

# NABU's Follow-up Biodiversity Assessment at the Kafa Biosphere Reserve, Ethiopia



## Dragonflies and damselflies (Odonata) of the Kafa Biosphere Reserve

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## Highlights

- A total of 57 Odonata (dragonflies and damselflies, hereafter referred to as “dragonflies”) species from nine families was recorded in the two 2014 and 2019 surveys (this represents 53% of the 108 species certain to occur in Ethiopia and 90.5% of the Kafa Biosphere Reserve’s confirmed dragonfly fauna). In the 2014 survey just 33 species were found, so the 2019 survey resulted in a further 29 species which could be added to the biosphere reserve’s total.
- The Ethiopian endemic *Crenigomphus denticulatus* was recorded for the first time since 1962 and is thus new to the Kafa Biosphere Reserve. *Pseudagrion sjoestedti* is new to Ethiopia.
- A total of 63 dragonfly species from nine families has now been recorded at the Kafa Biosphere Reserve, with at least 75 expected in total.
- Nine of the 12 species known to be endemic to Ethiopia are confirmed to be present at the Kafa Biosphere Reserve (*Pseudagrion guichardi*, *P. kaffinum*, *Crenigomphus denticulatus*, *Notogomphus cottarellii*, *N. ruppeli*, *Paragomphus crenigomphoides*, *Atoconeura aethiopica*, *Orthetrum kristenseni*, *Trithemis ellenbeckii*) as is one subspecies (*Palpopleura jucunda radiata*). Another endemic (*Elattonneura pasquinii*) is almost certain to occur, while suitable habitat may also be present for the final two (*Ischnura abyssinica*, *Crenigomphus abyssinicus*). Among the species that were present and that have a limited distribution outside Ethiopia are *Pinheyschna waterstoni* (also in western Sudan) and *Notogomphus lecythus* (also in western Kenya).
- Seven species are globally at risk of extinction according to the IUCN Red List of Threatened Species (five Vulnerable, two Endangered), while one is Near Threatened. All of these species except the near endemic *Pinheyschna waterstoni* are confined to Ethiopia.
- Most endemic species were found in streams, usually flowing from natural bogs or forests, typically at an altitude between 1,600 and 2,600 m a.s.l. *Pseudagrion kaffinum* and *Crenigomphus denticulatus*, however, were found only along or near Gojeb River at about 1,300 and 1,550 m respectively.
- Lower lying areas, including ponds and rivers, harbour more species but fewer endemics.
- The Ethiopian Highlander (*Atoconeura aethiopica*), Ethiopian Sprite (*Pseudagrion guichardi*), Cottarelli’s Longleg (*Notogomphus cottarellii*) and Rüppell’s Longleg (*N. ruppeli*) are used as monitoring species for habitat quality.
- The results demonstrate the significance of the natural and semi-natural habitats at the Kafa Biosphere Reserve for conserving Ethiopia’s biodiversity and endemics.



The Odonata Team (photo: Viola Clausnitzer; Klaas-Douwe B. Dijkstra)

## 1. Introduction

The insect order Odonata includes dragonflies and damselflies (hereafter referred to as “dragonflies” only), which all breed exclusively in freshwater habitats. Many species are sensitive to the disturbance of such sites and, therefore, are considered good indicators of anthropogenic change.

A survey of the Kafa Biosphere Reserve (Kafa BR) in December 2014 recorded only 33 dragonfly species in total, which is just over 30% of the species known from Ethiopia, while closer to 70% were considered likely to be present. The main recommendation of the report of the first biodiversity assessment was therefore to sample during the wet season in the boreal summer, which was done in August 2019.

This report details the results of the follow-up survey, undertaken in the first half of August 2019. Its goals were to (1) complete the list of species present; (2) obtain more data on the distribution and ecology of the localised and threatened species; and (3) provide training in the identification of the species, which are good flagships and indicators for conservation in the region.

Additional details on the research history, diversity, biogeography and ecology of Ethiopia's Odonata are provided in the previous report (Clausnitzer, 2017), as well as by Clausnitzer & Dijkstra (2005) and Consiglio (1978).

## 2. Materials and methods

### 2.1 Study area

The study sites listed in Table 1 cover all types of waters (headwaters, streams, rivers, wetlands, bogs, temporary pools) and landscapes (montane, bamboo, secondary and coffee forests, wooded savannah, grassland, cultivated fields) available in the region from just under 1,300 m altitude to about 2,600 m a.s.l.

### 2.2 Sampling and collecting methods

Adult dragonflies were observed with binoculars and caught with butterfly nets, mostly between 10 am and 4 pm. Adults depend on warmth and sunshine for their activity, but despite frequent rain and often overcast days, we believe the lists for most sites are generally complete. In most cases, adults were identified in the field using Dijkstra & Clausnitzer (2014). Collected adults were put in acetone for a night, dried and then stored in paper envelopes. Dragonfly larvae were caught in the water using a kitchen sieve or scoop net and subsequently stored in alcohol.

The authors were supported by Gebre Egzeabeher Hailay (EBI), Manaye Misganaw (EBI), Abdu Siraj Abagaro (Ranger), Abera Hoeto (Ranger), Mitiku Gebremariam (Ranger), Seid Mohamed (Bonga University), Teferi Phaulos (Bonga University) while a few extra records were provided by Tom Kirschey and Hendrik Müller, members of the herpetological team.

**Table 1:** List of study sites, characteristics and survey dates

No	Full survey	Position	Site	Date
1	yes	Between Bonga and Gimbo	Temporary pools in Shorori quarry	30/07/2019
2	yes	Between Bonga and Gimbo	Alemgono Wetland	30/07/2019
3	yes	Between Bonga and Gimbo	Shorori Wetland, stream and forest	30/07/2019
4	yes	Between Mera and Boka	Boka Forest bog and outflow stream	01/08/2019
5	yes	South-east of Boka	River in Bamboo Forest	01/08/2019
6	no		West of Konda	02/08/2019
7	no	Between Saja and Boginda	Road on descent to Gojeb	02/08/2019
8	yes	Between Medabo/Set and Boginda	Gojeb River and flooded areas	02/08/2019
9	yes	East of Saja	Wetland and stream on edge of Boginda Forest	02/08/2019
10	no	Between Konda and Medabo	Small river	03/08/2019
11	no	East of Enderach (Andracha)	Bridge on Gumi River	03/08/2019
12	yes	Between Konda and Chotio	North side of Gojeb Wetlands	03/08/2019
13	yes	South of Medabo and Set	East side of Gojeb Wetlands	03/08/2019
14	yes	Between Amiyo (Gojeb) and Arguba	Gojeb River and adjacent savannah	04/08/2019
15	yes	Between Dera (Dara) and Dimbra	Wetland and stream on edge of coffee forest	05/08/2019
16	yes	Between Dera (Dara) and Dimbra	Roadside stream	05/08/2019
17	yes	Between Dera (Dara) and Wushwush	Gravel pits in Komba Forest	05/08/2019
18	yes	West of Wushwush	Stream coming from Wushwush Tea Plantation	05/08/2019
19	no	Between Shaka and Kaka	Forest road	07/08/2019
20	no	South-east of Boka	Pool at edge of Bamboo Forest	07/08/2019
21	no	South-east of Tari	Roadside pools and drain	07/08/2019
22	yes	East of Enderach (Andracha)	Bridge on Gumi River	07/08/2019
23	yes	Between Tari and Felege Selam	Tributary of Gumi River	07/08/2019
24	no	Hill above the Guest House	Open-air museum south-east of Bonga	08/08/2019
25	yes	3 km south-east of Bonga	Forest clearing and swamp	08/08/2019
26	yes	Bonga town	Bonga town	09/08/2019
27	yes	Between Bonga and Awurada (Chiro)	Beha Wetland and its outflow, Kepi River	11/08/2019

### 2.3 Data analysis

Samples were properly prepared and exported in accordance with the national regulations of the Ethiopian Biodiversity Institute (EBI), with the main objective of verifying identifications. Half the material remains at the EBI as a reference, while the exported material will be kept at the Naturalis Biodiversity Center in Leiden, The Netherlands.

Information on point localities and species is stored in an Excel datasheet and all information will be transferred to the Odonata Database of Africa hosted by Jens Kipping. The data will also be added to the IUCN Red List of Threatened Species. Basic analysis was done using functions in Excel.

## 3. Results and discussion

### 3.1 Diversity

The table in Appendix 2 provides details of the 108 dragonfly and damselfly species certain to occur in Ethiopia, with those recorded at or near the Kafa BR during the 2014 and 2019 surveys specified. *Azuragrion nigradorsum* and *Orthetrum brachiale* are best removed from the national list (see Dijkstra & Clausnitzer, 2014) pending confirmation, as they may have been confused with *A. vansomereni* and *O. stemmale*. A total of 57 species was found in the 2019 survey, i.e. 53% of those confirmed for Ethiopia, excluding a possible observation of *Zosteraeschna ellioti* but including larvae of a *Paragomphus* species, a sighting of an unidentified *Phyllomacromia* species, and the finding of wings (without body) of *Gynacantha nigeriensis*. This exceeds the total of 33 species found during the 2014 dry-season survey by 24 species, with 29 species added to the overall Kafa BR list.

The difference between the two surveys is explained partly by the season, as demonstrated by the appearance of species that are presumably widespread at the biosphere reserve like *Africallagma elongatum*, *Anax speratus* and *Pinheyschna waterstoni*, lotic species with a limited flight season like *Notogomphus dorsalis* and *N. lecythus*, and lentic species that need rainfall to form their temporary reproductive habitats like *Pantala flavescens* and *Sympetrum fonscolombii*. Nonetheless, we estimate that about two-thirds of the additions can be explained by the wider exploration of the region in the follow-up survey. Most notably, nine species were added in the relatively low-lying area (1,295-1,375 m a.s.l.) along Gojeb River near Arguba, including river specialists such as *Mesocnemis singularis*, *Pseudagrion gamblesi*, *P. sjoestedti*, *Crenigomphus denticulatus* and *Brachythemis lacustris*, as well as more generalist species like *Ceriagrion suave*, *Pseudagrion hamoni*, *Orthetrum chrysostigma* and *Trithemis aconita*. Indeed, this is the only place where a new species for Ethiopia was found (*P. sjoestedti*).

Other additions to the Kafa region are: *Lestes tridens*, *Phaon iridipennis*, *Azuragrion vansomereni*, *Acisoma inflatum*, *Brachythemis impartita*, *Crocothemis sanguinolenta*, *Diplacodes lefebvreii*, *Diplacodes luminans*, *Orthetrum guineense*, *Orthetrum machadoi*, *Orthetrum monardi*, *Tramea basilaris*, *Trithemis kirbyi*.

The five species definitively found in 2014 only were *Zosteraeschna ellioti*, *Gynacantha villosa*, *Palpopleura jucunda*, *Tetrathemis polleni* and *Zygonyx torridus*. The last two were seen only at the low-lying bottom (1,293 m a.s.l.) of Gumi Valley near Awurada, where it rained during our 2019 visit. Sightings of *Gynacantha villosa*

at several sites in 2014 (as well as *G. nigeriensis* at one), demonstrate that adults of this genus are best sought in the dry season, as they only seem present as larvae in temporary pools in the wet.

A total of 63 species is now confirmed for the Kafa BR, but at least 11 more are presumed present based on the proximity of records of the Ethiopian endemic *Elatoneura pasquinii* (see below) as well as the widespread *Africallagma subtile*, *Agriocnemis exilis*, *Anaciaeschna triangulifera*, *Anax ephippiger*, *Gynacantha vesiculata*, *Paragomphus alluaudi*, *Phyllomacromia picta*, *Chalcostephia flavifrons*, *Orthetrum hintzi* and *Zygonyx natalensis*. Thus, the total number of species in the region should be at least 75 and possibly even 80 species.

### 3.2 Sites and habitats

By far the highest number of species recorded at any site was the 35 species from lower Gojeb River (site 14). This site is at lower elevation for the most part and has very high habitat heterogeneity of lentic and lotic habitats. Two sites which scored 16 species each were the Gojeb Wetlands (site 8) and temporary pools at Shorori (site 1). For most of the other sites fewer than four species were recorded, but this may partly be because the sampling intensity was different due to time and weather constraints.

Similar to the findings of Dijkstra & Clausnitzer (2005) and Clausnitzer (2017) the high proportion of endemic species is notable. The species number recorded for the Kafa BR could be raised tremendously, something that had already been suspected based on the report from the first survey (Clausnitzer, 2017). The general pattern of a species-poor but endemic-rich fauna and flora is most likely a result of the area's geological history and present-day isolation. The Ethiopian Highlands have undergone heavy volcanism and climate changes, which might be responsible for the relatively high level of adaptiveness.

### 3.3 Species

The first survey recorded seven of the twelve species unique to Ethiopia, while fieldwork in March 2004 had found an eighth endemic and the follow-up assessment added a ninth.

Nine of the twelve species known to be endemic to Ethiopia are confirmed present at the Kafa BR, as is one subspecies, *Palpopleura jucunda radiata*. Four of these have a similar ecology, favouring (often swift) streams typically near a forest: *Pseudagrion guichardi* and *Atoconeura aethiopica*, both ranked Vulnerable on the IUCN

Red List of Threatened Species, and *Notogomphus cotarellii* and *N. ruppeli*, both considered Endangered. All appear present from just under 1,600 to almost 2,600 m a.s.l. in the region, except *N. ruppeli*, which was not found below 1,900 m, neither there nor elsewhere in Ethiopia. The Near Threatened *Paragomphus crenigomphoides* may belong to this group, too. The only adult record (obtained in 2004) was near Wushwush at 1,845 m a.s.l., although possible larvae were found at 1,580 m a.s.l. in 2019. Recorded between 1,630 and 2,420 m a.s.l. in south-western Ethiopia, *Orthetrum kristenseni* has a similar altitudinal range but favours boggy pools. However, being much scarcer than its congeners *O. caffrum*, *O. julia* and *O. stemmale* at such habitats, it seems more sensitive to the heavy grazing and trampling impacts there, possibly relying on more natural bogs for its survival. Its current listing as Least Concern may therefore be somewhat optimistic.

The Vulnerable *Pseudagrion kaffinum* and Least Concern *Trithemis ellenbeckii* regionally have a lower and narrower altitudinal range, from 1,500 to 1,800 m a.s.l., as their preferred habitat of slower and more open streams and rivers occurs to be lower. Another endemic, the Vulnerable *Elatoneura pasquinii*, may occur with them. While not yet reported at the Kafa BR, it has been found between 1,610 and 1,650 m a.s.l., both to the east and north-west of the region. We are confident that it will be found, for example at Gojeb or its tributaries within the large Gojeb Wetland complex. Finally, multiple individuals of the Vulnerable *Crenigomphus denticulatus* were found among tall grass about 650 m from Gojeb River near Arguba, which flows at 1,295 m a.s.l. here. Although they may have emerged from one of the tributaries, larger rivers (Gojeb is 25 m wide here) are suitable for *Crenigomphus* species. The species was only known from three records in the 19th century and one in 1962 (Pinhey, 1982) and is new to the Kafa BR.

The two remaining species endemic to Ethiopia, the Near Threatened *Ischnura abyssinica* and the Vulnerable *Crenigomphus abyssinicus*, were not found during either survey. Most reliable records of the first are from open pools between 2,000 and 3,000 m a.s.l., so we suspect there is little suitable habitat in south-western Ethiopia. The second species is even more poorly known than *C. denticulatus*, with just a few specimens of mostly uncertain provenance, the last one collected in 1914 (pers. comm. J. Kipping).

Two additional species present at the Kafa BR have very limited ranges outside of Ethiopia. The Vulnerable

*Pinheyschna waterstoni* is also known from Jebel Marra of western Sudan and probably occurs in a wide range of faster-flowing waters at the BR, from at least 1,300 to 2,600 m a.s.l. The Least Concern *Notogomphus lecythus* is also known from a small area of western Kenya. It was only recorded along Gojeb, but surveyed at both the lower (1,295 m a.s.l.) and higher (1,560 m a.s.l.) localities.

Ethiopia's endemics appear to be quite tolerant to human impacts, probably because they evolved in response to the highlands' constant climatic and geological changes. Indeed, some of the species may not be as threatened as their current Red List status suggests. Nonetheless, given the pressures on the remaining forests, we recommend monitoring of these endemic species. Furthermore, as observed above for *Orthetrum kristenseni*, species of open habitats may be more sensitive than often believed, due to the increasing pressures of livestock on such sites.

## 4. Conclusions and recommendations for conservation and monitoring

### 4.1 Recommendations for dragonfly conservation

Deforestation and environmental degradation due to human disturbance, along with an increase in water pollution due to economic growth, even in remote areas, pose a major threat to Ethiopia's environmental health. Much of the natural landscape has been turned into agricultural land. Around 95% of Ethiopia's original forest has already been lost to agriculture and human settlements (Gordon & Carillet, 2003). As explained above, Ethiopia's endemic dragonflies are relatively tolerant to habitat disturbance. Still, even species adaptable to altered landscapes may disappear in the face of ongoing habitat change due to pollution, water extraction and reforestation with eucalypts.

The endemic species which require forested and clear rocky streams or rivers, such as the Ethiopian Sprite (Figure 1a), Cottarelli's Longleg (Figures 3a, b), Rüppell's Longleg (Figure 3c) and Ethiopian Highlander (Figure 4a) are of conservation concern and act as monitoring species for the core zones of the Kafa BR. Since they are easy to see and endemic to the montane habitats, the Ethiopian Highlander (Figure 4a), Ethiopian Skimmer (Figures 5a, b), Ethiopian Sprite (Figure 1a) and Kafa Sprite (Figure 1b) are considered as flagship species for the Kafa BR.

Conservation efforts at the Kafa BR have thus largely focused on the threatened montane upland habitat, which explains why core zones have not yet been

established in the wetlands. The huge wetlands of Gojeb River should be considered as a core zone, as well as the wetlands in the Afroalpine zone, i.e. beyond Boka Forest. Gojeb River especially, and streams draining into the Gojeb in the Arguba investment area, have a very high species diversity and there the endemic Little Talontail (*Crenigomphus denticulatus*) (Figure 2a and b) was recorded for the first time after its description over 60 years ago. This is only the second locality where it is known to occur and it might be considered as a flagship species for the lower habitats at the Kafa BR.

### 4.2 Suggestions for future studies

We currently have good data for the months of August (2019 survey) and December (2014 survey), as well as a few records from the authors' brief visit in March 2004. To complete the seasonal picture we suggest research in (1) April and May, as the start of the rains may be optimal for many of the lotic species; and (2) October, as the end of the rains may be the time when most lentic species emerge.

Concerning areal coverage, large parts of the west and the north of the Kafa BR have never been surveyed. It would be good to visit these regions as well. A detailed survey on the endemic species should be encouraged. This would allow the future monitoring of habitat quality.

## 5. References

For more reference on the odonatological history of Ethiopia consult Clausnitzer & Dijkstra (2005) and Clausnitzer (2017).

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## 6. Annex

### 6.1 Appendices

**Appendix 1:** List of collecting sites in 2019 for dragonflies including locality information (see also Table 1)

No	Position	Survey date	Additional date	Altitude min (a.s.l.)	Altitude max (a.s.l.)	Latitude	Longitude
1	Between Bonga and Gimbo	30/07/2019	10/08/2019	1,690 m	1,700 m	7.36371088	36.21228409
2	Between Bonga and Gimbo	30/07/2019		1,710 m	1,720 m	7.361938	36.2219696
3	Between Bonga and Gimbo	30/07/2019		1,620 m	1,630 m	7.359440804	36.2060318
4	Between Mera and Boka	01/08/2019	07/08/2019	2,420 m		7.294794559	36.37634659
5	South-east of Boka	01/08/2019		2,620 m		7.240357876	36.45194626
6	West of Konda	02/08/2019		1,610 m		7.600477695	35.99933243
7	Between Saja and Boginda	02/08/2019				7.507861614	36.05672836
8	Between Medabo/Set and Boginda	02/08/2019		1,560 m		7.55403614	36.0593605
9	East of Saja	02/08/2019		2,130 m	2,140 m	7.501667023	36.09070206
10	Between Konda and Medabo	03/08/2019		1,575 m		7.573671818	36.03019333
11	East of Enderach (Andracha)	03/08/2019		1,575 m		7.20290947	36.28380585
12	Between Konda and Chotio	03/08/2019		1,580 m		7.593741417	35.97877121
13	South of Medabo and Set	03/08/2019		1,560 m		7.563093185	36.05007172
14	Between Amiyo (Gojeb) and Arguba	04/08/2019	06/08 and 12/08/2019	1,295 m	1,375 m	7.409640312	36.39720535
15	Between Dera (Dara) and Dimbra	05/08/2019		1,780 m		7.320901871	35.99799728
16	Between Dera (Dara) and Dimbra	05/08/2019		1,790 m		7.319906235	36.00978088
17	Between Dera (Dara) and Wushwush	05/08/2019		1,950 m		7.310642242	36.0759964
18	West of Wushwush	05/08/2019		1,910 m		7.307193279	36.12187195
19	Between Shaka and Kaka	07/08/2019		1,920 m		7.288095474	36.48557663
20	South-east of Boka	07/08/2019		2,665 m		7.243246555	36.4432106
21	South-east of Tari	07/08/2019		2,295 m		7.161600113	36.33116913
22	East of Enderach (Andracha)	07/08/2019	03/08 and 05/08/2019	1,575 m		7.202408314	36.28335953
23	Between Tari and Felege Selam	07/08/2019		1,580 m		7.122454643	36.38181305
24	Hill above the Guest House	08/08/2019		1,970 m		7.253574371	36.2634201
25	3 km south-east of Bonga	08/08/2019		1,940 m	1,980 m	7.247397423	36.27408981
26	Bonga town	09/08/2019		1,760 m		7.262025356	36.24902344
27	Between Bonga and Awurada (Chiro)	11/08/2019		1,900 m		7.180156708	36.20835876

**Appendix 2:** List of the Odonata (dragonflies and damselflies) of Ethiopia according to literature studies and surveys by the authors, their Red List status and their occurrence at the Kafa BR; 1: recorded by the authors in 2004, 2014 or 2019, 2: literature record

Scientific name	Common name	IUCN Red List	Kafa BR	2014	2019
<b>Zygoptera (Selys, 1854)</b>					
<b>Lestidae (Calvert, 1901)</b>					
<i>Lestes</i> (Leach, 1815)	True Spreadwings				
<i>Lestes tridens</i> (McLachlan, 1895)	Spotted Spreadwing		1		1
<i>Lestes virgatus</i> (Burmeister, 1839)	Smoky Spreadwing		1	1	1
<i>Lestes pallidus</i> (Rambur, 1842)	Pallid Spreadwing				
<b>Calopterygidae (Selys, 1850)</b>					
<i>Phaon</i> (Selys, 1853)	African Demoiselles				
<i>Phaon iridipennis</i> (Burmeister, 1839)	Glistening Demoiselle		1		1
<b>Chlorocyphidae (Cowley, 1937)</b>					
<i>Platycypha</i> (Fraser, 1949)	Dancing Jewels				
<i>Platycypha caligata</i> (Selys, 1853)	Common Dancing Jewel		1	1	1
<b>Platycnemididae (Yakobson &amp; Bianchi, 1905)</b>					
<i>Elattoneura</i> (Cowley, 1935)	African Threadtails				
<i>Elattoneura pasquinii</i> (Consiglio, 1978)	Ethiopian Threadtail	VU	2		
<i>Mesocnemis</i> (Karsch, 1891)	Riverjacks				
<i>Mesocnemis singularis</i> (Karsch, 1891)	Common Riverjack		1		1
<b>Coenagrionidae (Kirby, 1890)</b>					
<i>Aciagrion</i> (Selys, 1891)	Slims				
<i>Aciagrion gracile</i> (Sjöstedt, 1909)	Graceful Slim		1	1	1
<i>Africallagma</i> (Kennedy, 1920)	African Bluets				
<i>Africallagma elongatum</i> (Martin, 1907)	Elongate Bluet		1		1
<i>Africallagma subtile</i> (Ris, 1921)	Fragile Bluet		2		
<i>Agriocnemis</i> (Selys, 1877)	Wisps				
<i>Agriocnemis exilis</i> (Selys, 1872)	Little Wisp		2		
<i>Agriocnemis inversa</i> (Karsch, 1899)	Highland Wisp				
<i>Agriocnemis sania</i> (Nielsen, 1959)	Nile Wisp				
<i>Azuragrion</i> (May, 2002)	Sailing Bluets				
<i>Azuragrion nigradorsum</i> (Selys, 1876)	Sailing Bluet				
<i>Azuragrion somalicum</i> (Longfield, 1931)	Somali Bluet				
<i>Azuragrion vansomerani</i> (Pinhey, 1956)	Tiny Bluet		1		1
<i>Ceriagrion</i> (Selys, 1876)	Citrils				
<i>Ceriagrion glabrum</i> (Burmeister, 1839)	Common Citril		1	1	1
<i>Ceriagrion suave</i> (Ris, 1921)	Suave Citril		1		1
<i>Ischnura</i> (Charpentier, 1840)	Bluetails				
<i>Ischnura abyssinica</i> (Martin, 1907)	Ethiopian Bluetail	NT			
<i>Ischnura senegalensis</i> (Rambur, 1842)	Tropical Bluetail				
<i>Proischnura</i> (Kennedy, 1920)	Fork-tailed Bluets				
<i>Proischnura subfurcata</i> (Selys, 1876)	Fork-tailed Bluet		1	1	1
<i>Pseudagrion</i> (Selys, 1876)	Sprites				
<i>Pseudagrion</i> (Selys, 1876) (A-group)					
<i>Pseudagrion gamblesi</i> (Pinhey, 1978)	Great Sprite		1		1

Scientific name	Common name	IUCN Red List	Kafa BR	2014	2019
<i>Pseudagrion guichardi</i> (Kimmins, 1958)	Ethiopian Sprite	VU	1	1	1
<i>Pseudagrion kaffinum</i> (Consiglio, 1978)	Kaffa Sprite	VU	1	1	1
<i>Pseudagrion kersteni</i> (Gerstäcker, 1869)	Powder-faced Sprite		1	1	1
<i>Pseudagrion salisburyense</i> (Ris, 1921)	Slate Sprite				
<i>Pseudagrion spernatum</i> (Selys, 1881)	Upland Sprite		1	1	1
<i>Pseudagrion</i> (Selys, 1876) (B-group)					
<i>Pseudagrion commoniae</i> (Förster, 1902)	Black Sprite				
<i>Pseudagrion hamoni</i> (Fraser, 1955)	Swarthy Sprite		1		1
<i>Pseudagrion massaicum</i> (Sjöstedt, 1909)	Masai Sprite				
<i>Pseudagrion niloticum</i> (Dumont, 1978)	Nile Sprite				
<i>Pseudagrion nubicum</i> (Selys, 1876)	Bluetail Sprite				
<i>Pseudagrion sjoestedti</i> (Förster, 1906)	Variable Sprite		1		1
<i>Pseudagrion sublacteum</i> (Karsch, 1893)	Cherry-eye Sprite				
<i>Pseudagrion torridum</i> (Selys, 1876)	Wing-tailed Sprite				
<b>Anisoptera (Selys, 1854)</b>					
<b>Aeshnidae (Leach, 1815)</b>					
<i>Anaciaeschna</i> (Selys, 1878)	Evening Hawker				
<i>Anaciaeschna triangulifera</i> (McLachlan, 1896)	Evening Hawker		2		
<i>Anax</i> (Leach, 1815)	Emperors				
<i>Anax ephippiger</i> (Burmeister, 1839)	Vagrant Emperor		2		
<i>Anax imperator</i> (Leach, 1815)	Blue Emperor		1	1	1
<i>Anax speratus</i> (Hagen, 1867)	Eastern Orange Emperor		1		1
<i>Gynacantha</i> (Rambur, 1842)	True Duskhawkers				
<i>Gynacantha nigeriensis</i> (Gambles, 1956)	Yellow-legged Duskhawker		1	1	1
<i>Gynacantha vesiculata</i> (Karsch, 1891)	Lesser Girdled Duskhawker		2		
<i>Gynacantha villosa</i> Grünberg, 1902)	Brown Duskhawker		1	1	
<i>Pinheyschna</i> (Peters & Theischinger, 2011)	Stream Hawkets				
<i>Pinheyschna waterstoni</i> (Peters & Theischinger, 2011)	Ethiopian Hawker	VU	1		1
<i>Zosteraeschna</i> (Peters & Theischinger, 2011)	Highland Hawkets				
<i>Zosteraeschna ellioti</i> (Kirby, 1896)	Highland Hawker		1	1	?
<b>Gomphidae (Rambur, 1842)</b>					
<i>Crenigomphus</i> (Selys, 1892)	Talontails				
<i>Crenigomphus abyssinicus</i> (Selys, 1878)	Ethiopian Talontail	VU			
<i>Crenigomphus denticulatus</i> (Selys, 1892)	Little Talontail	VU	1		1
<i>Crenigomphus renei</i> (Fraser, 1936)	Western Talontail				
<i>Ictinogomphus</i> (Cowley, 1934)	Tigertails				
<i>Ictinogomphus ferox</i> (Rambur, 1842)	Common Tigertail				
<i>Notogomphus</i> (Selys, 1858)	Tonglegs				
<i>Notogomphus cottarellii</i> (Consiglio, 1978)	Cottarelli's Longleg	EN	1	1	1
<i>Notogomphus dorsalis</i> (Selys, 1858)	Little Longleg		1		1
<i>Notogomphus lecythus</i> (Campion, 1923)	Northern Longleg		1		1
<i>Notogomphus ruppeli</i> (Selys, 1858)	Rüppell's Longleg	EN	1	1	1

Scientific name	Common name	IUCN Red List	Kafa BR	2014	2019
<i>Paragomphus</i> (Cowley, 1934)	Hooktails				
<i>Paragomphus alluaudi</i> (Martin, 1915)	Highland Hooktail		2		
<i>Paragomphus crenigomphoides</i> (Clausnitzer & Dijkstra, 2005)	Ethiopian Hooktail	NT	1		
<i>Paragomphus genei</i> (Selys, 1841)	Common Hooktail				
<b>Macromiidae (Needham, 1903)</b>					
<i>Phyllomacromia</i> (Selys, 1878)	African Cruisers				
<i>Phyllomacromia pallidinervis</i> (Förster, 1906)	Pale-veined Cruiser				
<i>Phyllomacromia picta</i> (Hagen in Selys, 1871)	Darting Cruiser		2		
<i>Phyllomacromia</i> sp.			1	1	1
<b>Libellulidae (Leach, 1815)</b>					
<i>Acisoma</i> (Rambur, 1842)	Pintails				
<i>Acisoma inflatum</i> (Selys, 1882)	Stout Pintail		1		1
<i>Acisoma variegatum</i> (Kirby, 1898)	Slender Pintail				
<i>Atoconeura</i> (Karsch, 1899)	Highlanders				
<i>Atoconeura aethiopica</i> (Kimmins, 1958)	Ethiopian Highlander	VU	1	1	1
<i>Brachythemis</i> (Brauer, 1868)	Groundlings				
<i>Brachythemis impartita</i> (Karsch, 1890)	Northern Banded Groundling		1		1
<i>Brachythemis lacustris</i> (Kirby, 1889)	Red Groundling		1		1
<i>Brachythemis leucosticta</i> (Burmeister, 1839)	Southern Banded Groundling				
<i>Bradinopyga</i> (Kirby, 1893)	Rockdwellers				
<i>Bradinopyga strachani</i> (Kirby, 1900)	Red Rockdweller				
<i>Chalcostephia</i> (Kirby, 1889)	Inspector				
<i>Chalcostephia flavifrons</i> (Kirby, 1889)	Inspector		2		
<i>Crocothemis</i> (Brauer, 1868)	Scarlets				
<i>Crocothemis erythraea</i> (Brullé, 1832)	Broad Scarlet		1	1	1
<i>Crocothemis sanguinolenta</i> (Burmeister, 1839)	Little Scarlet		1		1
<i>Diplacodes</i> (Kirby, 1889)	Perchers				
<i>Diplacodes lefebvrii</i> (Rambur, 1842)	Black Percher		1		1
<i>Diplacodes luminans</i> (Karsch, 1893)	Barbet Percher		1		1
<i>Hemistigma</i> (Kirby, 1889)	Piedspots				
<i>Hemistigma albipunctum</i> (Rambur, 1842)	African Piedspot				
<i>Nesciothemis</i> (Longfield, 1955)	Blacktails and Peppertails				
<i>Nesciothemis farinosa</i> (Förster, 1898)	Eastern Blacktail		1	1	1
<i>Orthetrum</i> (Newman, 1833)	Skimmers				
<i>Orthetrum abbotti</i> (Calvert, 1892)	Little Skimmer		1	1	1
<i>Orthetrum brachiale</i> (Palisot de Beauvois, 1817)	Banded Skimmer				
<i>Orthetrum brevistylum</i> (Kirby, 1896)	Three-striped Skimmer				
<i>Orthetrum caffrum</i> (Burmeister, 1839)	Two-striped Skimmer		1	1	1
<i>Orthetrum chrysostigma</i> (Burmeister, 1839)	Epaulet Skimmer		1		1
<i>Orthetrum guineense</i> (Ris, 1910)	Guinea Skimmer		1		1
<i>Orthetrum hintzi</i> (Schmidt, 1951)	Dark-shouldered Skimmer		2		

Scientific name	Common name	IUCN Red List	Kafa BR	2014	2019
<i>Orthetrum julia</i> (Kirby, 1900)	Julia Skimmer		1	1	1
<i>Orthetrum kristenseni</i> (Ris, 1911)	Ethiopian Skimmer		1	1	1
<i>Orthetrum machadoi</i> (Longfield, 1955)	Highland Skimmer		1		1
<i>Orthetrum monardi</i> (Schmidt, 1951)	Woodland Skimmer		1		1
<i>Orthetrum sabina</i> (Drury, 1770)	Slender Skimmer				
<i>Orthetrum stemmale</i> (Burmeister, 1839)	Bold Skimmer		1	1	1
<i>Orthetrum trinacia</i> (Selys, 1841)	Long Skimmer				
<i>Palpopleura</i> (Rambur, 1842)	Widows				
<i>Palpopleura deceptor</i> (Calvert, 1899)	Deceptive Widow				
<i>Palpopleura jucunda</i> (Rambur, 1842)	Yellow-veined Widow		1	1	
<i>Palpopleura lucia</i> (Drury, 1773)	Lucia Widow		1	1	1
<i>Palpopleura portia</i> (Drury, 1773)	Portia Widow		1	1	1
<i>Pantala</i> (Hagen, 1861)	Rainpool Gliders				
<i>Pantala flavescens</i> (Fabricius, 1798)	Wandering Glider		1		1
<i>Rhyothemis</i> (Hagen, 1867)	Flutterers				
<i>Rhyothemis semihyalina</i> (Desjardins, 1832)	Phantom Flutterer				
<i>Sympetrum</i> (Newman, 1833)	True Darters				
<i>Sympetrum fonscolombii</i> (Selys, 1840)	Nomad or Red-veined Darter		1		1
<i>Tetrathemis</i> (Brauer, 1868)	Elfs				
<i>Tetrathemis polleni</i> (Selys, 1869)	Black-splashed Elf		1	1	
<i>Tholymis</i> (Hagen, 1867)	Twister				
<i>Tholymis tillarga</i> (Fabricius, 1798)	Twister				
<i>Tramea</i> (Hagen, 1861)	Saddlebag Gliders				
<i>Tramea basilaris</i> (Palisot de Beauvois, 1817)	Keyhole Glider		1		1
<i>Tramea limbata</i> (Desjardins, 1832)	Ferruginous Glider				
<i>Trithemis</i> (Brauer, 1868)	Dropwings				
<i>Trithemis aconita</i> (Lieftinck, 1969)	Halfshade Dropwing		1		1
<i>Trithemis annulata</i> (Palisot de Beauvois, 1807)	Violet Dropwing				
<i>Trithemis arteriosa</i> (Burmeister, 1839)	Red-veined Dropwing		1	1	1
<i>Trithemis dejouxi</i> (Pinhey, 1978)	Stonewash Dropwing				
<i>Trithemis donaldsoni</i> (Calvert, 1899)	Denim Dropwing				
<i>Trithemis ellenbeckii</i> (Förster, 1906)	Ethiopian Dropwing		1	1	1
<i>Trithemis furva</i> (Karsch, 1899)	Navy Dropwing		1	1	1
<i>Trithemis imitata</i> (Pinhey, 1961)	Copycat Dropwing				
<i>Trithemis kirbyi</i> (Selys, 1891)	Orange-winged Dropwing		1		1
<i>Trithemis stictica</i> (Burmeister, 1839)	Jaunty Dropwing		1	1	1
<i>Urothemis</i> (Brauer, 1868)	Baskers				
<i>Urothemis assignata</i> (Selys, 1872)	Red Basker				
<i>Urothemis edwardsii</i> (Selys, 1849)	Blue Basker				
<i>Zygonyx</i> (Hagen, 1867)	Cascaders				
<i>Zygonyx natalensis</i> (Martin, 1900)	Blue Cascader		2		
<i>Zygonyx torridus</i> (Kirby, 1889)	Ringed Cascader		1	1	

**Appendix 3:** Record sites of the Odonata (dragonflies and damselflies) at the Kafa BR

Scientific name/ Site No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total Sites
<i>Acia grion gracile</i>								X																				1
<i>Acisoma inflatum</i>													X				X											2
<i>Africallagma elongatum</i>	X						X	X					X	X	X		X	X				X	X	X				11
<i>Anax imperator</i>	X												X	X			X											4
<i>Anax spec.</i>				X																								1
<i>Anax speratus</i>	X							X		X				X														4
<i>Atoconeura aethiopica</i>				X	X											X	X	X	X			X	X		X			8
<i>Azuragrion vansomereni</i>														X			X											2
<i>Brachythemis impartita</i>											X																	1
<i>Brachythemis lacustris</i>													X															1
<i>Brachythemis spec.</i>																		X										1
<i>Ceragrion glabrum</i>	X		X					X					X	X			X											6
<i>Ceragrion suave</i>													X															1
<i>Crenigomphus denticulatus</i>													X															1
<i>Crocothemis erythraea</i>													X	X	X													3
<i>Crocothemis sanguinolenta</i>												X																2
<i>Diplacodes lefebvreii</i>																	X											1
<i>Diplacodes luminans</i>	X													X														2
<i>Gynacantha nigariensis</i>																												1
<i>Lestes tridens</i>	X																X											2
<i>Lestes virgatus</i>		X	X					X					X				X											5
<i>Mesocnemis singularis</i>													X															1
<i>Nesiothemis farinosa</i>	X												X															2
<i>Notogomphus dorsalis</i>			X											X									X		X			4

Scientific name/ Site No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total Sites
<i>Notogomphus cottarellii</i>														X														2
<i>Notogomphus lecythus</i>							X						X															2
<i>Notogomphus ruppeli</i>			X																					X				2
<i>Notogomphus spec.</i>			X					X									X											3
<i>Orthetrum abbotti</i>													X															1
<i>Orthetrum cafferum</i>								X				X	X	X	X													5
<i>Orthetrum chrysostigma</i>												X	X	X														1
<i>Orthetrum guineense</i>	X												X	X														3
<i>Orthetrum julia</i>	X	X	X				X	X			X	X	X	X	X	X		X	X	X		X	X					13
<i>Orthetrum kristenseni</i>								X																X				2
<i>Orthetrum machadoi</i>								X					X															2
<i>Orthetrum monardi</i>	X																											1
<i>Orthetrum stemmale</i>	X	X	X									X																3
<i>Palpopleura lucia</i>	X	X	X					X			X	X	X	X			X											7
<i>Palpopleura portia</i>	X	X	X					X				X									X			X				6
<i>Pantala flavescens</i>	X												X												X			3
<i>Paragomphus spec.</i>																					X							1
<i>Phaon iridipennis</i>								X																				1
<i>Phyllomacromia spec.</i>											X																	1
<i>Pinheyschna waterstoni</i>					X					X												X	X		X			5
<i>Platycypha caligata</i>			X					X			X			X				X	X			X	X			X		8
<i>Proischnura subfucata</i>	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	16
<i>Pseudagrion gamblesii</i>													X															1
<i>Pseudagrion guichardi</i>				X					X						X	X		X	X			X	X		X			6
<i>Pseudagrion hamoni</i>													X															1
<i>Pseudagrion kaffinum</i>								X	X	X																		2

Scientific name/ Site No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total Sites
<i>Pseudagrion kersteni</i>	x												x															2
<i>Pseudagrion sjoestedti</i>														x														1
<i>Pseudagrion spernatum</i>	x		x	x	x							x		x	x	x		x				x	x					14
<i>Sympetrum foncolombii</i>	x												x												x			3
<i>Tramea basilaris</i>	x																											1
<i>Trithemis weneri</i>								x																				1
<i>Trithemis aconita</i>														x														1
<i>Trithemis arteriosa</i>	x													x														2
<i>Trithemis ellenbeckii</i>	x							X	x				x															4
<i>Trithemis furva</i>														x														1
<i>Trithemis kirbyi</i>	x																											1
<i>Trithemis spec.</i>																					x							1
<i>Trithemis stictica</i>	x							X				x																3
<i>Zosterateschna ellioti</i>																												1
Total species per site	16	9	12	7	2	2	2	3	5	3	2	7	13	35	6	6	10	9	2	1	1	7	10	1	11	2	3	



## 6.2 Photos



Figure 1a



Figure 1b



Figure 1c

### Figures 1a-c:

The endemic Sprite *Pseudagrion guichardi* (a) and *P. kaffinum* (b) are the most readily recognisable flagship species at the Kafa BR, as males of both have an orange labrum ('lip') and blue abdomen tip ('tail'). *Pseudagrion guichardi* is much larger than *P. kaffinum* and occurs in higher elevations along clear and fast streams, while the Kaffa Sprite has been recorded from Gojeb River. Similar is *P. spernatum* (c, left species) which almost invariably occurs alongside *Pseudagrion guichardi* (c, right species), but is smaller and has no orange face. (photos: Viola Clausnitzer; Klaas-Douwe B. Dijkstra)



Figure 2a



Figure 2b

### Figures 2a, b:

The endemic *Crenigomphus denticulatus* (left female, right male) was recorded for the first time in 57 years. Its precise habits are unknown, but it may be a flagship species of large rivers like Gojeb. (photos: Viola Clausnitzer; Klaas-Douwe B. Dijkstra)



**Figures 3a-d:** The endemic *Notogomphus cottarellii* (above; female on the left, male on the right) and *N. ruppeli* (below; female on the left, male just after emergence from its larval skin on the right) are indicators of fairly natural streams. While the former is much larger than the latter, they are easily confused with each other and with *N. dorsalis* and *N. lecythus* when not closely examined. (photos: Viola Clausnitzer; Klaas-Douwe B. Dijkstra)



Figure 4a



Figure 4b

**Figures 4a, b:** The endemic *Atoconeura aethiopica* (a) is a flagship species of forested streams and rivers. Mature males are deceptively similar to the abundant *Orthetrum julia* (b) although that species will rarely perch on rocks by fast-flowing water (as seen on the left) and never has the thin central yellow line between the forewing bases and the 'neck'. (photos: Viola Clausnitzer; Klaas-Douwe B. Dijkstra)



Figure 5a



Figure 5b

**Figures 5a, b:** The endemic *Orthetrum kristenseni* is much scarcer at the Kafa BR than some other skimmer species and may thus be an indicator of relatively pristine bogs and wetlands. It should be separated with care from *O. caffrum* in which the second white stripe is usually more pronounced and the first stripe does not lie right against the spiracle, the dot-like opening on the side of the thorax. (photos: Viola Clausnitzer; Klaas-Douwe B. Dijkstra)