



AM

Meaning of scientific name: The species was named in honour of the American, Dr A Donaldson Smith. On his expedition from Berbera to Lake Rudolf (today Lake Turkana) in 1894-1895, he collected a male of this dragonfly species on a brook flowing into the Erer River (Ethiopia).

Distribution: From Namibia and South Africa (Kwazulu-Natal) to Eritrea and southern Arabia. In Namibia, it occurs at the Kunene and Okavango Rivers. In central Namibia, there are two isolated populations at the Sartorius von Bach Dam and the Oanob Dam, respectively.

Ecology and behaviour: Occurs at large perennial rivers and at some large impoundment lakes. In contrast to most other *Trithemis* species, the males mainly perch on the ground and, preferably, on rocks in the river or lake. In the north, the flight season may be throughout the year. To date the species has been recorded in July and August, from November to January, and from March to May. In central Namibia, the flight season spans only from March to May.

Threats and conservation: Not threatened.

Trithemis furva Karsch, 1899

[Navy Dropwing]

Identification: This species has a broad abdomen covered with a rich blue pruinosity in mature males. In females and immature males, the abdomen is mainly yellowish from above with a mid-dorsal black line. Females have a yellow wash near the tip and at the node of each wing. A very similar species is *T. dorsalis*, which occurs in the upper Okavango River, although it has not yet been recorded in Namibia.



ES

Meaning of scientific name: Latin *furva* – “the dark-coloured, dusky” or “the black mare”. The single male specimen from which Ferdinand Karsch described the new species was blackish-brown.

Distribution: From the Cape of Good Hope in South Africa to Somalia, southern Arabia and Madagascar. In Namibia, it occurs at the Orange River and in the Naukluft Mountains, where most specimen records originate. A single male was recorded in the stream below the Sartorius von Bach Dam. Unconfirmed records also exist from the Okavango River. Occurrence there is possible since the species is known from the upper Okavango in Angola.

Ecology and behaviour: A running water species. Males were observed perching over small perennial streams in and near the Naukluft Mountains. However, the species has not been observed every year in that area, so invasions may be possible. The flight season is from November to May.

Threats and conservation: Not threatened.

***Trithemis aconita* Lieftinck, 1969**
[Monk's Hood Dropwing]

Identification: A dark and slender species, the mature males having a rich, dark blue pruinose thorax. The slender abdomen is black with two thin yellow lines on each of S5 to S8, and is usually not pruinose (or only in older individuals). The frons is a metallic blue, while the eyes are dark blue.



JK

Meaning of scientific name: The name refers to the shape of the anterior lamina of the male genitalia, which is reminiscent of the *Aconitum* or Monk's Hood flower.

Distribution: From Guinea and Ethiopia to South Africa. In Namibia, it has mainly been recorded at the Okavango River at Andara and Popa Falls. It also occurs at the Chobe River rapids at Impalila Island and at the Zambezi River rapids near Katima Mulilo.

Ecology and behaviour: Occurs at river sections with intact riverine forest. The males usually perch in trees overhanging the water. Nothing is known about the exact larval habitat as yet. The flight season is not fully clear either; adults have been observed in June, August and December, and from February to April. The highest abundance at Popa Falls and Andara was in August.

Threats and conservation: In Namibia, they are very restricted to small river sections where riverine forest is intact. A major threat is ongoing destruction of the forests, particularly along the Okavango River. However, re-colonisation from upstream sites in Angola seems likely.

***Trithemis aequalis* Lieftinck, 1969**
[Dark Dropwing]



Identification: This is a bit of a mysterious species because somewhat different descriptions of the colouration exist. While the original description from Lake Bangweulu specimens states that the dorsum and sides of the synthorax are dull, with “a thin dusting of fine dark bluish pruinescence”, the description of Okavango Delta specimens (described as *T. falconis*) is “synthorax with some reddish violet pruinosity dorsally”. Since this species was not seen alive, the colouration cannot be validated. It may be that the two isolated populations vary in colour. If so, the Namibian species may have a rather reddish-violet pruinosity. The frons is bronzy-violet above. The abdomen is slender and mostly black, with yellow streaks in two rows on S3 to S8.

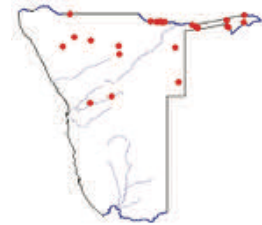
Meaning of scientific name: Latin *aequalis* – “similar”, “of similar size”, or “of similar shape”. In his species description, Maurits A Lieftinck emphasises many similarities between this species and *Trithemis nuptialis*, *T. aenea* and *T. anomala*.

Distribution: Confined to Zambia, Botswana and Namibia. In Namibia, two single males of the species have been recorded at the Okavango River at Andara (1960) and Popa Falls (1993).

Ecology and behaviour: One of the typical species of the Zambezi flooded grasslands ecoregion. The biology and ecology of the species is relatively unknown. As regards the flight season, the only records in Namibia are from September and November.

Threats and conservation: *T. aequalis* has a relatively large extent of occurrence. However, within this large southern African region the area occupancy may be much smaller because the species has only been encountered at a few localities to date. During recent surveys in the Okavango Delta the species was not recorded, meaning the population may have declined. The last record of the species is that from Popa Falls in 1993. Its Global Red List status is “Data deficient”.

***Trithemis hecate* Ris, 1912**
[Hecate Dropwing]



Identification: This is one of the darkest *Trithemis*, having an almost black appearance. The abdomen is almost completely black in mature males, with no or only very small yellow streaks; females have broader yellow streaks. Pruinosity in males is very dark blue; the frons is purplish-blue.

Meaning of scientific name: *Hekátê* is the name of the Greek Goddess of Magic and the Dead.

Distribution: The species occurs from Senegal and Kenya to Namibia and South Africa (Kwazulu-Natal), as well as on Madagascar. In Namibia, it is widespread in the north, particularly in the Cuvelai system and along the Okavango, Kwando and Zambezi Rivers. It occurs at Tsumkwe, and reproducing populations have also been recorded at the Otavi Mountains. The southernmost records of single individuals are from Tsaobis and the Sartorius von Bach Dam.

Ecology and behaviour: The species mainly occurs at swampy river sections and in the oshanas. In the Otavi Mountains, a large population exists at a spring-fed



Male



Female

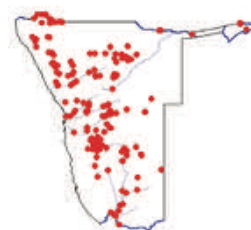
reservoir. The southern records, particularly those of the lower Swakop catchment at Tsaobis, were obviously dispersing individuals that may have accompanied swarms of other species entering the desert. The flight season is from November to June.

Threats and conservation: Not threatened.

The ‘red’ *Trithemis*

Trithemis kirbyi ardens (Gerstäcker, 1891) [Orange-winged Dropwing, Rock Dropwing]

Identification: The males of the Rock Dropwing are bright red in colour, and their thorax has pinkish-violet sides. The eyes and frons are also red. Most distinct are the broad orange-red bases of all four wings, with the orange reaching about halfway up to the node of each wing. *Brachythemis lacustris* males are very similar, but are stouter in appearance; in the latter species, the orange-red reaches the node of the hindwing. *T. kirbyi* has red veins in the wings and a uniformly coloured pterostigma, while *B. lacustris* has black veins and a bicoloured pterostigma. *T. kirbyi* females are mainly brownish, with some black markings on the abdomen. A wash of yellow in the posterior part of the hindwing, separated from the yellow spot at the wing’s base, is diagnostic when compared with the females of *Brachythemis* and other *Trithemis*.



Meaning of scientific name: The species name refers to William Forsell Kirby (1844–1912), the leading British specialist in Odonata at the end of the 19th century. The subspecific name is Latin, *ardens* – “burning”.



ES

Distribution: The Rock Dropwing occurs on continental Africa, the Comoros and Madagascar. *Trithemis kirbyi kirbyi* Selys, 1891 occurs in India. In Namibia, the species is widespread and common in almost all parts of the country, but surprisingly rare at the Okavango River and in Caprivi.

Ecology and behaviour: *T. kirbyi* colonises all kinds of freshwater habitats. In the arid parts it can be observed regularly at swimming pools and water tanks. The larvae develop in temporary as well as perennial waters. The species is multivoltine, with rapid larval development. The larvae develop from egg to emergence in less than 50 days. However, in contrast to other rapidly growing species, the larvae of *T. kirbyi* are relatively inactive. Therefore, and due to their colouration, they are inconspicuous and are able to co-occur with predatory fish in perennial waters. The flight season is throughout the year. In the desert, adults often aestivate in the dry season.

Threats and conservation: Not threatened.

Trithemis annulata (Palisot de Beauvois, 1807) [Violet Dropwing]

Identification: The males of this colourful species cannot be mistaken. They have a bright violet pruinosity on the thorax and a reddish-violet pruinosity on the abdomen, contrasting with yellow wing spots at the bases of the hindwings. The eyes are also violet and the frons is a metallic bluish-violet. The females are olive-brown and have an almost unmarked abdomen. The two last abdominal segments have a black mid-dorsal marking in both sexes.





Meaning of scientific name: From Latin *an(n)ulus* – “small ring”; therefore, *annulatus* means “with horizontal stripes”. These stripes on the posterior margins of the abdominal segments, being very fine, are obscured by the pruinosity in the males.

Distribution: Occurs in Africa and Arabia, to southern Europe, the Levant and Mesopotamia. The subspecies *T. a. haematina* (Rambur, 1842) is known from Madagascar and the Mascarene islands. It is widespread all over Namibia, from the most arid parts to the large perennial rivers in the north and south.

Ecology and behaviour: In Namibia, the species is particularly common at the large perennial rivers and at impoundment lakes, but is also present at some temporary and artificial fresh waters, such as farm dams. The flight season is throughout the year, but most records are from November to April. The species has a rapid larval development, which enables it to breed in temporary waters and produce several generations per year.

Threats and conservation: Not threatened.

***Trithemis arteriosa* (Burmeister, 1839)**
[Red-veined Dropwing]

Identification: This species and the following one, *T. monardi*, are very similar. Both are small compared with the other red *Trithemis*. The bright red colour of the abdomen is contrasted by its black underside and black markings reaching the dorsum of the abdomen on



S6 to S10. The thorax is purplish-red above. S10 is completely black from above, whereas S9 is black only on the posterior half. The wing veins are bright red and appear fully red in flight. The amber area on the base of the hindwing does not reach beyond the discoidal cell (which distinguishes *T. arteriosa* from *T. monardi*). *T. arteriosa* females are brownish and slender compared with other *Trithemis* females; they also only have small amber patches on the wings.

Meaning of scientific name: Latin *arteria* – “blood vessel, vein” and *-osus/-osa* – “having plenty of” aptly describe the conspicuous red veins in the wings.

Distribution: Throughout Africa, including Madagascar, together with southern Europe and western Asia. In Namibia, the species is widespread, but less common than *T. kirbyi ardens*.

Ecology and behaviour: The species is common along the northern perennial rivers, usually at stretches with reeds. In the rest of the country it also occurs at waters with emergent vegetation; it is most common at perennial waters, i.e. perennial streams and wetlands below dams. There are a few observations from temporary waters, but breeding there is not confirmed. A large population occurs at the Oanob Dam, which does not match the typical habitat because there are almost no reeds. The species occur as adults throughout the year, with a significant peak between November and April.

Threats and conservation: Not threatened.



***Trithemis monardi* Ris, 1931**
[Monard's Dropwing]



Identification: *T. monardi* is similar to *T. arteriosa*. It is small and slender. The bright red colour of the abdomen is contrasted with its black underside and the black markings reaching the dorsum of the abdomen on S6 to S10. The thorax is purplish-red above. The wing veins are bright red and appear fully red in flight. The amber area on the base of the hindwing reaches beyond the discoidal cell. Cells in the area are filled with brown. The amber wing patches at the base of the forewing and hindwing only reach as far as the discoidal cell. *T. monardi* females have larger amber patches on the wings.

Meaning of scientific name: The species is named in honour of the Swiss naturalist Dr Albert Monard (1886–1952), who collected the species at the Chimpopo River, southern Angola, in 1928.

Distribution: Occurs in southern Angola, Namibia and Botswana. The subspecies *Trithemis monardi insuffusa* Pinhey, 1970 occurs in eastern Angola, Zambia, Malawi, Zimbabwe and Mozambique. In Namibia, it is known from the Kunene, Okavango and Kwando Rivers. There are also some records from the Otavi Mountains and an historic record from the Okosongomingo Farm at the Kleiner Waterberg.

Ecology and behaviour: The habitats are often sections of running water with reeds. In the Otavi Mountains, the species occurs at spring-fed farm dams. In Namibia, the flight season lasts from September to April; adults have been seen in highest abundance in February.

Threats and conservation: Not threatened.



JK

***Trithemis pluvialis* Förster, 1906**
[River Dropwing]



Identification: The males have a red abdomen, brownish thorax, brown eyes, and a pale brown frons. Both forewings and hindwings have amber patches at the bases, but those in the hindwings are large. The dark mid-dorsal streaks on the last two abdominal segments in both sexes are diagnostic. This pattern is only found in one other species, namely *T. annulata*.

Meaning of scientific name: From Latin – “bringing the rain”. The type specimen was collected in the Usambara Mountains, Tanzania. It is not known why the author associated it with rain.

Distribution: Occurs from Kenya and the Democratic Republic of Congo to South Africa. In Namibia only observed at the Kwando River so far. The record of this species is based on the observation of one male at the Kwando River. The record remains unproven because no specimens have been collected nor have photos been taken. The presence in Namibia therefore needs confirmation.

Ecology and behaviour: It frequents the wooded margins of flowing streams and rivers. Territorial males typically perch on branches overhanging the water.

Threats and conservation: Not threatened.



HR

***Trithemis weneri* Ris, 1912**
[Elegant Dropwing]



Identification: This species is characterised by a very slender cylindrical abdomen. In males, the abdomen is red and the thorax brownish. The last two abdominal segments bear a dark pattern only on the posterior halves. There is no amber patch in the forewing, while that in the hindwing is only along the inner margin.

Meaning of scientific name: The species is named in honour of the Austrian zoologist and explorer Dr Franz Werner, who collected two males of the new species at Gondokoro in Uganda in 1905.

Distribution: Occurs from Nigeria and Uganda to the northern Namibian and the South African (Limpopo River) borders. In Namibia, it has to date only been observed along the Kunene River.

Ecology and behaviour: In Namibia, the species is known only from a stretch of river in an arid environment, which fits the general description of the species ecology. The current research observed only a few individuals, so little information about the ecology was gleaned. The flight season is from November to March.

Threats and conservation: Not threatened.



VC

Crocothemis Brauer, 1868 [Scarlets]

This genus of European, African, Asian and Australasian dragonflies is represented in Africa by six species. Three species occur in Namibia. Despite a combination of several venational characteristics, there is no useful feature for distinguishing the genus from others. The species are medium-sized. The adult males have a red abdomen.

Meaning of scientific name: Greek *krókos* – “saffron” hints at the saffron-coloured basal patches of the hindwings of all *Crocothemis* species that were known at the time the genus was established. Greek *-themis* – “law as established by custom” and Goddess of Order, was first used as an element in dragonfly names by Hermann August Hagen in 1861. Today, this word element is widespread in the Libellulidae, e.g. *Brachythemis*, *Nesciothemis*, *Rhyothemis* and *Trithemis*.

Key to the *Crocothemis* species

- 1 Base of hindwing with yellow patch. Thorax mainly brownish to redish. 2
- Base of hindwing without yellow patch. Thorax grey. *C. divisa*
- 2 Pterostigma usually red; thorax with extensive pink. Lateral carina of S5 with five to twelve denticles. The thorax of adult males tends to be purplish-red. In females, vulvar valvules are long and scooped, reaching near the tip of S10. Smaller species, 32–38 mm in length. *C. sanguinolenta*
- Pterostigma yellow, never red; thorax reddish-brown. Lateral carina of S5 with more than 16 denticles. The thorax of adult males blood-red to brown. In females, the vulvar valvules are short and prominent, not reaching S10. Usually larger species, about 40 mm or more in length, but small individuals (< 35 mm) also occur. *C. erythraea*

Crocothemis divisa Karsch, 1889 [Pale Scarlet, Slender Scarlet]

Identification: Adult males are less intensively red than the other *Crocothemis* species. The thorax of the male is brownish-grey. The combination of grey thorax and red abdomen is unique in Namibian libellulids. Neither sex has a yellow base spot in the hindwing.



Meaning of scientific name: Latin *divisus* – “divided, split” refers to the symmetrically divided discoidal cell in the hindwings, one of the features by which the type specimens of the new species differed from *C. erythraea*.

Distribution: The species is widespread in the savannahs of continental Africa. It also occurs in Madagascar. In Namibia, it has only been recorded once to date, namely in February 2004 in the Groot Paresis Mountains.

Ecology and behaviour: The species breeds in small, temporary, flowing waters in the savannah. It survives the dry season as sexually inactive adults. Both sexes

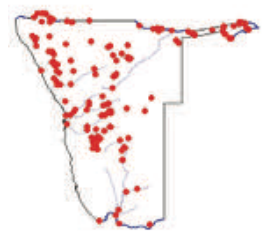


use rocks as well as the big termite mounds of *Macrotermes* spp. as daytime resting sites. The insects, which perch in the shade on the ribs of the steep mound sides, repeatedly change their positions during the course of the day in response to direct solar illumination. Flights are very short and are not accompanied by the aggressive behaviour typical of sexually active individuals.

Threats and conservation: Not threatened globally, but rare in Namibia.

Crocothemis erythraea (Brullé, 1832) [Broad Scarlet]

Identification: Males with blood-red, broadened and flattened abdomen. The thorax is reddish-brown. In comparison with the other *Crocothemis* species, the bases of the hindwings bear larger amber patches that, at their maximum width, are as wide towards the tip of the wing as two or three antenodal cross-veins. The pterostigma is yellowish to orange. Two species common in Namibia, *Sympetrum fonscolombii* and *Trithemis kirbyi*, share the features of the broad, blood-red abdomen and broad amber wing base. The following characteristics may help in the field: *Trithemis kirbyi* males have an amber wing base, also in the forewing, while the sides of the thorax in *S. fonscolombii* bear a greenish-yellow line.



Meaning of scientific name: From Greek *erythraîos* – “red”.



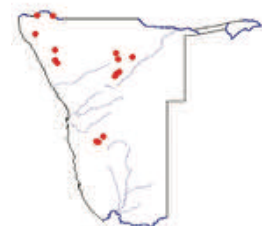
ES

Distribution: The species is common throughout Africa, Madagascar, the Arabian peninsula and the Mediterranean, as well as northwards to central Europe and Britain and eastwards to India. In Namibia, it is widespread and common across the country.

Ecology and behaviour: The Broad Scarlet colonises all kinds of freshwater habitats successfully, including temporary waters. At larger rivers it is more common in lentic than in lotic waters, e.g. in backswamps. In contrast to many other species, it colonises waters with dense emergent vegetation such as rushes. The species has a rapid larval development and is able to produce several generations within one year. Development from egg to emergence needs less than 50 days. The flight season is throughout the year. Males of *C. erythraea* usually perch on twigs or stems of vegetation at the water, which is in contrast to males of the similar *C. sanguinolenta*, which mostly perch on bare rock.

Threats and conservation: Not threatened.

Crocothemis sanguinolenta (Burmeister, 1839) [Small Scarlet]



Identification: In general, this species appears like a smaller version of *Crocothemis erythraea*. Adults of the two species are not easily distinguished. Both sexes of *C. sanguinolenta* tend to have extensive pink colouring at the sides of the thorax, and have a reddish pterostigma. *C. sanguinolenta* females are easier to distinguish because the vulvar

valvules point backwards and are elongated, almost reaching the end of the last abdominal segment. In *C. erythraea*, the vulval valvules point downwards and are not elongated.

Meaning of scientific name: Latin *sanguinolentus* – “splattered with blood”.

Distribution: The Small Scarlet occurs all over sub-Saharan Africa and Madagascar to southern Arabia. An isolated relict population exists in the Dead Sea basin. In Namibia, the species occurs at a few isolated locations, usually springs, along the Kunene River (e.g. in the Baines Mountains), in Kaokoveld, Damaraland and the Naukluft Mountains. Historic records are from the Waterberg and Otavi Mountains.

Ecology and behaviour: In Namibia, the species occurs at permanent springs in the more arid parts of the country, usually in mountain ranges. All habitats are characterised by small, rocky, swift-flowing waters. Small waterfalls are often present. The larvae assemble mainly near the bases of sedges in the swift currents of riffle stretches, as well as in small pools in waterfalls. The adult males perch on rocks close to the water. Larval development takes about 60 days, which seems to be too long to survive in most temporary waters. The flight season is throughout the year.

Threats and conservation: The populations at the Waterberg and in the Otavi Mountains appear to be extinct due to habitat degradation.



AM

Olpogastra Karsch, 1895 [Bottletails]

This genus consists of a single species, which is an African endemic although it is very widespread over most of sub-Saharan Africa. Some other species, including one that occurs in Namibia, that have formerly been part of this genus have recently been placed into the genus *Zygonoides* (see below). For a description of the characteristics of *Olpogastra*, see below.

Meaning of scientific name: Greek *olpe* – “leather oil flask” and *gaster* – “belly”, i.e. abdomen. The name refers to the shape of the abdomen in this genus, which is conspicuously inflated in the first three abdominal segments.

Olpogastra lugubris Karsch, 1895 [Slender Bottletail]

Identification: The Slender Bottletail is very specific in its features, particularly in the enormous bulbous S1–3 (as seen from the side), combined with very thin and slender S4 to S10.

The abdomen is longer than the wings. The general colouration of the body is yellow and black. The markings on the thorax are a somewhat metallic green-black. The eyes are a metallic green. Whereas in colour and size the species is similar to *Zygonyx torridus* and *Zygonoides fuelleborni*, the shape of the abdomen is unique.

Meaning of scientific name: Latin *lugubris* – “indicative of mourning, mournful”, refers to the mainly dark colour of the species, as if the insects were in mourning dress.



Distribution: The species occurs from The Gambia and Somalia to South Africa, and is common at most rivers. In Namibia, it is common and widespread at the Kunene, Okavango, Kwando and Zambezi Rivers. There are additionally two records at isolated localities in the interior. A few individuals have been observed at Tsaobis in the Swakop River valley. Others were found at the Sartorius von Bach Dam in February and November 2006.

Ecology and behaviour: The species lives at large perennial rivers. The larvae are to be found particularly in dense vegetation, even in strong currents. They have been caught in particularly high numbers in the small, swiftly flowing river channels at Popa Falls. The mature males typically perch on vegetation directly at the water, waiting for females. The records at Tsaobis and the Sartorius von Bach Dam suggest that the species may occasionally be translocated far from its main habitats at the perennial rivers. However, it is not known if the species may reproduce successfully at such newly colonised localities. The flight season is mainly the rainy season; most records were made between November and April, but single records exist from June and July.

Threats and conservation: Not threatened.

Zygonoides Fraser, 1957 [Spectaculars]

Members of *Zygonoides* are large, spectacular dragonflies. The genus consists of three continental African and one Madagascan species. In southern Africa, only one species occurs. A record of a second species, *Zygonoides occidentis* (Ris, 1912), in the upper Okavango River system requires confirmation and seems unlikely. This genus comes close to *Olpogastra* and has recently been revised, resulting in the former subgenus *Zygonoides* to be evaluated to full genus status. However, *Zygonoides* do not have the specific shape of the abdomen as shown by *Olpogastra*.

Meaning of scientific name: Greek *-oides* – “looking like” refers to the genus being very similar to *Zygonyx*.

Zygonoides fuelleborni (Grünberg, 1902) = *Olpogastra fuelleborni* Grünberg, 1902 [Fuelleborn's Spectacular]

Identification: The species comes close to *Zygonyx torridus* in general colouration, but is darker. It has yellow patches edging S5 to S7 on both sides of the mid-dorsal carina, and connecting on top of each segment. By contrast, *Z. torridus* has such yellow patches on almost all segments except S9 and S10, and the patches are not connected. The abdomen of *Z. fuelleborni* is constricted at S3 and S4, forming a distinct waist – a characteristic



not being as distinct in *Zygonyx*. The thorax has small yellow spots on the sides. The eyes are dark greenish. The best characteristic by means of which to distinguish between the two species in the field is the males' behaviour at the water. Fuelleborn's Spectacular males perch at the water, whereas Ringed Cascader males permanently patrol over rapids.

Meaning of scientific name: The species is dedicated to the German medical doctor, Friedrich Fülleborn (1866–1933), who collected the type specimen at Langenburg in southern Tanzania in August 1898.

Distribution: The species is mainly spread over eastern Africa, ranging from Kenya to northern South Africa. In southern Africa, it also reaches the west coast. In Namibia, several records are from the Kunene, Okavango and Zambezi Rivers, whereas the species has not been recorded at the Kwando River to date.

Ecology and behaviour: *Zygonoides fueelleborni* is a river species that has mainly been recorded at swiftly flowing sections of river and at rapids. Like in some gomphids, there are many more records of exuviae than of live individuals. The exuviae are typically found at trees at the water's edge. As in *Olpogastra*, but unlike the very similar *Zygonyx*, the males sit on perches at the water. The flying season is mainly during the rain months. The species was recorded between November and March, and there is a single record from May.

Threats and conservation: Not threatened.

***Zygonyx* Hagen, 1867 [Cascader]**

The genus is represented in south-eastern Europe, Africa, Madagascar, several smaller western Indian Ocean islands, the Indian peninsula, and south-east Asia. Two species occur in southern Africa. They are medium to large in size, and breed in rapids and waterfalls. Males conspicuously patrol over the white, swift-flowing turbulent water. The larvae live on the surface of rocks and timber or between leaves in the strong, turbulent current.



Meaning of scientific name: Greek *zygon* – “(inter alia) pair” and *ónyx* – “claw”. In this genus, the claws have a tooth of equal size to the claws themselves, so that each leg seems to have a pair of claws, not one bifid claw.

Key to the *Zygonyx* species

- 1 Male. 2
- Female. 3
- 2 (1) Frons a bright metallic blue. Body pruinose grey-blue in mature males. Abdomen black with fine yellow lateral streaks in immature males. *Z. natalensis*
- Frons a dark metallic violet. Body not pruinose grey-blue. Abdomen black with yellow lateral spots. *Z. torridus*
- 3 (1) Abdomen black with fine yellow lateral streaks. *Z. natalensis*
- Abdomen black with yellow lateral spots. *Z. torridus*

Zygonyx natalensis (Martin, 1900) [Blue Cascader]

Identification: Adult males of this species are distinct in the genus by having a grey-blue pruinosity when patrolling at rapids and waterfalls. Thus, they look like Skimmers, although the latter would not patrol over the water for extended periods. The frons is a bright metallic blue. The abdomen of females and immature males is black with fine yellow lateral streaks.



Meaning of scientific name: Portuguese *natal* – “Christmas”. René Martin described this dragonfly species after specimens originating from South Africa



(Kwazulu-Natal). On his first voyage to India, the Portuguese navigator Vasco da Gama named that part of the African coast Natal because he arrived there on Christmas Day, 1497.

Distribution: It occurs from eastern and western equatorial Africa to South Africa. In Namibia, it lives at rapids and waterfalls at the perennial rivers in the north, namely at the Kunene (Epupa and Ruacana Falls), Okavango (Andara and Popa Falls) and Zambezi Rivers (rapids at Katimo Mulilo).

Ecology and behaviour: The Blue Cascader inhabits waterfalls and rapids of perennial rivers. Males are territorial, patrolling above the white, turbulent section of a river and chasing rivals away. They roughly patrol along a flight path of 5–20 m in a flight level of 0.6 to 0.9 m above the actual water surface. After copulation, the pair looks for an oviposition site in tandem. As a rule they separate for oviposition and the female, guarded by the hovering male, settles on roots or stalks. The eggs, which become sticky in water, are either washed away by the current from her motionless abdomen or deposited by her active movements to release them. If a rival male disturbs a pair during his search flight, the female will start to deposit her eggs in tandem flight in the open water. This often lowers the risk of the rival taking over from the occupied male. The larvae cling to the surface of rocks or roots in the strong, turbulent current. Emergence takes place at overhanging rocks. In Namibia, the flight season is synonymous with the rainy season. Adults were recorded between December and April.

Threats and conservation: Not threatened.

Zygonyx torridus (Kirby, 1899) [Ringed Cascader]



Identification: Adult males have a black body with yellow markings. The frons is a dark metallic violet. Males patrol at rapids and waterfalls. In colouration, the Ringed Cascader is somewhat similar to *Z. fuelleborni*. Also, *Phyllomacromia* are similar in size and have a black-and-yellow colouration. However, there is no other species of that size with a black-and-yellow body in both sexes, which patrols over torrential water or flies in tandem for relatively longer periods.

Meaning of scientific name: Latin *torridus* – “dried up by heat, hot” (not to be mistaken for *torrens* – “torrent”). The name refers to the “torrid zone”, the tropics, where the type specimens were found.

Distribution: The Ringed Cascader occurs all over Africa, in south-western Europe, on the Arabian peninsula, in Pakistan, and on the Mascarenes. The form on Mauritius is regarded as the subspecies *Z. t. insularis* Pinhey, 1981, and that in Pakistan as the subspecies *Z. t. isis* Fraser, 1924. In Namibia, the species is scat-



AM

tered over the country but locally common. It is recorded from the Okavango River and from a number of perennial streams and sections of rivers in the arid western parts of the country.

Ecology and behaviour: Like the Blue Cascader, it inhabits waterfalls and rapids in arid and savanna regions. But, unlike *Z. natalensis*, it also occurs at small streams. The larvae dwell specifically at the base of sedges and other emerging plants in torrential water. It is one of the few running water species with a high tendency for migration. In Namibia, the flight season is throughout the year; there are no records from June so far.

Threats and conservation: Not threatened.

Short key to dragonfly larvae

Basic key to dragonfly larvae

This field guide mainly focuses on adult dragonflies, in which the identification characteristics are often straightforward. By contrast, the larvae of about 40% of the species living in Namibia are still unknown, and in others the distinguishing of species is difficult. However, some dragonflies, such as many Gomphidae and Macromiidae and even some Libellulidae, are often easier to record via the empty skins (exuviae) left behind after the dragonfly has emerged from its aquatic habitat and hatched from its larval skin. A simplified key to dragonfly larvae is included here. This provides more of an overview of the forms than being an actual identification key (for such keys, see the suggested further reading). The morphological details used for the key are described in the chapter on dragonfly morphology.

Distinctive features of the larvae of Odonata families that occur in Namibia (Grey = Zygoptera [damselflies], Blue = Anisoptera [dragonflies])

First distinction	Second distinction	Third distinction	Family
Leaf-like appendages at rear of abdomen	Antenna: first segment as long as other segments	Three terminal appendages; labium deeply incised	Calopterygidae
		Two terminal appendages; labium with small incision	Chlorocyphidae
	Antenna: all segments of similar length	Labium elongated, reaching hind legs; spoon-shaped	Lestidae
		Labium short, not reaching hind legs; not spoon-shaped	Coenagrionoidea
Leaf-like appendages absent; triangular anal pyramid instead	Labium flat; palpal do not cover the face	Antenna consists of 4 segments; segment 3 enlarged; labium short, reaching first leg	Gomphidae
		Antenna consists of 7 segments; all similarly shaped; labium long, exceeding second leg	Aeshnidae
	Labium spoon-shaped; palpal cover the face	Upper appendages as long as paraprocts; all legs extremely long	Macromiidae
		Upper appendages shorter; shorter legs	Libellulidae

Zygoptera larvae

Damselfly larvae are less diverse in body shape than dragonfly larvae, which makes it particularly difficult to identify species. However, at least the families are easy to distinguish (see the key on p. 256). Calopterygidae and Chlorocyphidae, in particular, have some distinct features. The major types of Zygoptera larvae are illustrated in Plate 23.

Calopterygidae larvae

Like calopterygid adults, the larvae are conspicuous. The most striking features are the long, distant antennae with a very prominent first antennal segment. The body is slender with very long legs and long, robust caudal lamellae. The larvae attach themselves to aquatic vegetation and are not very active, probably to avoid being washed away by the current and also to prevent being spotted by predatory fish. Only one species, *Phaon iridipennis*, occurs in Namibia.

Chlorocyphidae larvae

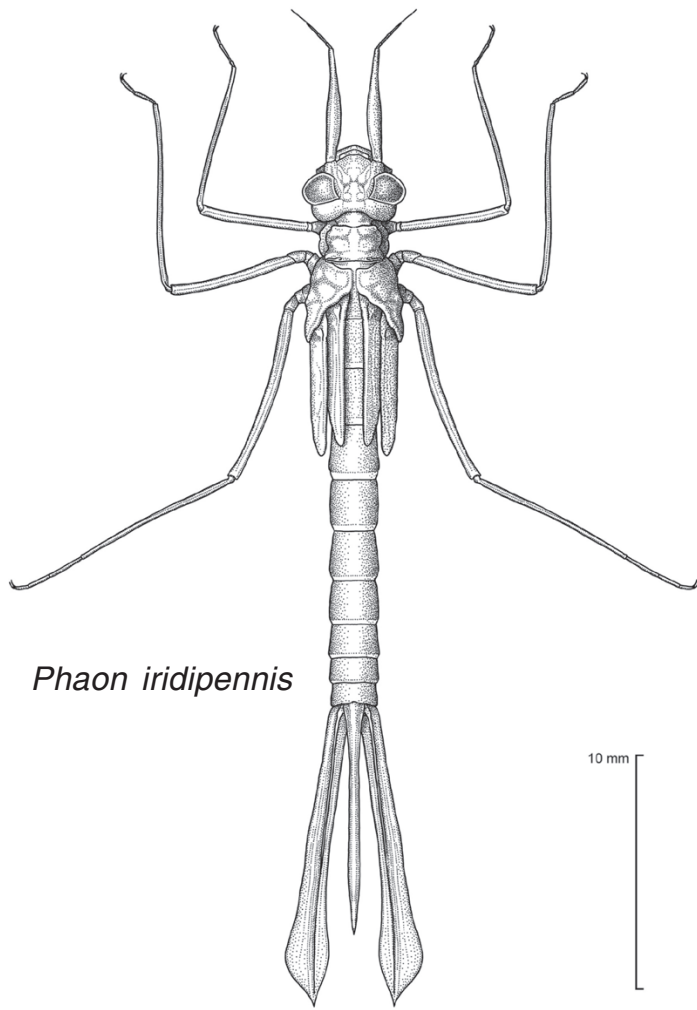
Chlorocyphid larvae are unique in that they have no median caudal lamella. Hence, they only have two terminal lamellae, while other Zygoptera larvae have three. The larvae attach themselves to rocks, roots and timber and are not very active, probably to avoid being washed away by the current and also to prevent being spotted by predatory fish. In Namibia, only one species occurs, namely *Platycypha caligata*.

Lestidae larvae

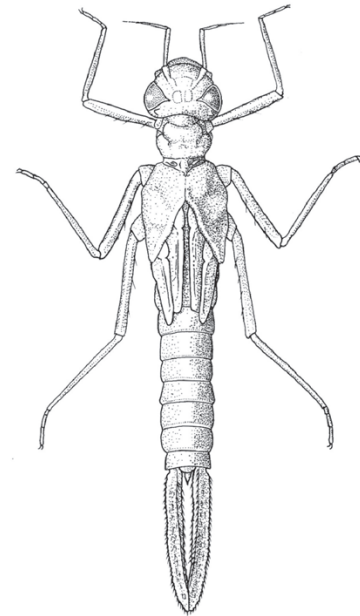
The larvae of Spreadwings are long and slender, with the head at its widest part being much broader than the abdomen. The three terminal appendages are also elongate and, to some extent, stiff. The cuticula of most of the body is thin and translucent. The labium is very distinct, being elongate and appearing from below like a spoon with a long handle. The species are extremely difficult to distinguish and not all larvae are known yet. Most species spend their larval life in temporary waters where larval development can be very rapid.

Coenagrionoidea larvae

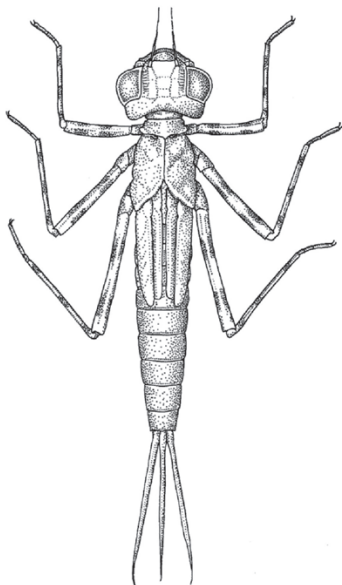
Although these are the most diverse group of damselflies, the general larval appearance is uniform. Identification is usually difficult. All Coenagrionoidea have in common three leaf-like lamellae at the abdomen (which may, however, break off), a relatively short labium reaching approximately to the first legs, and a slender body that is usually more compact than that of Lestidae. Coenagrionoidea occur in all types of freshwater habitats. The larvae of by far the most species in this family live among plants, e.g. submerged weeds, reeds, or grass-like vegetation. Some



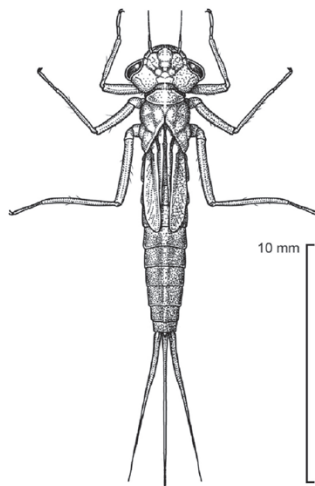
Phaon iridipennis



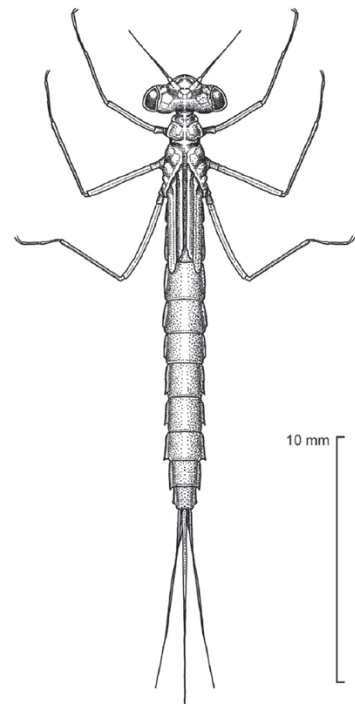
Platycypha caligata



Mesocnemis singularis



Ischnura senegalensis



Lestes pallidus

Plate 23: Overview of body shapes of Zygoptera larvae

species may also attach themselves to the roots of trees or live among coarse detritus such as leaves. The larvae of eight of the nine genera in Namibia are described in the following table.

Identification characteristics of Coenagrionoidea larvae

Distinction 1	Distinction 2	Distinction 3	Distinction 4	Distinction 5	Genus
Prementum extends back to base of first leg					<i>Mesocnemis</i>
Prementum extends back beyond base of first leg	Caudal lamellae broad				<i>Ceriagrion</i>
	Caudal lamellae slender	Lamellae with nodus			<i>Pseudagrion</i>
		Lamellae without nodus	Lamellae pointed	Lamellae shaped like lance-tip	<i>Agriocnemis</i>
				Lamellae margin with spines	<i>Elatoneura</i>
				Dark spots at base of wing sheets	<i>Ischnura</i>
		Lamellae rounded		Abdomen with dark zigzag line	<i>Africallagma</i>
				Abdomen with dark spots	<i>Azuragrion</i>

Anisoptera larvae

Anisoptera larvae vary particularly by the shape of their labium. There are two major forms: one that has a flat labium with forceps-like labial palps, which are built to catch mainly larger prey organisms (Aeshnidae and Gomphidae). The second form has labial palps that cover the face, allowing these larvae to feed on plankton organisms as well (Macromiidae and Libellulidae).

Gomphidae larvae

In most Clubtails, it is easier to record larvae than adults. Larvae often occur in abundance in the substrates near river margins. With some effort, the exuviae in particular can easily be found at the margins of rivers or lakes. Moreover, Clubtail

larvae – and, therefore, also their exuviae – are very specific and can easily be distinguished to the genus level just by looking at the general body shape. Some types have distinct snorkel-like tubes allowing them to breathe while burrowed deep into the river sediment. Within the genera, however, identification can be difficult, as in *Paragomphus*. Indeed, the larvae of a few of the species are still unknown. Plate 24 below depicts the body forms of all Namibian gomphid genera.

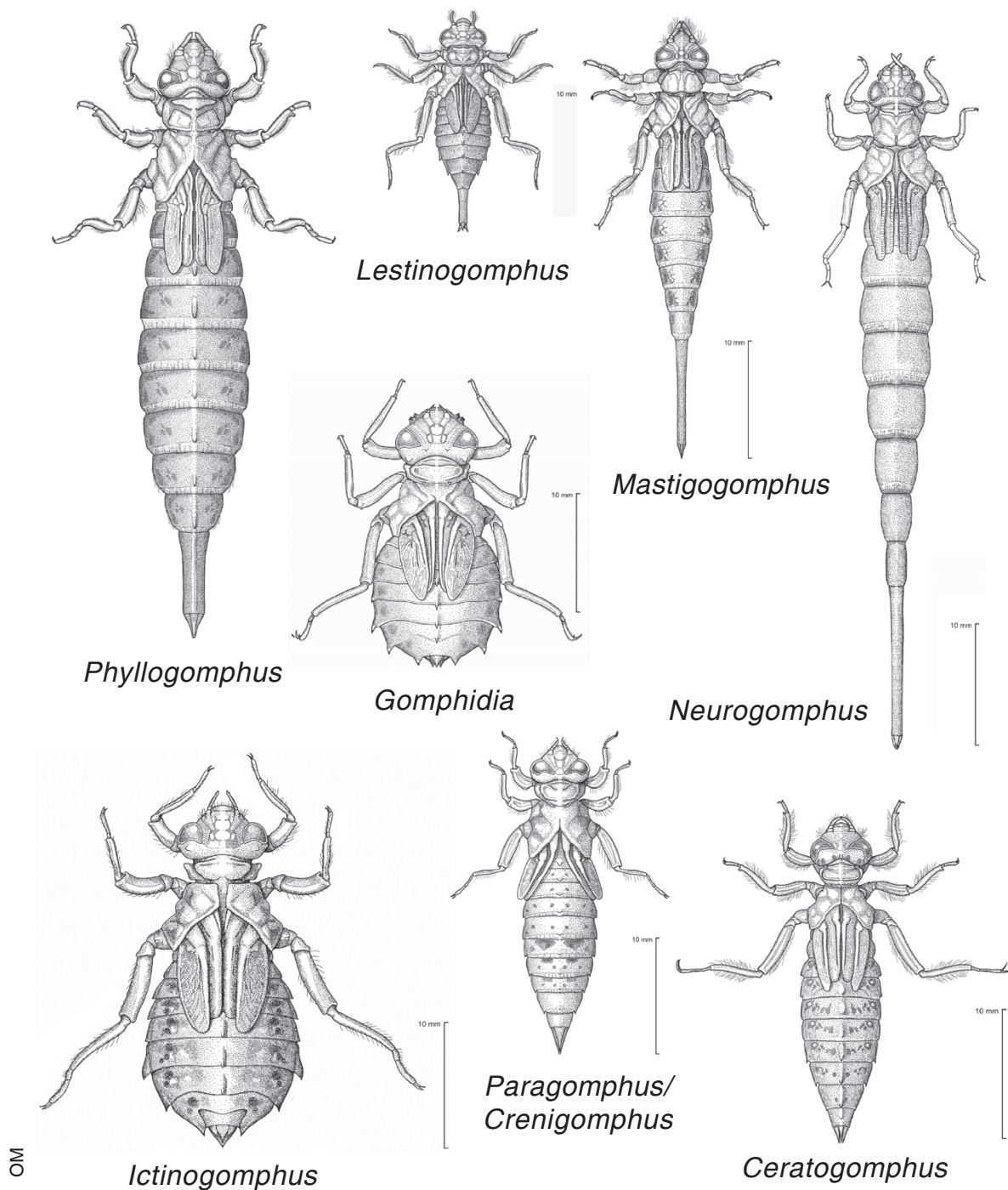


Plate 24: Overview of the general body shape of gomphid larvae

Identification characteristics of Gomphidae larvae

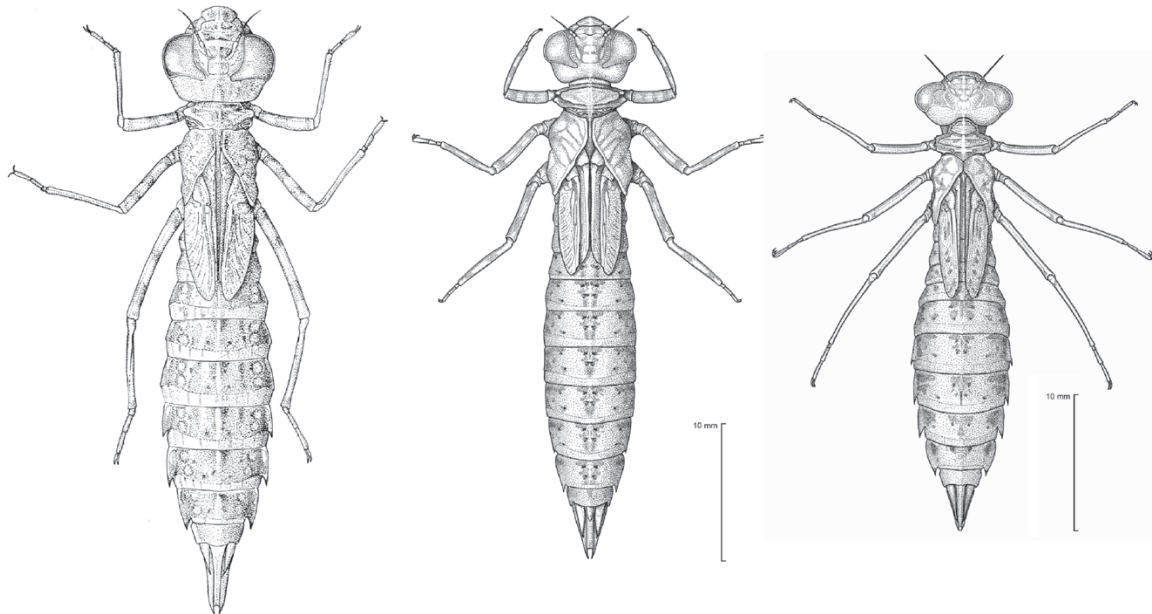
Distinction 1	Distinction 2	Distinction 3	Distinction 4	Distinction 5	Genus
Abdomen ends in a tube	Hind legs shorter than abdomen	Hind legs longer than abdomen			<i>Lestinogomphus</i>
		Dorsal spines present			<i>Phyllogomphus</i>
		Dorsal spines absent	Labium concave		<i>Neurogomphus</i>
			Labium convex		<i>Mastigogomphus</i>
No tube	Abdomen rounded	Lateral spines reach tip of abdomen			<i>Gomphidia</i>
		Spines do not reach tip of abdomen			<i>Ictinogomphus</i>
	Abdomen elongate	Dorsal spines absent			<i>Notogomphus</i>
		Dorsal spines present	Last antennal segment long and kinked		<i>Crenigomphus</i> <i>Paragomphus</i>
			Last antennal segment short	Base of dorsal spines elongate	<i>Ceratogomphus</i>
				Base of dorsal spines rounded	

Aeshnidae larvae

Aeshnidae larvae are unique in body shape compared with other dragonfly larvae in that they have relatively large eyes (in the larger larval stadia) and an elongated body that lacks breathing tubes. Between the genera, the body shapes are relatively uniform. Emperor larvae have large eyes, long labia that reach to at least the coxa (i.e. the “hip”) of the middle legs (and usually beyond it), and long anal pyramids. *Aeshna* have smaller eyes than *Anax*, but still larger than those of *Gynacantha*. Diagnostic is the length of the upper appendages compared with the rest of the anal pyramid. Size differences are not diagnostic due to wide size variation within the genera. *Anax ephippiger* can be almost as small as the *Aeshna* shown in Plate 25, whereas *Anax tristis* is much larger than the *A. imperator* illustrated in the plate. *Gynacantha* may also be larger.

Identification characteristics of Aeshnidae larvae

Head – anterior margin	Eyes	Upper appendages/paraprocts	Genus
Straight	Very large	< 50%	<i>Anax</i>
Slightly convex	Large	ca 50%	<i>Aeshna</i>
Incised	Small	> 50%	<i>Gynacantha</i>



Anax imperator

Aeshna minuscula

Gynacantha manderica

Plate 25: Overview of the body shape of Aeshnidae larvae

Macromiidae larvae

Macromiidae larvae are very distinct in that they have extremely long legs and a rounded abdomen, giving them a spider-like appearance. Like libellulids, they have enlarged labial palps. The larvae also carry “horns” on the head, which are specific in their shape. This characteristic can distinguish the Namibian species. The larvae live in slow to moderately flowing sections of the river, usually near the margins where fine detritus or leaves accumulate. The larvae burrow in the shallows and may be covered by these substrates.

Libellulidae larvae

Libellulid larvae differ from most other dragonfly larvae in that their labium has enlarged palps that cover the lower parts of the head and leave only the eyes free. In Namibia, only *Macromiidae* species have a similar labium, but this differs from

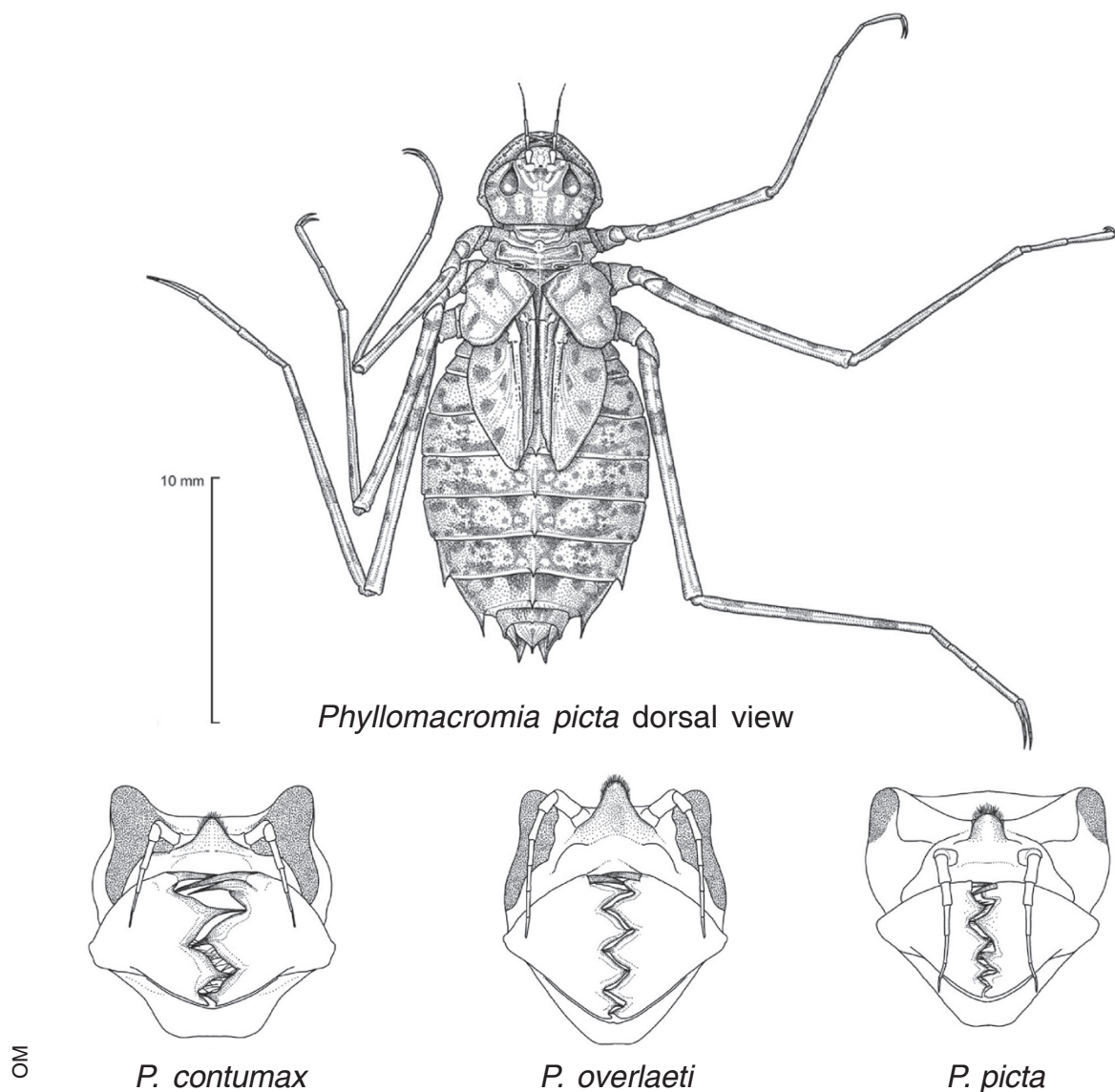


Plate 26: The body shape of a Macromiidae larva, and heads in frontal view of *Phyllomacromia contumax*, *P. picta* and *P. overlaeti*

libellulids in that they have long, spider-like legs. Identifying libellulid larvae on the species level is often impossible. This is due, on the one hand, to the larvae of many species still being unknown. On the other, the general body shape of libellulid larvae is often very uniform, and only details such as the presence of spines on the sides or on top of the abdomen or some differences in colour patterns are features that differ between the genera and species. There are, however, some exceptions, which often comprise species associated with flowing water. These may have very specific larvae, e.g. some are very compact and robust, often with very distinct lateral and dorsal spines, as in *Olpogastra*, *Zygonoides* or *Brachythemis*. Another species that is easy to identify is *Pantala flavescens*, which has large lateral but no dorsal spines, and a very soft cuticle. The only similar larva is that of *Tramea*. This

large larva can be found particularly in temporary waters, in which it is often the top predator shaping the whole animal assemblage. The following sketches depict the more general types of libellulid larvae, and some species that are common and easy to identify.

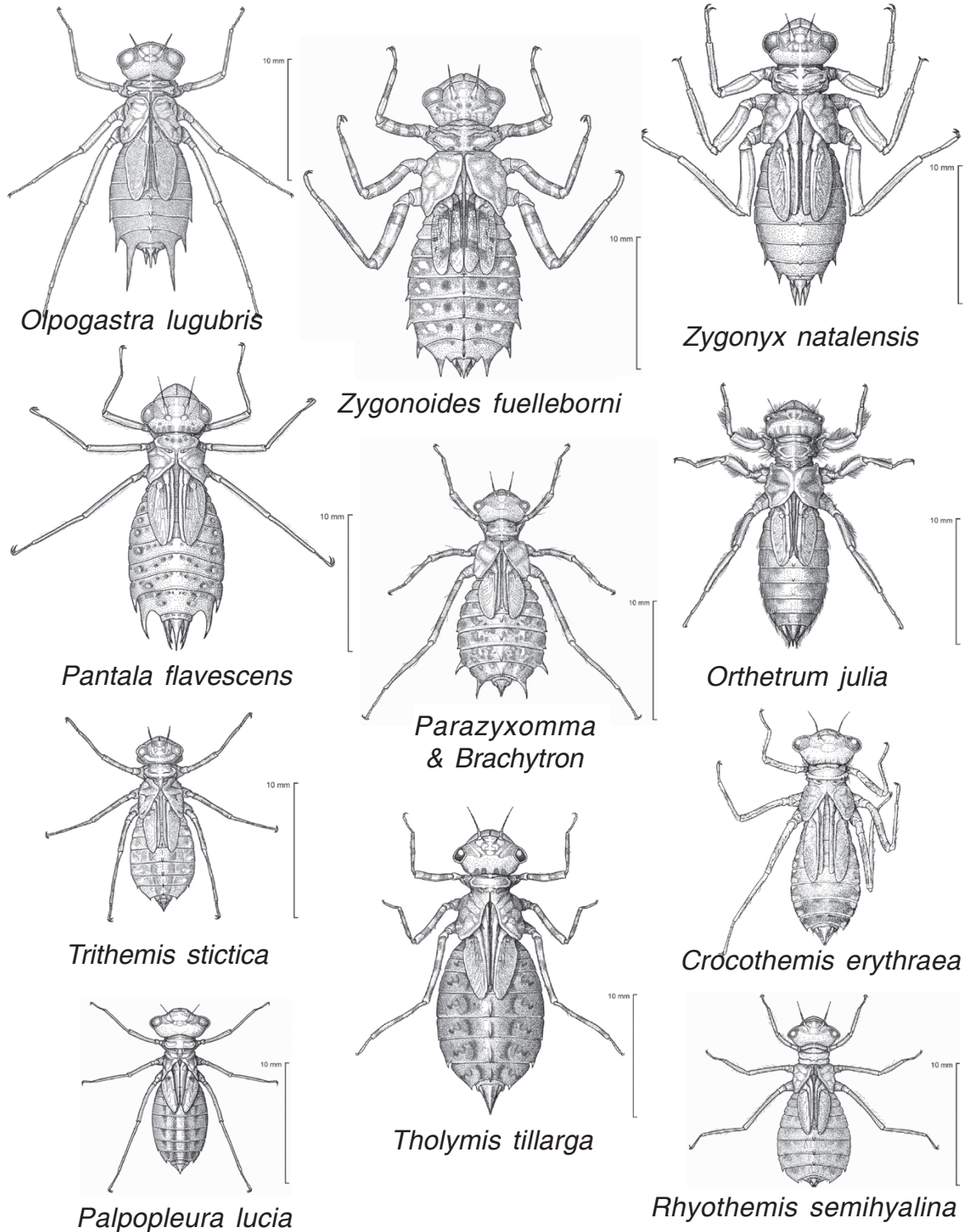


Plate 27: Overview of body shapes of Libellulidae larvae

Identification characteristics of Libellulidae larvae

Distinction 1	Distinction 2	Distinction 3	Distinction 4	Distinction 5	Genus
Distinct lateral spines (LS)	Dorsal spines absent	Spine length at S8 and S9 similar			<i>Tramea</i>
		Spines at S8 and S9 dissimilar			<i>Pantala</i>
	Dorsal spines present	Very long LS			<i>Olpogastra</i>
		Short LS	Flattened legs	LS at S8 and S9	<i>Zygonyx</i>
				LS at S7 to S9	<i>Zygonoides</i>
			Rounded legs	LS directed sideways	<i>Brachythemis</i> <i>Parazyxomma</i>
				LS directed backwards	<i>Urothemis</i> <i>Chalcostephia</i>
Weak or absent LS	Dorsal spines present			<i>Trithemis</i> <i>Tholymis</i>	
	Dorsal spines absent	Head rectangular from above			<i>Orthetrum</i> <i>Nesciothemis</i>
		Head not rectangular	White stripe on mid-abdomen	Small larva	<i>Palpopleura</i> <i>Hemistigma</i>
				Larger larva	<i>Bradinopyga</i> <i>Sympetrum</i>
			White stripe absent	Abdomen tipped	<i>Crocothemis</i> <i>Diplacodes</i> <i>Sympetrum</i>
				Abdomen rounded	<i>Acisoma</i> <i>Rhyothemis</i>

Checklist of the dragonflies of Namibia and neighbouring countries

The checklist of Namibian Odonata includes 127 species so far, but up to 10 additional species not yet recorded in the country can be expected to occur here as well. The species number in South Africa is 158, in Botswana 123, and in Angola 152. For comparison, the northern adjoining countries are of particular interest. However, Angola is extremely under-surveyed and many more species are expected to occur there. Indeed, there is a database of Namibian Odonata containing more than 6,000 records, whereas the Angolan database has a mere 450. In the checklist below, only the southern Angolan (A) species are listed, some of which can be expected to occur in Namibia as well. Botswana (B) and Namibia (N) have similar dragonfly assemblages, and share most of their species. The adjoining regions south and south-east of Namibia belong to the Kalahari, are poor in species, and do not add species to the list.

Scientific name	Vernacular name	N	B	A
Family Calopterygidae	Demoiselles	—	—	—
<i>Phaon iridipennis</i> (Burmeister, 1839)	Glistening Demoiselle	x	x	x
<i>Umma femina</i> (Burmeister, 1839)	Bella Donna	—	—	x
Family Chlorocyphidae	Jewels			
<i>Platycypha caligata</i> (Selys, 1853)	Dancing Broad-legged Jewel	x	x	x
<i>Chlorocypha crocea</i> Longfield, 1947	Saffron Forest Jewel	—	—	x
Family Lestidae	Spreadwings			
<i>Lestes amicus</i> Martin, 1910	—	—	—	x
<i>Lestes dissimulans</i> Fraser, 1955	Cryptic Spreadwing	x	x	x
<i>Lestes pallidus</i> Rambur, 1842	Pale/Pallid Spreadwing	x	x	x
<i>Lestes pinheyi</i> Fraser, 1955	Pinhey's Spreadwing	x	x	x
<i>Lestes plagiatus</i> (Burmeister, 1839)	Common Spreadwing	—	x	x
<i>Lestes tridens</i> MacLachlan, 1895	Spotted Spreadwing	x	x	—
<i>Lestes virgatus</i> (Burmeister, 1839)	Smoky Spreadwing	—	x	—
Superfamily Coenagrionoidea				
Family Platynemididae	Stream Damsels			
<i>Mesocnemis singularis</i> Karsch, 1891	Common Riverjack	x	x	x
Family Protoneuridae	Threadtails			
<i>Elatoneura cellularis</i> (Grünberg, 1902)	Tropical Threadtail	x	x	—
<i>Elatoneura glauca</i> (Selys, 1860)	Common Threadtail	x	x	x
<i>Elatoneura</i> sp. nov. undescribed	—	—	—	x
Family Coenagrionidae	Narrow-winged Damselflies			
<i>Aciagrion (Mombagrion) heterostictum</i> Fraser, 1955	Long Slim	x	—	—
<i>Aciagrion (Aciagrion) steeleae</i> Kimmins, 1955	Steele's Slim	—	x	—
<i>Africallagma fractum</i> (Ris, 1921)	Slender Bluet	—	—	x
<i>Africallagma glaucum</i> (Burmeister, 1839)	Swamp Bluet	x	x	—
<i>Africallagma subtile</i> (Ris, 1921)	Pale Bluet	x	x	x
<i>Agriocnemis angolensis</i> Longfield, 1947	Angolan Whisp	x	x	x
<i>Agriocnemis exilis</i> Selys, 1872	Little Whisp	x	x	
<i>Agriocnemis gratiosa</i> Gerstäcker, 1891	Gracious Whisp	x	x	x
<i>Agriocnemis ruberrima albifrons</i> Balinsky, 1961	Orange Whisp	x	x	—
<i>Agriocnemis victoria</i> Fraser, 1928	Victoria Whisp	x	x	—
<i>Azuragrion nigradorsum</i> (Selys, 1876)	Black-tailed Bluet	x	x	—

Scientific name	Vernacular name	N	B	A
<i>Ceriagrion corallinum</i> Campion, 1914	Coral-red Orange	x	x	—
<i>Ceriagrion glabrum</i> (Burmeister, 1839)	Common Orange	x	x	x
<i>Ceriagrion katamborae</i> Pinhey, 1961	Katambora Orange	x	x	—
<i>Ceriagrion suave</i> Ris, 1921	Pleasant Orange	x	x	x
<i>Ischnura senegalensis</i> (Rambur, 1842)	Common Bluetail	x	x	x
<i>Pinheyagrion angolicum</i> (Pinhey, 1966)	Angola Bluet	—	x	x
<i>Pseudagrion acaciae</i> Förster, 1906	Acacia Sprite	x	x	—
<i>Pseudagrion angolense</i> Selys, 1876	Angola Sprite	—	—	x
<i>Pseudagrion assegaii</i> Pinhey, 1950	Assegai Sprite	x	x	—
<i>Pseudagrion coeleste</i> Longfield, 1947	Catshead Sprite	x	x	x
<i>Pseudagrion commoniae nigerrimum</i> Pinhey, 1950	Black Sprite	x	x	
<i>Pseudagrion deningi</i> Pinhey, 1961	Dark Sprite	x	x	x
<i>Pseudagrion fisheri</i> Pinhey, 1961	Fisher's Sprite	—	x	—
<i>Pseudagrion glaucescens</i> Selys, 1876	Glaucous Sprite	x	x	x
<i>Pseudagrion hageni</i> Karsch, 1893	Painted Sprite		x	x
<i>Pseudagrion hamoni</i> Fraser, 1955	Hamon's Sprite	x	x	x
<i>Pseudagrion helenae</i> Balinsky, 1964	Helen's Sprite		x	
<i>Pseudagrion inconspicuum</i> Ris, 1931	Inconspicuous Sprite	—	—	x
<i>Pseudagrion kersteni</i> (Gerstäcker, 1869)	Kersten's Sprite	x	x	x
<i>Pseudagrion massaicum</i> Sjöstedt, 1909	Massai Sprite	x	x	x
<i>Pseudagrion nubicum</i> Selys, 1871	Nubian Sprite	x	x	
<i>Pseudagrion rufostigma</i> Longfield, 1947	Ruby Sprite	x	x	—
<i>Pseudagrion salisburyense</i> Ris, 1921	Salisbury Sprite	x	x	x
<i>Pseudagrion sjoestedti jacksoni</i> Pinhey, 1961	Sjoestedt's Sprite	x	x	x
<i>Pseudagrion spermatum</i> Hagen in Selys, 1881	Powder Sprite	—	—	x
<i>Pseudagrion sublacteum</i> (Karsch, 1893)	Cherry-eye Sprite	x	x	x
<i>Pseudagrion sudanicum rubroviride</i> Pinhey, 1955	Sudan Sprite	x	x	x
<i>Pseudagrion vaalense</i> Chutter, 1962	Vaal Sprite	x	—	—
Family Gomphidae				
<i>Ceratogomphus pictus</i> Hagen, 1854	Common Thorntail	x	x	
<i>Crenigomphus cornutus</i> Pinhey, 1956	Horned Hooktail	x	x	—
<i>Crenigomphus hartmanni</i> (Förster, 1898)	Hartmann's Hooktail	x	—	x
<i>Crenigomphus kavangoensis</i> Suhling & Marais, 2005	Kavango Hooktail	x	—	x
<i>Gomphidia quarrei</i> (Schouteden, 1934)	Quarré's Fingertail	x	x	x
<i>Ictinogomphus dundoensis</i> (Pinhey, 1961)	Swamp Tigertail	x	x	
<i>Ictinogomphus ferox</i> (Rambur, 1842)	Common Tigertail	x	x	x
<i>Lestinogomphus angustus</i> Martin, 1911	Common Fairytail	x	x	x
<i>Lestinogomphus silkeae</i> Kipping, 2006	Silke's Fairytail	—	x	—
<i>Neurogomphus (Mastigogomphus) sp.</i>		x	—	—
<i>Neurogomphus cocytius</i> Cammaerts, 2004	Kokyos Siphontail	x	x	x
<i>Neurogomphus zambeziensis</i> Cammaerts, 2004	Zambezi Siphontail	x	x	—
<i>Notogomphus praetorius</i> (Selys, 1878)	Southern Longleg	x		x
<i>Onychogomphus rossi</i> (Pinhey, 1966)	Ross' Claspertail	—	—	x
<i>Paragomphus cataractae</i> Pinhey, 1963	Cataract Hooktail	x	—	—
<i>Paragomphus cognatus</i> (Rambur, 1842)	Rock Hooktail	x	—	—
<i>Paragomphus elpidius</i> (Ris, 1921)	Corkscrew Hooktail	x	x	x
<i>Paragomphus genei</i> (Selys, 1841)	Common Hooktail	x	x	x
<i>Paragomphus sabicus</i> Pinhey, 1950	Clubbed Hooktail	x	x	x
<i>Phyllogomphus selysii</i> Schouteden, 1933	Bold Leaf-tail	x	x	x
Family Aeshnidae				
<i>Aeshna minuscula</i> McLachlan, 1896	Friendly Hawker	x	—	—
<i>Aeshna rileyi</i> Calvert, 1892	Bull's Eye Hawker	—	—	x
<i>Anax bangweuluensis</i> Kimmins, 1955	Swamp Emperor	x	x	—
<i>Anax ephippiger</i> (Burmeister, 1839)	Vagrant Emperor	x	x	x
<i>Anax imperator</i> Leach, 1815	Blue Emperor	x	x	x
<i>Anax speratus</i> Hagen, 1867	Orange Emperor	x	—	x
<i>Anax tristis</i> Hagen, 1867	Black Emperor	x	x	x

Scientific name	Vernacular name	N	B	A
<i>Gynacantha manderica</i> Grünberg, 1902	Little Dusk-hawker	x	—	—
<i>Gynacantha villosa</i> Grünberg, 1902	Brown Dusk-hawker	x	x	—
Family Macromiidae	Cruisers			
<i>Phyllomacromia contumax</i> Selys, 1879	Two-banded Cruiser	x	x	x
<i>Phyllomacromia kimminsi</i> (Fraser, 1954)	Kimminsi's Cruiser		x	
<i>Phyllomacromia overlaeti</i> (Schouteden, 1934)	Clubbed Cruiser	x	x	—
<i>Phyllomacromia picta</i> (Hagen, 1871)	Darting Cruiser	x	x	x
Family Libellulidae	Libellulids			
<i>Acisoma panorpoides ascalaphoides</i> Rambur, 1842	Grizzled Pintail	x	x	
<i>Acisoma trifulidum</i> Kirby, 1889	Broad Pintail	—	—	x
<i>Aethiothemis discrepans</i> Lieftinck, 1969	Southern Gorgeous Skimmer	x	x	x
<i>Aethriamanta rezia</i> Kirby, 1889	African Pygmy Basker	x	x	—
<i>Brachythemis lacustris</i> (Kirby, 1889)	Red Groundling	x	x	x
<i>Brachythemis leucosticta</i> (Burmeister, 1839)	Banded Groundling	x	x	x
<i>Brachythemis wilsoni</i> Pinhey, 1952	Swamp Groundling, Wilson's Groundling	—	x	—
<i>Bradinopyga cornuta</i> Ris, 1911	Horned Rock-dweller	x	x	—
<i>Chalcostephia flavifrons</i> Kirby, 1889	Inspector	x	x	—
<i>Crocothemis divisa</i> Karsch, 1898	Pale Scarlet	x	x	—
<i>Crocothemis erythraea</i> (Brullé, 1832)	Broad Scarlet	x	x	x
<i>Crocothemis sanguinolenta</i> (Burmeister, 1839)	Small Scarlet	x	x	x
<i>Diplacodes deminuta</i> Lieftinck, 1969	Little Percher	x	x	x
<i>Diplacodes lefebvrei</i> (Rambur, 1842)	Black Percher	x	x	x
<i>Diplacodes luminans</i> (Karsch, 1893)	Luminous Percher, Barbet Percher	x	x	x
<i>Hemistigma albipunctum</i> (Rambur, 1842)	Pied-spot	x	x	x
<i>Micromacromia flava</i> (Longfield, 1945)	—	—	—	x
<i>Nesciothemis farinosa</i> (Förster, 1898)	Black-faced Dancing Skimmer	x	x	x
<i>Nesciothemis minor</i> Gambles, 1966	Small Dancing Skimmer	—	x	—
<i>Olpogastra lugubris</i> Karsch, 1895	Slender Bottletail	x	x	x
<i>Orthetrum abbotti</i> Calvert, 1892	Little Skimmer	x	—	x
<i>Orthetrum brachiale</i> (Palisot de Beauvois, 1817)	Strong Skimmer, River Skimmer	x	x	x
<i>Orthetrum cafferum</i> (Burmeister, 1839)	Two-striped Skimmer	x	x	x
<i>Orthetrum chrysostigma</i> (Burmeister, 1839)	Epaulette Skimmer	x	x	x
<i>Orthetrum guineense</i> Ris, 1910	Guinea Skimmer	x	—	x
<i>Orthetrum hintzi</i> Schmidt, 1951	Hintz's Skimmer	x	x	—
<i>Orthetrum icteromelas cinctifrons</i> Pinhey, 1970	Spectacled Skimmer	x	x	—
<i>Orthetrum julia falsum</i> Longfield, 1955	Julia Skimmer	x	x	x
<i>Orthetrum machadoi</i> Longfield, 1955	Machado's Skimmer	x	x	—
<i>Orthetrum macrostigma</i> Longfield, 1947	—	—	—	x
<i>Orthetrum robustum</i> Balinsky, 1965	Robust Skimmer	x	x	—
<i>Orthetrum stemmale</i> (Burmeister, 1839)	Tough Skimmer	x	x	
<i>Orthetrum trinacria</i> (Selys, 1841)	Long Skimmer, Slender Skimmer	x	x	—
<i>Palpopleura deceptor</i> (Calvert, 1899)	Deceptive Widow	x	x	—
<i>Palpopleura jucunda jucunda</i> Rambur, 1842	Yellow-veined Widow	x	x	x
<i>Palpopleura lucia</i> (Drury, 1773)	Black-winged Widow	x	x	x
<i>Palpopleura portia</i> (Drury, 1773)	Shadow-bridge Widow	x	x	x
<i>Pantala flavescens</i> (Fabricius, 1798)	Global Wanderer	x	x	x
<i>Parazyxomma flavicans</i> (Martin, 1908)	Twilight Groundling, Banded Duskdarter	x	x	—
<i>Porpax risi</i> Pinhey, 1958	—	—	—	x
<i>Rhyothemis fenestrina</i> (Rambur, 1842)	Black-winged Flutterer	x	x	x
<i>Rhyothemis mariposa</i> Ris, 1913	Butterfly Flutterer	—	—	x
<i>Rhyothemis semihyalina</i> (Desjardins, 1832)	Phantom Flutterer	x	x	—
<i>Sympetrum fonscolombii</i> (Selys, 1840)	Red-veined Darter	x	x	x
<i>Sympetrum navasi</i> Lacroix, 1921	Swamp Darter	x	x	—
<i>Tholymis tillarga</i> (Fabricius, 1798)	Old World Twister	x	x	—
<i>Tramea basilaris</i> (Palisot de Beauvois, 1807)	Keyhole Glider	x	x	x
<i>Tramea limbata</i> (Desjardins, 1832)	Ferruginous Glider, Voyaging Glider	x	x	—
<i>Trithemis aconita</i> Lieftinck, 1969	Monk's Hood Dropwing	x	x	—

Scientific name	Vernacular name	N	B	A
<i>Trithemis aequalis</i> Lieftinck, 1969	Dark Dropwing	x	x	—
<i>Trithemis annulata</i> (Palisot de Beauvois, 1807)	Violet Dropwing	x	x	x
<i>Trithemis arteriosa</i> (Burmeister, 1839)	Red-veined Dropwing	x	x	x
<i>Trithemis brydeni</i> Pinhey, 1970	Bryden's Dropwing	—	x	—
<i>Trithemis donaldsoni</i> (Calvert, 1899)	Denim Dropwing, Donaldson's Dropwing	x	x	x
<i>Trithemis dorsalis</i> (Rambur, 1842)	Dorsal Dropwing	—	—	x
<i>Trithemis furva</i> Karsch, 1899	Navy Dropwing	x	x	x
<i>Trithemis hecate</i> Ris, 1912	Hecate Dropwing	x	x	—
<i>Trithemis ardens</i> (Gerstäcker, 1891)	Orange-winged Dropwing, Rock Dropwing	x	x	x
<i>Trithemis monardi</i> Ris, 1931	Monard's Dropwing	x	x	x
<i>Trithemis pluvialis</i> Förster, 1906	River Dropwing	x	—	x
<i>Trithemis stictica</i> (Burmeister, 1839)	Jaunty Dropwing	x	—	x
<i>Trithemis</i> spec. nov. undescribed	Okavango Dropwing	x	x	x
<i>Trithemis weneri</i> Ris, 1912	Elegant Dropwing	x	—	—
<i>Urothemis assignata</i> (Selys, 1872)	Red Basker	x	x	—
<i>Urothemis edwardsii</i> (Selys, 1849)	Blue Basker	x	x	x
<i>Zygonooides fuelleborni</i> (Grünberg, 1902)	Fuelleborn's Spectacular	x	x	x
<i>Zygonyx natalensis</i> (Martin, 1900)	Blue Cascader	x	x	x
<i>Zygonyx torridus</i> (Kirby, 1889)	Ringed Cascader	x	x	—

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BIOTA AFRICA – Sustainable use of biodiversity in southern Africa



BIOTA AFRICA is an internationally recognised research project aiming at scientific support for the sustainable use and conservation of biodiversity in Africa, established by 69 partner institutions in various African countries and Germany. It is based on the principles of the United Nations Convention on Biological Diversity (CBD) and provides a substantial German contribution to the international DIVERSITAS programme. The project was initiated in October 2000 with research taking place in Namibia and South Africa, and has recently reached the third stage of governmental promotion. The German Federal Ministry of Education and Research currently sponsors the major part of this multilateral cooperative project.

In Namibia, the Namibian Biodiversity Programme of the Ministry of Environment and Tourism and the Directorate of Agricultural Research and Training of the Ministry of Agriculture, Water and Forestry played a major role when developing the research scheme. Amongst the institutions actively involved in the project are the University of Namibia, the Polytechnicon of Namibia, the Desert Research Foundation of Namibia, the National Museum, and the National Herbarium in the National Botanical Research Institute. The partnering institutions have jointly created a data-sharing protocol that ensures maximum benefit for South Africa and Namibia.

Project focus is placed on the analysis of the impact of different land-use practices that are subject to natural resources and socio-economic conditions and exposed to global environmental change, including the effects of climate change and chang-





The BIOTA Southern Africa Research transect

ing biogeochemical cycles. For this purpose, the project compares changes in biodiversity of neighbouring test sites (biodiversity observatories) that are subject to different land-use practices, property management conditions and economic demands and in order to predict future scenarios. At the same time, land-users and decision-makers are provided with tools and policies for the sustainable use of the respective ecosystems.

As the change processes, e.g. those driven by climate change, can be very slow-going, a long-term infrastructure has been established which will be handed over to the partner countries at the end of the project. Standardised biodiversity observatories of one square kilometre in size are equipped with weather stations and a detailed monitoring programme that also includes remote sensing, soil fertility data and agricultural indicators (e.g. biomass).

The BIOTA AFRICA project includes capacity development on various levels from university students to local land-users. Many Namibian colleagues have already received tailored training in Germany, e.g. for remote sensing methodology or modelling approaches. Eight para-ecologists have been employed and trained to date to establish a local knowledge base and develop monitoring and analysis skills in the local communities. The programme has been perceived as a great success by all stakeholders involved. The presentation of this approach at several conferences like the United Nations Convention to Combat Desertification has received extremely positive feedback.

Local communities are actively involved with all biodiversity observatories, and their requirements are always taken into account. In Namibia, local integration involves both local communities with traditional land-use practices and businesses dealing with sustainability, e.g. the Gondwana Desert Collection/Nature Investment as well as local research institutions under the auspices of the Ministry of Agriculture, Water and Forestry.

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Dragonflies are fascinating insects, true jewels of the watershed. Their diversity in Namibia is surprisingly high for such an arid country. This book describes 127 species recorded in Namibia and their distribution range, habitat, ecology and behaviour, while the identification keys cover not only the Namibian species, but also those of neighbouring Botswana and southern Angola, 149 species in all. The general overview of dragonfly biology and the species descriptions are extensively illustrated with 174 photographs, 27 plates with line drawings and 125 distribution maps.

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Both authors have studied dragonflies for well over 20 years. Between 2000 and 2007 their research on Namibian Odonata formed part of the BIOTA AFRICA programme.



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