

# THE STATUS AND DISTRIBUTION OF FRESHWATER BIODIVERSITY IN CENTRAL AFRICA

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CENTRAL AFRICA



The IUCN Red List of Threatened Species™ Regional Assessment

# Chapter 5. The status and distribution of dragonflies and damselflies (Odonata) in central Africa

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## 5.1 Overview of the regional Odonata in relation to the freshwater ecoregions

Equatorial Africa is naturally dominated by almost continuous Guineo-Congolian lowland rainforest, which has a gradual transition of riverine forests and woodland into peripheral savannahs. The highest odonate diversity in tropical Africa is found here (Figure 5.1): all African countries with well over 200 species have a considerable portion of this forest within their borders (Dijkstra and Clausnitzer 2006). Although many species range throughout Africa's forested heart, it can be subdivided into four main areas of endemism (Dijkstra 2007a), of which only the more westerly Upper Guinea lies outside the central Africa assessment region (see Dijkstra *et al.* 2010). The three others are (1) the Lower Guinea, with the Cameroon highlands as its focus, (2) the Congo Basin, and (3) the slope east of the Congo River towards the Albertine Rift. Each area, which agree reasonably with the freshwater ecoregions of Thieme *et al.* (2005), is discussed separately below, as is the large area of more open habitats to the south of the rainforest belt that dominates Katanga and adjacent Angola and Zambia. Central Africa has the richest, but also the least known and probably (currently) least imperilled, odonate fauna in Africa. Therefore this report focuses primarily on what we do and, especially, do not know. Much emphasis is given on

recent discoveries, including collection work conducted as part of the central African freshwater biodiversity assessment and fieldwork by the authors in Cameroon and Gabon (all results otherwise still unpublished). We attempt to provide information on all threatened (or Near Threatened) and Data Deficient species in the region, their status being Least Concern unless indicated.

### 5.1.1 Lower Guinea

The **Northern, Central and Southern West Coastal Equatorial** ecoregions together are best known as the Lower Guinea, whose rainforests have the richest odonate fauna in Africa: typical rainforest groups such as Calopterygidae, Chlorocyphidae and *Chlorocnemis* are about twice as species rich here than elsewhere. The region is best characterised by the presence of several presumably relict damselfly genera, some with distinct Madagascan and Neotropical affinities: *Pentaplebia* (Amphipterygidae) has its nearest relative on South America's Guyana Shield. The genus was believed to be endemic to the Cameroon highlands with two species, but a third taxon was discovered recently in south-eastern Gabon and north-western Congo (Mézière and Lambret unpubl.). *Neurolestes trinervis* (Megapodagrionidae) and *Stenocnemis pachystigma* (Platycnemididae) both occur from the Cameroon highlands to the Mayombe Hills of south-western Congo. The

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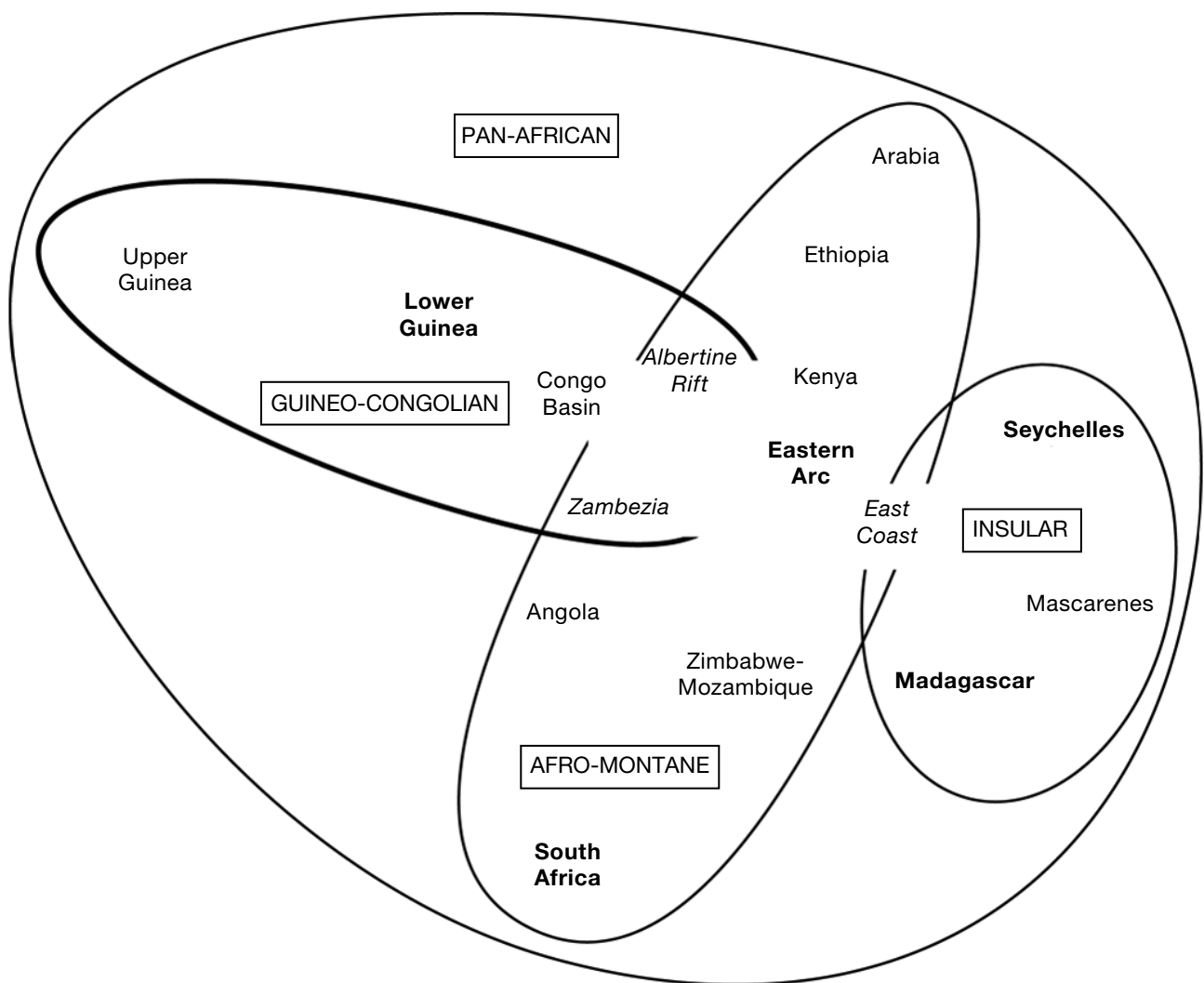


Figure 5.1 Schematic representation of Afrotropical odonate diversity. Each ellipse represents about one-fifth of species richness, the thick-bordered ellipse two-fifths. The name of the fauna represented by each ellipse is given in upper case; discussed regions are given in lower case. Regions in bold font harbour ancient relicts, often in regionally endemic genera, those in italic font have a 'mixed' character where faunas intersect. The border between the western and central African assessment regions ran through the Lower Guinean relict region, and that between the central and eastern/southern assessment regions through the Albertine and Zambebian intersection areas. The choice of these borders greatly complicated the assessment of odonate diversity.

*Sapho* males with broad blue wings are found on many streams and rivers in the Lower Guinea and western Congo Basin. In the centre of this range, specimens have a matt band on the wings and are classified as *S. gloriosa*, while in the periphery (e.g. Cameroon Highlands, Congo Basin) this band is absent and males are identified as *S. orichalcea*. Possibly the two are variants of one species. Photos: © K.-D.B. Dijkstra.





Two characteristic jewel damselflies (Chlorocyphidae) of the Lower Guinean rainforest: (a) *Chlorocypha gracilis*, (b) *Platycypha rufitibia*. Photos: © C. Vanappelghem (a) and J. Kipping (b).

former is closely related to *Nesolestes nigeriensis* (DD) from the Cameroon highlands, which despite the close relationship of both to the Madagascan genus *Nesolestes*, probably represent a second *Neurolestes* species (Kalkman *et al.* 2010). Other characteristic Lower Guinea endemics are: *Sapho gloriosa*, *Chlorocypha gracilis*, *Platycypha rufitibia*, *Chlorocnemis contraria* (VU<sup>RG</sup>), *Platycnemis rufipes*, *Diastatomma tricolor*, *Phyllomacromia insignis* and *Zygonyx speciosus*.

**Northern West Coastal Equatorial:** One of the richest odonate faunas in Africa in terms of restricted range species and relicts is centred on the southern end of the Cameroon highlands, on the border of the western and central African assessment areas. This artificial division has hampered the proper assessment of this unique diversity, but many of the endemic species are probably not threatened globally, although they were considered regionally Vulnerable or Endangered in western Africa due to deforestation, especially in Nigeria (Dijkstra *et al.* 2010). This area was studied by the Cameroon Dragonfly Project (Vick 1996, 1998, 1999, 2000, 2002, 2003a, 2003b), and the similar fauna of Bioko is also reasonably well known (Brooks and Jackson 2001; Pinhey 1971c; 1974). Perhaps the defining species of these Cameroon highlands is *Nubiolestes diotima* (VU<sup>RG</sup>) the only African species of the otherwise Neotropical family Perilestidae. Other characteristic endemics of this area and the adjacent lowlands are *Pentaplebia stabli* (VU<sup>RG</sup>), *Africocypha lacuselephantum* (VU<sup>RG</sup>), *Chlorocypha centripunctata* (NT<sup>RG</sup>), *Chlorocypha neptunus*, *Sapho puella* (DD), *Umma mesumbei* (NT), *Umma purpurea* (EN<sup>RG</sup>), *Nesolestes nigeriensis* (DD), *Chlorocnemis eisentrauti* (DD), and unnamed *Chlorocnemis* near *C. pauli* (EN<sup>RG</sup>), *Elattonaura pruinosa*, *Pseudagrion risi*, *Notogomphus maryae* (DD), *N. moorei*, *Tragogomphus aurivillii* (DD), and *Phyllomacromia caneri*. If the present populations of *Phyllomacromia aeneothorax* are considered specifically distinct from those in the Upper Guinea, as recommended by Dijkstra (2005; Dijkstra *et al.* 2010), this constitutes another endemic. Until recently, *Azuragrion buchholzi* (NT) and *Trithemis hartwigi* (DD) were thought to be confined to standing waters, possibly specifically crater lakes, in Bioko and adjacent Cameroon, but extend to south-eastern Gabon, while *T. hartwigi* was also photographed much further east in east DRC.

**Central West Coastal Equatorial:** The rainforest of southern Cameroon, mainland Equatorial Guinea and northern Gabon are insufficiently surveyed for Odonata. A notable exception is the Makokou region of north-eastern Gabon (Figure 5.2), that was studied intensively by Legrand (1975, 1977, 1979, 1982, 1984a, 1984b, 1986, 1992, 2002). He described numerous species from this area, some of which have not yet been recorded elsewhere (all DD): *Chlorocypha helenae*, *Pseudagrion spinithoracicum*, *Onychogomphus emiliae*, and *Tragogomphus ellioti*. It is likely, however, that all will be found to be more widespread, though possibly confined to (part of) the Lower Guinea, as recent field and collection work yielded the first new records of several other 'Makokou species': *Chlorocnemis interrupta* (DD), *Aciagrion brosetti* (DD), *Malgassophebia westfalli* (DD), *Palpopleura albifrons* and *Tetrathemis fraseri* (DD) were found elsewhere in Gabon, up to 300 km from the type locality, *M. westfalli* and specimens near *Aciagrion balachowskyi* (DD) in southern Cameroon, and *P. albifrons* and *Tetrathemis longfieldae* from several widespread localities in DRC in the collections of the Royal Museum of Central Africa (RMCA) in Tervuren, Belgium. Of other species described from the region, the precise type locality of *Neurogomphus agilis* (DD) was unknown, but it was rediscovered in the Sanaga Delta, Cameroon. Similarly, the origin of *Cornigomphus guineensis* (DD) described from 'Spanish Guinea' is unclear, although it may be the same as *Onychogomphus mariannae* (NE) described in *Paragomphus* from Mt Nimba, Guinea, and reported from Makokou by Legrand (1992) (see Dijkstra *et al.* 2010). The latter record was erroneously overlooked for the central Africa assessment. *Paragomphus aureatus* (DD) from north-west Gabon and *Prodasineura perisi* (DD) from north-east Rio Muni have not been reported since their descriptions. *Elattonaura josemorai* was described from south-west Rio Muni and extends to adjacent Cameroon and south-western Congo, but its separation from *E. pruinosa* occurring further northern in Cameroon is not well resolved.

**Southern West Coastal Equatorial:** The southern end of the Lower Guinea, encompassing the southern half of Gabon and the south-west of Congo, is odonatologically the least known, although it is probably equally rich as the central and northern parts. This is demonstrated by recent research by Nicolas Mézière

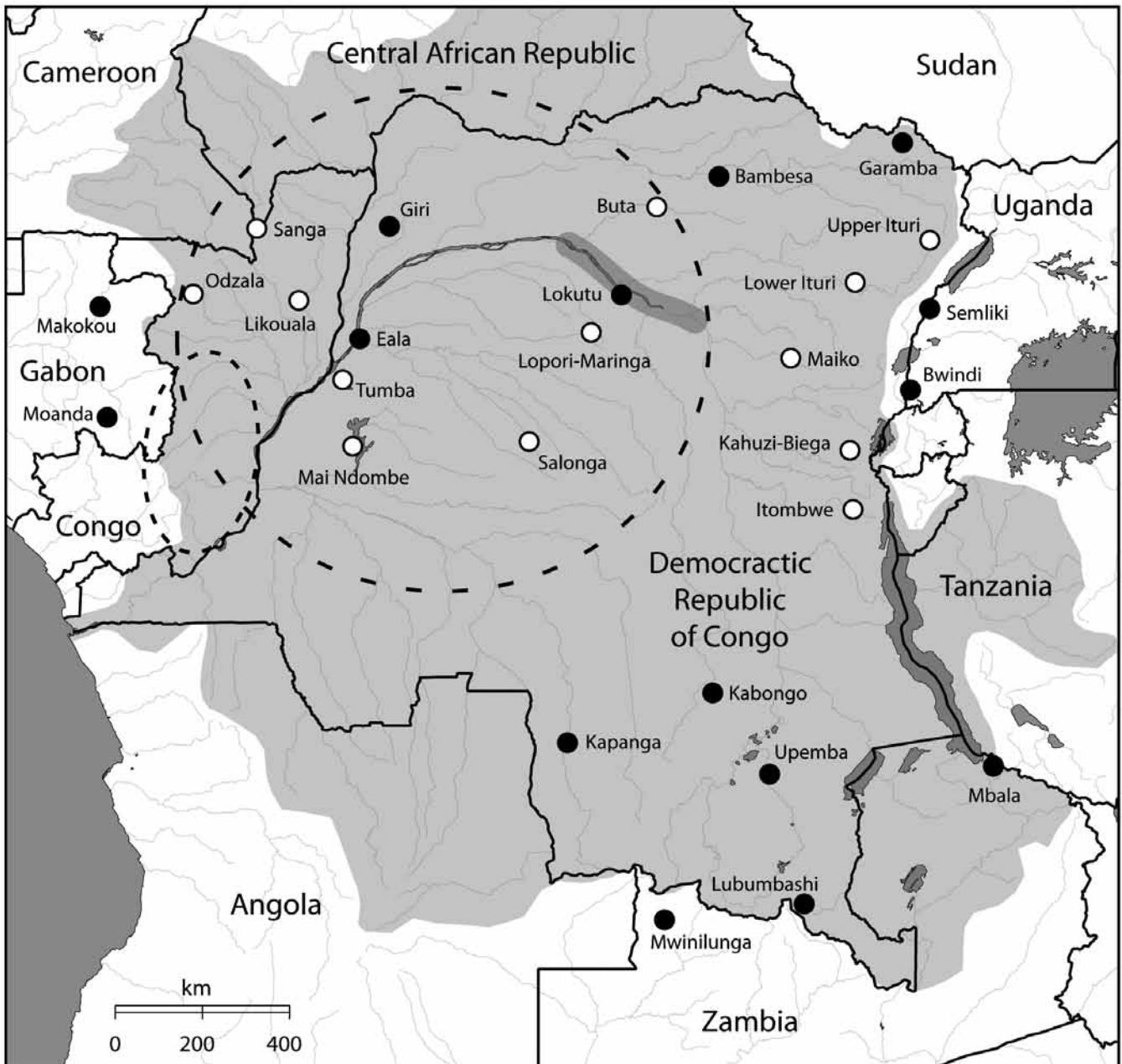


Figure 5.2 Odonatological exploration of the Congo Basin. Legend: Open circles: sites of high conservation priority according to Congo Basin Forest Partnership, none of which have been surveyed for Odonata; Filled circles: sites with reasonable (historic) odonatological data, none of which are CBFP priorities; Pale grey area: Congo River watershed; Large dashed ellipse: approximate extent of ‘cuvette centrale’, defined as part of basin below 500 m; Small dashed ellipse: approximate extent Batéké Plateau; Dark grey line: route Congo 2010 expedition. Adapted from Dijkstra (2007a).

around Moanda (Figure 5.2) in south-east Gabon: in less than two years, in an area of about 200 by 100 km and between 400 and 700 m altitude, over 170 species have been recorded. Among these are numerous rediscoveries and range extensions of poorly known species, like *Elattonaura morini* (DD), *Aciagrion brosetti* (DD), *Azuragrion buchholzi* (NT), *Notogomphus spinosus*, *Aethiothemis mediofasciata* (DD), *Malgassophlebia westfalli* (DD), *Palpopleura albifrons*, *Tetrathemis fraseri* (DD), *Trithemis hartwigi* (DD), and *T. osvaldae* (DD), all of which should probably be reassessed as LC in light of these finds. The area presents an interesting mix of species thought to be (largely) confined to the Congo Basin (*Chlorocypha aphrodite*, *Platycnemis nyansana*, *Elattonaura incerta*, *E. vrijdaghi*, *Pseudagrion simplicilaminatum*, *P. thenartum*, *Diastatomma*

*multilineatum*, *Ictinogomphus regisalberti*, *Lestonogomphus congoensis*, *Phyllogomphus annulus*, *Trithemis congolica*, *Trithetrum congoense*, *Zygonyx regisalberti*) and isolated sites of savannah/woodland species generally occurring much further north or south (*Lestes ochraceus*, *Pseudagrion torridum* (NA), *Gomphidia quarrei*, *Lestonogomphus angustus*, *Paragomphus serrulatus* (= *bredoi*), *Nesciothemis nigriensis*, *Trithemis bifida*). Illustrative of the fauna’s diversity and complexity is that several of these species meet their counterparts here from the west African rainforests (*Ictinogomphus fraseri*, *Trithemis basitincta*) or non-forest habitats outside the Congo Basin (*Trithemis aconita*, *Trithetrum navasi*). The research also produced new species of *Pentaplebia*, *Africocypha*, *Mesocnemis*, *Elattonaura*,

*Porpax*, *Trithemis*, *Urothemis*, *Zygonyx* and two of *Pseudagrion*. Remarkably, most of the new species are not very localised: the *Mesocnemis* and *Zygonyx* were first discovered during the afternoon excursion of the central African evaluation workshop to the Sanaga River north of Yaoundé (750 km north), while the *Pentaplebia* and one *Pseudagrion* species were found about 350–400 km south-west in north-western Congo (Philippe Lambret pers. comm.). The *Trithemis* also occurs at Makokou and in extreme south-west Cameroon (625 km north-west). The locally abundant new *Urothemis* had been photographed 26 years earlier 1,500 km east in DRC. This demonstrates how rapidly our knowledge of this rich fauna will expand once further areas are studied. Two more *Pseudagrion* species were described from this ecoregion by Legrand (1987): *P. grilloti* (DD) is only known from the Mayombe Hills in western Congo, but *P. simonae* has been found throughout the ecoregion. Finally, *Neurogomphus angustisigna* (DD) is only known from the holotype from the lower Ogooué River (Pinhey 1971a).

### 5.1.2 Central Congo Basin

Ever-shifting rivers, swamps, forests, woodlands and savannahs in the Congo Basin create an enormous mosaic of prime odonate habitat in time and space. Africa's heart has always been on a crossroads, between the forests to the west and east in wet periods, and between the savannahs to the north and south in drier times, when sensitive species could survive in presumed forest refuges west and east of the basin and along its rivers. Kingdon (1989) postulated that the basin is an “evolutionary whirlpool” of species diversification, conservation and dispersal, leading to high endemism and diversity. This could be especially true for Odonata, because of their strong ties to freshwater and vegetation structure (e.g. Dijkstra 2006b). Unfortunately our knowledge of the fauna is concentrated in a handful of peripheral sites, sampled mostly in the 1930s to 1960s (Figure 5.2). This data largely comes from the collection of the RMCA, which was treated by Schouteden (1934) and especially Fraser (1949; 1953a; 1953b; 1954a; 1954b; 1955a; 1955b; 1956; 1957; 1958a; 1958b; 1958c; 1958d; 1959), and databased as part of this assessment. Species found in a large part of the basin (but see **Southern West Coastal Equatorial** ecoregion), and largely confined to it, are *Chlorocypha aphrodite*, *Elattonneura centrafricana*, *E. vrijdaghi*, *Prodasineura odzala*, *Pseudagrion*

*simplicilaminatum*, *P. thenartum*, *Ictinogomphus regisalberti*, *Phyllogomphus annulus*, *Phyllomacromia maesi*, *P. schoutedeni*, *P. seydeli*, *Lokia circe*, *L. erythromelas*, *Porpax garambensis*, *P. sentipes*, *Trithemis apicalis* (= *Porpacithemis trithemoides*), *T. congolica*, and *Zygonyx regisalberti*.

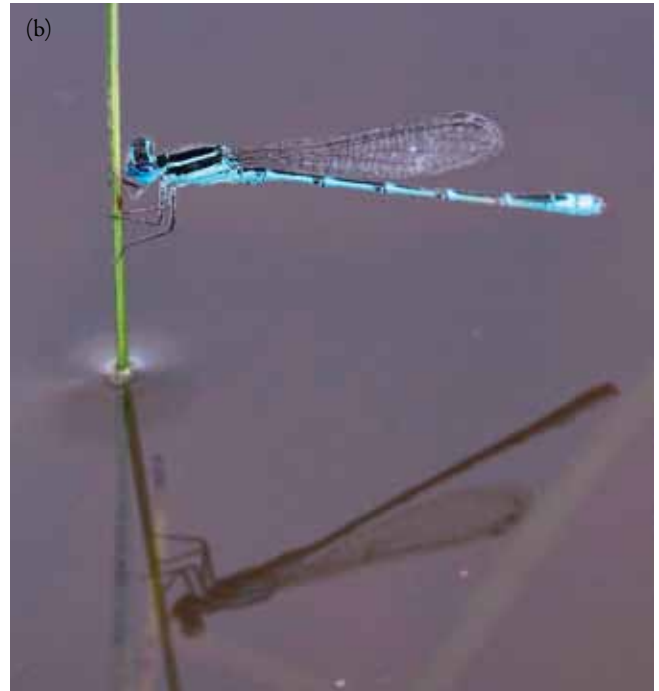
**Sangha:** This ecoregion between the Lower Guinea-Congo watershed and the swamp forest of the Congo and Ubangi (see Cuvette Centrale) is very poorly known. Most available information was provided by Aguesse (1966), Carletti (1997), Legrand and Lachaise (1980) and Pinhey (1962). *Elattonneura incerta*, *Prodasineura odzala* and *Trithemis fumosa* (DD) were described from near Odzala National Park, but *T. fumosa* has since only been reported from near Bangui in the Central African Republic (Pinhey 1971b) and both others from a few sites in DRC and Gabon. In the south-west of the **Sangha** ecoregion, the open grasslands of the Batéké Plateau (Figure 5.2) are wedged between the Lower Guinea and Congo Basin forests. Numerous very clear rivers with forest galleries cut through and run off this sandy plateau, such as the Lékoni and Léfini. Explorations on the plateau's western fringe in south-eastern Gabon, suggest these waters have a distinctive fauna: *Platycypha picta* (DD) and *Pseudagrion bernardi* were known previously only from central Congo, while newly discovered species of *Pseudagrion* and *Elattonneura* may also be endemic.

**Cuvette Centrale:** This saucer-like area below 500 m in the central Congo Basin (Figure 5.2) is a seemingly monotonous forested plain crossed by countless rivers. Ecologically, the lower reaches of the **Sudanic Congo (Oubangui)**, **Tumba** and **Mai Ndombe** ecoregions belong to the ‘cuvette’ as well. Various species appear to be endemic to the region's huge rivers (most notably the Ubangi and middle Congo) like *Neurogomphus chapini*, *N. martininus*, *N. uelensis* (including similar *N. paenuelensis* (DD)), *Paragomphus acuminatus*, and *Zygonoides occidentis*, or at least with the associated forest habitat, like *Agriocnemis stygia* and *Hadrothemis vrijdaghi*. Our knowledge of the fauna largely stems from material in RMCA from two sites. Almost a hundred species were collected at Eala, mainly by J. Ghesquière in 1933–1937, although some of these may be doubted, because *Orthetrum cafferum*, *O. camerunense*, *Proischnura subfurcata*, and *Trithemis furva* favour open highlands. A. Bal collected along the Giri River south of Kungu in 1934–1935, amassing 85

New damselfly species discovered recently in south-east Gabon; (a) genera *Africocypha*, and (b) genera *Pseudagrion*. Photos: © C. Vanappelghem.



Two species described from the highlands of Cameroon and Bioko: while *Notogomphus moorei* (a) may well be endemic, *Azuragrion buchholzi* (b) has been found more widely. Photos: © C. Vanappelghem (a) and K.-D.B. Dijkstra (b).



Two species described from Makokou in north-east Gabon, but since found to be more widespread: (a) *Aciagrion brosetti*, (b) *Palpopleura albifrons*. Photos: © N. Mézière.



Two characteristic damselflies of Congo Basin streams: (a) *Chlorocypha aphrodite*, (b) *Pseudagrion simplicilaminatum*. Photos: © K.-D.B. Dijkstra.





Two characteristic damselfies of clear sandy rivers of the Batéké Plateau: (a) *Platycypha picta*, (b) *Pseudagrion bernardi*. Photos: © N. Mézière (a) and C. Vanappelghem (b).

species. Together these collections provide the only impression of the typical dragonfly fauna of the cuvette, sharing typical Congolian species such as *Agriocnemis stygia*, *Phyllomacromia maesi*, *Lokia circe*, *L. erythromelas*, *Porpax sentipes*, *Trithemis apicalis*, *T. congolica*, and *H. vrijdaghi*, but also the only records of *Congothemis longistyla*, and most of the few known of *Elatoneura incerta* and *Tetrathemis longfieldae* (see above). *Diastatomma multilineatum*, described from the Giri area, was recently recorded 700 km south-west in south-eastern Gabon. It is still the only known locality for and an unnamed *Chlorocypha* (NE), while *Chlorocypha ghesquierei* (DD) was recorded only at Eala. Rather little is known of the swamps around Lake Mai-Ndombe and Tumba. *Trithetrum congoense* is possibly a characteristic species, known only from near Brazzaville, Eala and Lake Tumba (Dijkstra and Pilgrim 2007) until it was discovered at grassy riverbanks in south-east Gabon. Although geographically in the **Kasai** ecoregion, Bumbuli, the only known locality of *Paragomphus maynei* (DD), lies in the southern Cuvette: the least explored of one of the most poorly explored parts of Africa. Also the western Cuvette, including the swamp forests of north-east Congo (e.g. along the Likouala River), is entirely unexplored (Figure 5.2). Dijkstra (2007b, 2008) obtained an impression of the central basin's remarkable diversity by recording 86 species within 13 days in a small area around Lokutu. Only 28% were widespread species; the fauna was estimated to number over 125 species.

The survey produced two conspicuous new species (both DD), *Mesocnemis saralisa* and *Platycypha eliseva*, and range extensions over thousands of kilometres. *Ceriagrion ignitum* and *Chlorocypha pyriformosa*, for example, had not been found outside western Africa before, the former not even since its description from Ghana (see Dijkstra *et al.* 2010).

An expedition conducted in April–June 2010 on the Congo, going downstream from Kisangani (route shown in Figure 5.2), yielded many additions: including prior data, 171 species have been found along this 350 km stretch of the river. Many new species were found, including probable new species of *Ceriagrion*, *Prodasineura*, *Aciagrion*, *Notogomphus* and *Paragomphus*, and range extensions were proven for several more. The extensive sympatry of *T. congoense* with *T. navasi*, the only species of the recently erected genus *Trithetrum* (Dijkstra and Pilgrim 2007) is also notable. Despite these efforts, the southern and western Cuvette, including the swamp forests of north-east Congo, remain entirely unexplored.

**Uele:** This ecoregion incorporates the open habitats on the north-eastern fringe of central Africa. The fauna is poorly known, with two notable exceptions, Bambesa and Garamba National Park (Figure 5.2). The former lies on the northern forest-savannah border and is the locality most often attached to odonates kept

Two finds near the Congo at Lokutu: *Platycypha eliseva*; (b) *Neurogomphus uelensis*. Photos: © K.-D.B. Dijkstra.



in RMCA, thanks to the efforts of H.J. Brédo, P. Henrard and especially J. Vrijdagh (1932–1940). As a consequence, 21 species were first described from here, although only *Elatoneura vrijdaghii*, *Pseudagrion thenartum*, *Anax congoliath*, *Diastatomma selysi*, *Lestinogomphus congoensis*, *Notogomphus leroyi*, *Paragomphus nigroviridis*, *Phyllomacromia aureozona*, *Ph. schoutedeni*, and *Malgassophlebia bispina* are presently considered valid and have all been found to be widespread. It is possible that material from “Bambesa” came from a much larger part of north-east DRC, as the 143 species obtained are suspected to originate from the savannahs to the north, swamp forests to the south-west and highlands to the south-east. Garamba National Park was surveyed by H. de Saeger in 1949–1954, resulting in records of almost 80 species (Pinhey 1966). Among these are some species that are better known from western Africa, especially in savannah habitats: *Ceriagrion rubellocerinum*, *Pseudagrion emarginatum*, *Phyllomacromia flavimitella*, *Brachythemis wilsoni*, *Nesciothemis nigeriensis*, *Orthetrum latibami*, and *Trithemis kalula*. Garamba is the type locality of *Ph. flavimitella* and *O. latibami*, as well as of *Orthetrum saegeri* and *Porpax garambensis*

**Lower Congo:** This region is here taken to include the **Lower Congo Rapids** and **Malebo Pool** ecoregions, which have not been studied specifically for Odonata. The region is characterised by more open habitats, which extend northwards to the Batéké Plateau (see Sangha). As a consequence, the Odonata differ by a greater proportion of open-land species penetrating from the south. Most of these are widespread and avoid dense forest, but among them are a three principally ‘Katangan’ species (see below): *Umma electa*, *Phyllomacromia congolica*, and *Zygonyx eusebia*. A potential endemic of this region, *Elatoneura morini* (DD), was described from near Brazzaville (Legrand 1985) and known from a single male in RMCA collected near Kinshasa, but it was found to extend to north-western Congo and south-eastern Gabon (N. Mézière and P. Lambret pers. comm.).

### 5.1.3 Katanga

In the southern half of the Congo Basin, rainforest gives way to woodlands and savannah, and the land gradually slopes up, reaching elevations over 1,000 m. As a consequence, this area, named here after the large southern DRC province that dominates it, has a very different fauna from the rest of central Africa (Figure 5.1). Many species that are typical of eastern and southern Africa occur only here in central Africa and DRC, such as *Chlorocypha consueta*, *Lestes amicus*, *Elatoneura cellularis*, *Africallagma sinuatum*, *Pseudagrion inconspicuum*, *P. makabusiense*, *P. salisburyense*, *Notogomphus praetorius*, *Phyllomacromia monoceros*, *Atoconeura biordinata*, *Bradinyopyga cornuta*, *Hadrothemis scabrifrons*, *Orthetrum macrostigma*, *Porpax risi*, *Itherochoria jeanneli*, and *Trithemis pluvialis*. Some of these species also penetrate from the east in the highlands of eastern DRC: *Platycypha caligata*, *Lestes virgatus*, *Agriocnemis gratiosa*, *Pseudagrion hageni*, *P. massaicum*, *P. spernatum*, *Aeshna rileyi*, *Gynacantha villosa*, *Crenigomphus hartmanni* and *Orthetrum machadoi*. Aside from these widespread species, the fauna includes species (largely) confined to the Zambezan area that extends to adjacent Angola, Zambia and in some cases into the Okavango regions of Namibia and Botswana: *Umma electa*, *Chlorocypha frigida*, *C. seydeli*, *Chlorocnemis wittei*, *Aciagrion heterosticta*, *Pseudagrion coeruleipunctum* (DD), *P. fisheri*, *P. greeni* (VU<sup>RG</sup>), *P. rufostigma*, *Diastatomma soror*, *Ictinogomphus dundoensis*, *Phyllomacromia unifasciata*, *Lokia ellioti*, *Neodythemis fitzgeraldi* (DD), *Nesciothemis fitzgeraldi* (DD), *Rhyothemis mariposa*, *Trithemis anomala*, and *Zygonyx atritibiae*.

**Kasai:** The fauna of south-west Katanga is best known through the efforts of G.F. Overlaet who collected along the Upper Lulua, mainly between Kapanga and Dilolo, in 1918–1937, although mainly 1932–1934. Some 90 species were recorded, including

Two species described from Bambesa but since found much more widely. Both were photographed in south-east Gabon: (a) *Elatoneura vrijdaghii*; (b) *Lestinogomphus congoensis*. Photos: © C. Vanappelghem (a) and N. Mézière (b).





Two damselflies, restricted to forest streams within the Katanga region of southern DRC and northern Zambia. Both photographed near Ikelenge, north Zambia, a famous collecting site of Pinhey: (a) *Chlorocnemis wittei*, (b) *Umma electa*. Photos: © J. Kipping.

the types of *Microgomphus schoutedeni*, *Phyllomacromia overlaeti*, and *Phyllomacromia seydeli*, and poorly known species like *Chlorocypha seydeli*, *Prodasineura flavifacies* (DD) and *Lestinogomphus congoensis*. Dundo (= Chitato), in the centre of the **Kasai** ecoregion on the Angola-DRC border, is also the origin of many records (Longfield 1959, Pinhey 1961a, Pinhey 1961b), but their geographic accuracy is doubtful: ‘Dundo’ may refer to the collection held at this town rather than material obtained there. This is especially problematic as several species, some taxonomically dubious, are only known from ‘Dundo’: *Chlorocypha rubriventris* (DD), *Pseudagrion dundoense* (DD), *Ictinogomphus dundoensis*, *Paragomphus machadoi* (DD), and *Lestinogomphus bivittatus* (DD). Of these only *I. dundoensis* has since found to be quite widespread in swamps from Lake Bangweulu to the Okavango Delta, and ‘Dundo’ is an extreme and probably erroneous outlier.

**Upper Lualaba:** C. Seydel obtained almost 50 species from Kabongo in 1951–1954 (Figure 5.2), including the types of *Chlorocypha seydeli* (only other site Tshibalaka near Kapanga), *Phyllogomphus schoutedeni* (also Lubumbashi), and *Paragomphus interruptus* and *Rhyothemis splendens* (both DD), which have yet to be found elsewhere. G.F. de Witte obtained over 70 species in the huge Upemba National Park (Figure 5.2) in 1945–1949 (Fraser 1955c). *Chlorocnemis wittei* and *Phyllomacromia unifasciata* were described from here, but extend to north Zambia. Of particular interest are two species so far appearing endemic to the park and environs: *Allocnemis mitwabae* is known only from near Lubudi and Mitwaba, while *Pseudagrion symoensii* is confined to the Kundelungu Plateau in the eastern part of the park. *Chlorocypha wittei* is also known only from the park, but was not evaluated due to confusion with the more widespread *C. fabamacula* (Dijkstra unpubl.). Without specific information about threats, these species are (or should be) considered as globally NT.

**Bangweulu/Mweru:** This region is comparatively well-known, due to the work of J.J. Symoens (Lieftinck 1969; Pinhey 1967) and the earlier efforts of C. Seydel (1923–1959). Although in RMCA alone 145 species are labelled as originating from

Elisabethville/Lubumbashi (Figure 5.2), ambiguous collection data and the absence of records from the well-studied parts of adjacent Zambia (see Pinhey 1984), suggests that especially forest species such as *Phaon camerunensis*, *Umma longistigma*, *U. saphirina*, *Chlorocypha trifaria*, *Chlorocnemis nigripes*, *Elatoneura lliba*, *Ceriagrion annulatum*, *Pseudagrion glaucum* (= *basicornu*), *P. serrulatum*, *Hadrothemis coacta*, *Lokia erythromelas*, *Micromacromia camerunica*, *Thermochoria equivocata* (confused with the locally common *T. jeanneli*), and *Trithemis tropicana* were collected much further afield. *C. annulatum* even has its type locality here, as do *Aciagrion heterosticta*, *Gynacantha immaculifrons* (NA), *Ictinogomphus regisalbertyi*, *Neurogomphus pallidus* (DD), *Onychogomphus seydeli*, *Phyllomacromia congolica*, and *Aethiothemis bequaerti*. Of these, only *N. pallidus* has not been found elsewhere. The swamps in this region, especially around Lake Bangweulu, form an outpost for species like *Pinheyagrion angolicum*, *Pseudagrion coeleste*, *P. deningi*, *P. helenae*, *Anax bangweuluensis* (NT<sup>RG</sup>), *Diplacodes pumila*, *Trithemis aequalis* and *T. brydeni* (DD), which are more abundant further south, for instance in the Okavango Delta of Botswana. *Lokia gamblesi* (DD) is only known from the holotype male collected at Kisongo on the Katanga-Zambia border.

#### 5.1.4 Albertine Rift and Slope

Most of central Africa is low-lying. The highlands on its western border, reaching their highest point on Mt Cameroon at almost 4,100 m, are rather isolated, but to the south and east the Congo Basin slopes up towards the huge highland area that stretches across eastern Africa from Ethiopia to South Africa. Although an Afro-montane dragonfly fauna (Figure 5.1) is seen especially in the more open habitats of Katanga, central Africa’s forest-clothed highest mountains lie along the Albertine Rift on its eastern border, with the Ruwenzori just reaching over 5,100 m. This slope incorporates the ecoregions of **Upper Congo**, including **Upper Congo Rapids**, and the **Albertine Highlands**, including Ituri, and the eastern portion of the **Cuvette Centrale** ecoregion. Aside from a few widespread montane species occurring very peripherally in central Africa, like *Aeshna ellioti*, these highland have a characteristic Albertine fauna, with endemism in forest



Two damselflies which are known to occur in the swamps of Lake Bangweulu as well as the Okavango Delta of Botswana. (a) *Pinheyagrion angolicum*, (b) *Pseudagrion helena*. Photos: © J. Kipping.

genera such as *Chlorocypha*, *Chlorocnemis*, *Neodythemis* and *Tetrathemis*, as well as in the more montane genera *Notogomphus* and *Atoconeura*. Most knowledge of this fauna comes from Bwindi Impenetrable National Park and other forests in south-west Uganda (e.g. Dijkstra and Kisakye 2004; Dijkstra 2006a; Dijkstra and Vick 2006). Unfortunately, the western slope of the rift, the part covered in the central African assessment, is almost completely unstudied. Nonetheless it seems relevant to discuss all Albertine species here, because these species, or related new species, must occur on the western slope. Many of the species range widely beyond the Albertine Rift highlands, extending throughout the forested highlands east of the Congo, from western Kenya and Tanzania to north-east DRC and down to Katanga. Examples are *Chlorocypha trifaria*, *Chlorocnemis pauli* (NT<sup>RG</sup>), *Africallagma pseudelongatum*, *Notogomphus leroyi*, *N. lujai*, *Paragomphus lacustris*, *P. viridior*, *Phyllomacromia sylvatica*, *Atoconeura pseudseudoxia*, *Lokia coryndoni* (DD) and *Tetrathemis denticauda* (DD). *Pseudagrion rufocinctum* and *Trithemis integra* range from eastern DRC to west Tanzania and east Uganda). However, most Albertine species have not or only marginally been found in the central African assessment area: *Chlorocypha hasta* (NA; western Tanzania), *C. jacksoni* (VU<sup>RG</sup>), *C. molindica* (EN<sup>RG</sup>), *C. schmidtii* (VU), *C. tenuis* (LC<sup>RG</sup>; Uvira to western Kenya), *Platycypha pinheyi* (NA;

Lake Tanganyika), *Chlorocnemis superba* (DD; east DRC to western Uganda and Tanzania), *Agriocnemis palaeforma* (NA; papyrus swamps in Uganda), *Tragomphus* (= *Onychogomphus*) *bwambae* (NA; Semliki Valley), *Neurogomphus wittei* (NA; Lake Tanganyika), *Notogomphus flavifrons* (NA; south-west Uganda), *Onychogomphus styx* (NA; west Tanzania, east Uganda to west Kenya), *Idomacromia jilliana* (NA; south-west Uganda), *Atoconeura eudoxia* (NA; Burundi, Ruwenzori to west Kenya), *Neodythemis munyaga* (NA; south-west Uganda), *N. nyungwe* (NA; Rwanda), *Tetrathemis corduliformis* (DD; Rutshuru and east Uganda to west Kenya) and *T. ruwensoriensis* (NA; Ruwenzori). The taxonomically dubious *Neurogomphus vicinus* is also DD because the position of its type locality Kibombo is ambiguous. Possibly the fauna of the Congo Basin's eastern fringes (Figure 5.2) is similarly rich in species and endemics as that of the Lower Guinea, but we have virtually no information on this.

## 5.2 Conservation status (IUCN Red List Criteria: Regional scale)

The summary presented here is based on a regional species assessment applying the IUCN Red List Categories and Criteria and Regional Guidelines. For comparison, results from western

Two damselflies found in the forested regions of eastern DRC and adjacent East Africa: (a) *Chlorocnemis pauli*; (b) *Africallagma pseudelongatum*. Photos: © A. Cordero Rivera.



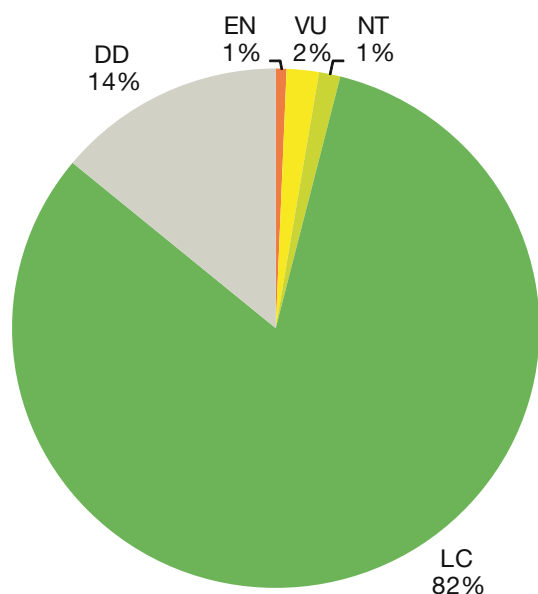
Africa are given in square brackets. The regional Red List status of any species which is endemic to central Africa will be equivalent to its global status. Because most species are widespread and/or are tolerant to some habitat degradation, only 12 (2.6%) of the species assessed in central Africa are regionally threatened, with a further six (1.3%) assessed as Near Threatened [9.4% and 1% respectively of 287 species in western Africa]. The remaining 96% of species are generally widespread and (therefore) of Least Concern, also because extensive forests still stand in the region. However, the extensive habitat degradation in the region is a

**Table 5.1 The number of Odonata species in each regional Red List Category in the central African region.**

	Regional Red List Category	Number of Species	Number of Regional Endemics
Threatened Categories	Extinct	0	0
	Regionally Extinct	0	0
	Extinct in the Wild	0	0
	Critically Endangered	0	0
	Endangered	3	0
	Vulnerable	9	2
	Near Threatened	6	3
	Least Concern	375	46
	Data Deficient	64	42
	Not Applicable	47	0
<b>Total*</b>		<b>457</b>	<b>93</b>

\* The total figure does not include NA (Not Applicable) species. All species assessed as regionally threatened that are endemic to the region are also globally threatened.

**Figure 5.3 The proportion of Odonata species in each Regional Red List Category in the central African region. IUCN Red List Status: CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near Threatened, LC – Least Concern, DD – Data Deficient.**



threat whose impacts must be continuously monitored. Ninety-three species are endemic (20.4%), of which only two (2.2%) are deemed under threat [24.6% of 61]. Moreover, 14.0% of all species [13.9%], as well as 45% of the endemics [31%], is considered too poorly known for an assessment of threat. Altogether, 17.9% of all central African species [24.4%] and 50% of its endemics [61%] require further attention (particularly research) because they are either threatened, Near Threatened or poorly known (DD). The comparison with western Africa is relevant because it is the only other region with extensive rainforest and associated endemism (Figure 5.1). The degree of endemism there is similar (21.3%), but the proportion of threatened species is notably higher, especially among the endemics. This difference may be slightly exacerbated by the higher Data Deficiency among central African endemics, but the main cause is the much greater fragmentation of western African rainforests.

### 5.3 Patterns of species richness

In very broad lines, odonate diversity in Africa peaks on the equator, with the richest assemblages in rainforest habitats (Dijkstra and Clausnitzer 2006). That the pattern in central Africa is more patchy (Figure 5.4a) is probably largely the effect of poor sampling in large but probably rich parts of south-east Cameroon, south-west Gabon, west and north Congo, north-west Angola and especially most of DRC, particularly the central and poorly accessible parts. The diversity of endemic species, which constitute one fifth of the fauna, shows a rather different pattern, with a strong concentration of endemism in the northern Congo Basin (Figure 5.4b). However, the delimitation of the central African assessment region runs right through three regions of endemism: (1) Lower Guinea, shared with western Africa; (2) Albertine Rift, with eastern Africa; (3) Zambezia, with southern Africa. The range-restricted species in those areas are therefore not classified as central African endemics, although they are highly localised and sometimes threatened. Indeed, the only concentration of threatened species in central Africa (Figure 5.4c) is in the Lower Guinea, especially the highlands on the Cameroon-Nigeria border. Thus the central concentration of endemism in Figure 5.4b mainly shows where most species confined within the region's borders overlap (mid-domain effect), although the Congo Basin is also the fourth main area of endemism in central Africa (see Figure 5.1). Data Deficiency is virtually pandemic, with concentrations ironically in species-rich areas that have been comparatively well-researched (Figure 5.4d), because from there multiple species were described for which no new information has been obtained since.

### 5.4 Major threats to dragonflies

Central Africa has the richest and, as yet, least threatened odonate fauna in the continent. This is because the region is largely very rich in water and still extensively forested. The Congo Basin, for example, contains the second-largest intact rainforest area in the World, and one-quarter of Africa's freshwater. Through the

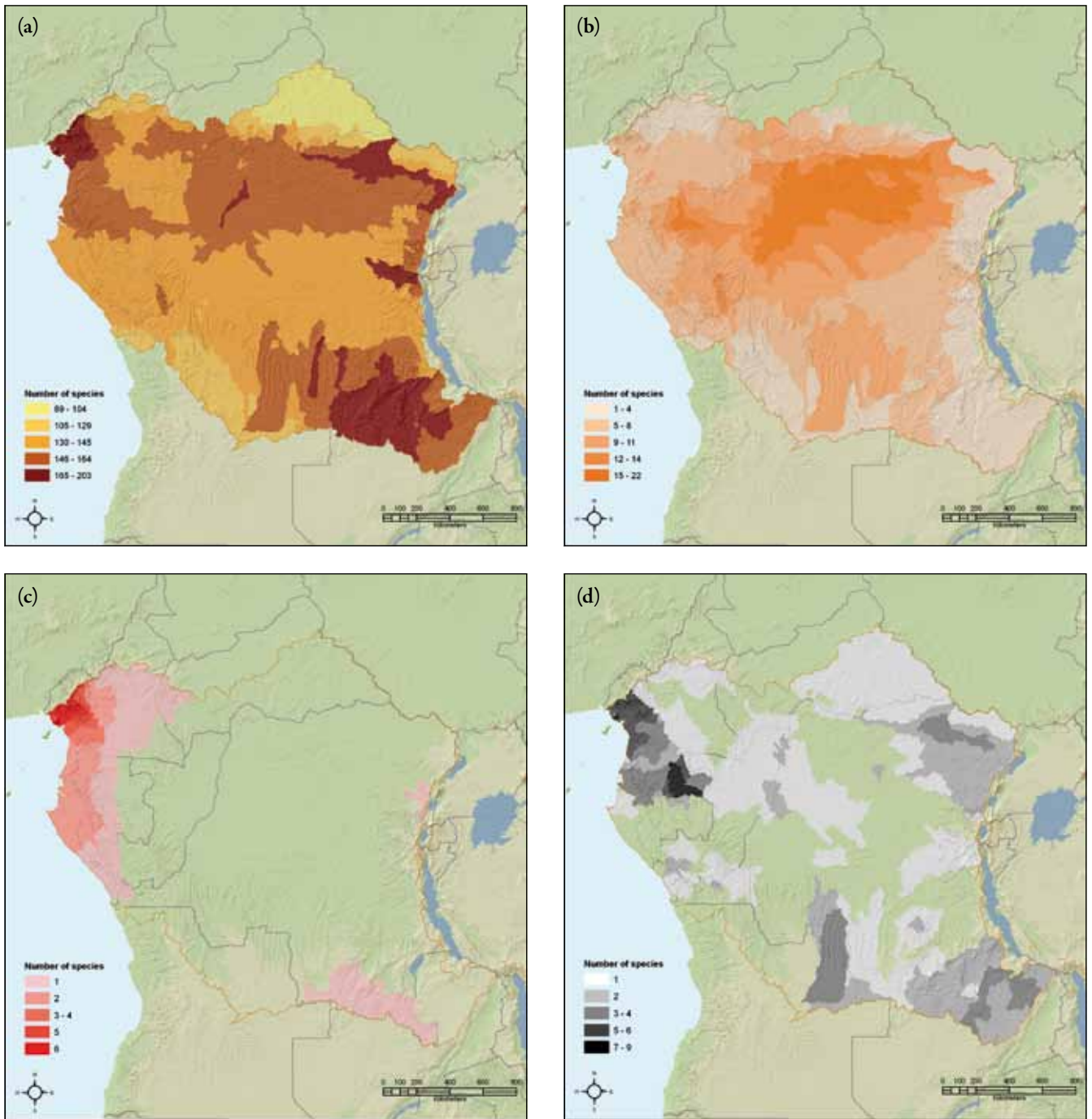


Figure 5.4 Richness of (a) all Odonata species, (b) endemics, (c) threatened, and (d) Data Deficient species in central Africa, based on known and inferred distribution mapped to river sub-catchments.

Two localised libellulids discovered recently in south-east Gabon: (a) *Aethiothemis mediofasciata*, (b) *Nesciothemis nigeriensis*. Photos: © C. Vanappelghem (a) and N. Mézière (b).



assessment process the major threats to the Odonata of central Africa can be quantified in terms of proportion of species affected by each threat. Odonata may be sensitive to any changes in the flow, oxygen and temperature regimes of the waterways they inhabit. Figure 5.5 shows that habitat loss is by far the greatest threat to odonates, impacting half of all species and 91% of threatened species. Habitat loss due to agriculture affects 25% of all species, and 58% of threatened species, and deforestation, 43% of all species and 25% of threatened species. As human populations grow explosively, the general alteration of the natural landscape (especially through deforestation, urbanisation and agricultural encroachment) and the subsequent alteration of water bodies (e.g. by erosion, eutrophication and siltation) is the main threat to Odonata in central Africa and indeed the tropics worldwide. Aside from land and water, energy is gaining prominence as a tropical resource: the feasibility of the Grand Inga scheme, which could generate over twice the power of China's Three Gorges Dam, and REDD (Reduced Emissions from Deforestation and Degradation) in central Africa depends on the Congo Basin's environmental health.

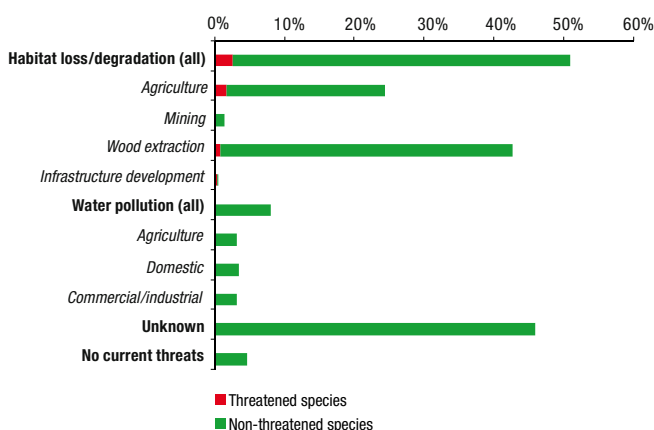


Figure 5.5 Percentage of Odonata species affected by each threat. Note that many species have more than one threat listed.

This photo was taken in 1983 north-east of Kalima near Kindu, eastern DRC. *Trithemis hartwigi* was known previously from only four sites on Bioko and adjacent Cameroon, almost 2,000 km away. It was recently found to be abundant in SE Gabon. Photo: © C. Vanappelghem.



Further threats are much more localised, such as water pollution, and the effects of mining. Given the likely increase in development in the area, these are a potentially increasing problem throughout central Africa. There are also 46% of species where the threats are unknown which reflects the high levels of species assessed as Data Deficient. Only 5% of species are thought to have no threats, all of which are assessed as Least Concern.

## 5.5 Conservation recommendations

### 5.5.1 Conservation measures

**Habitat degradation:** For now, most central African endemic dragonflies appear to survive in the fragments of natural forest that remain. Because deforestation has led to the demise of virtually all forest in the region, the survival of the remnants, especially the large tracts in DRC, is vital.

**Damming large rivers:** The impact of dams, at least downstream, can be reduced if a natural water regime with normal seasonal fluctuations is retained. Otherwise breeding habitats and life cycles of dragonflies and other aquatic fauna will be seriously disturbed.

**Mining:** Where mining takes place it is of the utmost importance that minimal damage to the watershed is ensured by leaving broad zones around water bodies (rivers, inundation zones) untouched. Also minimising the outflow of mining water into the river systems will reduce the possible negative effect of those activities.

### 5.5.2 Research action required

Having the continent's richest but least known odonate fauna, all of central Africa requires more surveys. Huge areas, such as northern Angola, eastern Cameroon, eastern Central African Republic and large parts of DRC have no records at all. However, the three greatest priorities, with the expectation of the discovery of many new species, lie in the Congo Basin (Figure 5.2):

1. Western Cuvette, including Odzala, Sanga and Likouala areas.
2. Southern Cuvette, including Tumba, Mai Ndombe, Lopori-Maringa and Salonga areas.
3. Western Albertine Slope, including Ituri, Maiko, Kahuzi-Biega and Itombwe areas.

Targeted surveys to determine the status and ecologies of (potentially) threatened species should be undertaken in this understudied region. A study of the impact of mining, e.g. in Katanga, on stream systems and their dragonflies would be insightful.

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