



Dragonflies and damselflies (Odonata) at the Kafa Biosphere Reserve

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Highlights

- A total of 33 Odonata (=dragonflies and damselflies, hereafter referred to as “dragonflies”) species from seven families were recorded (31.1% of Ethiopia’s dragonfly fauna and 65% of dragonfly fauna ever recorded in the Kafa BR).
- A total of 51 dragonfly species from nine families has ever been recorded in the Kafa BR.
- Three species are new to Ethiopia (*Aciagrion gracile*, *Tetrathemis polleni*, *Phyllomacromia spec.*).
- Twelve species were recorded the first time for the Kafa BR, including the endemic and endangered *Notogomphus ruppeli*.
- Eight of the recorded species are endemic to the Ethiopian highlands (*Pseudagrion guichardi*, *P. kaffinum*, *Notogomphus cottarellii*, *N. ruppeli*, *Atoconeura aethiopica*, *Orthetrum kristenseni*, *Palpopleura jucunda radiata*, *Trithemis ellenbeckii*).
- Five species are threatened according to the global IUCN Red List of Threatened Species (three ‘vulnerable’, two ‘endangered’), all of them endemic to Ethiopia.
- Endemic species were only found in montane and submontane forest streams.
- The lower areas (wetlands) exhibit higher diversity, but no endemic species.
- The Ethiopian Highlander (*Atoconeura aethiopica*), the Ethiopian Sprite (*Pseudagrion guichardi*) and the Kaffa Sprite (*Pseudagrion kaffinum*) are flagship species.
- In addition to these flagship species, the montane forest gomphids Cottarelli’s Longlegs (*Notogomphus cottarellii*) and Rüpell’s Longlegs (*Notogomphus ruppeli*) could be good indicators of the status of conservation of the forests.
- These findings show the great significance of the natural habitats within the Kafa BR for maintaining Ethiopia’s diversity and high level of endemism and the importance of conserving the remaining natural and semi-natural sites.

1. Introduction

The degree of endemism in Ethiopia's flora and fauna is exceptionally high. This is largely the result of the vast highlands being isolated by the surrounding dry lowlands. Only the most versatile and mobile species tend to be found in both Ethiopia and the rest of tropical Africa. These are mainly montane species. Most of Ethiopia's endemic species also belong to the Afrotropical Highlands biome (Kingdon 1989). Despite the many species endemic to Ethiopia, conservation efforts and even knowledge of their habitats are virtually non-existent. The highlands are among the most densely populated areas in Africa, and only small fragments of semi-natural vegetation remain. This loss of natural habitats has taken place over many centuries in the northern and central highlands, but is a more recent phenomenon in the southwest.

The most comprehensive overview of Ethiopian dragonfly fauna is provided by Clausnitzer and Dijkstra (2005), while Consiglio (1978a) provides a review of the history of dragonfly research in Ethiopia. In general, Ethiopian dragonflies were largely neglected in the second half of the 20th century, although Italian scientists undertook a zoological expedition in the early 1970s (Brignolin et al. 1978). The results, published by Consiglio (1978a, 1978b) and Pinhey (1982), include the description of three endemic dragonfly species.

When it comes to dragonflies, Ethiopia is species poor but rich in endemics. Kenya and Uganda have 170 and 228 recorded species, respectively, while Ethiopia has only 106 (Dijkstra & Clausnitzer 2014). This indicates

a data deficiency in Ethiopia's southern and southwestern areas, especially the Gambela area, but also reflects the impoverished forest fauna of Ethiopia due to long-term isolation and a history of strong climatic and habitat changes. Comparing the dragonfly communities of Kenyan and Tanzanian highlands to those from Ethiopia, two main patterns emerge: openland species are generally shared but scarcer in Ethiopia; Ethiopia has much fewer forest species, none of which are shared (see also Clausnitzer & Dijkstra 2005). Most of the species common in open habitats in the Kenyan and Tanzanian highlands above 1450 m a.s.l. are common in Ethiopia and were also recorded during this expedition: *Pseudagrion spernatum*, *Proischnura subfurcata* and *Orthetrum julia* are dominant species in both areas. *Platycypha caligata*, *Ceriagrion glabrum*, *Anax imperator*, *Crocothemis erythraea* and *Pantala flavescens* are also generally widespread in both areas, while species such as *Pseudagrion kersteni*, *Trithemis arteriosa*, *T. annulata*, *Nesiothemis farinosa* and *Crocothemis sanguinolenta* are scarce in upland Ethiopia compared with Kenya and Tanzania. One important factor might be seasonality; fieldwork should be carried out during the rainy season in April and May, especially in the lower wetlands, when one would expect to find more Afrotropical species than currently recorded (including new records for the Ethiopian dragonfly fauna). The heterogeneous habitats of the floodplain and inundation zones around the Gojeb River should support higher dragonfly diversity than currently reported.

2. Materials and Methods

2.1 Study area

Dragonflies were recorded at different study sites: core zones, PFM sites and wetlands. The sample sites were selected based on the presence of aquatic habitats (streams, rivers, headwaters, swamps, etc.).

2.2 Sampling methods

Our team consisted of Thies Geertz, collecting land and freshwater molluscs, Tom Kirschey, surveying amphibians and reptiles, and field assistants Tizita

Tamiru, Mitiku Gebremariam and Admasu Asefa. Adult dragonflies were collected using a sweep net at each sample site (Fig. 5). The weather was always good (full sunshine) and sampling was done between 10 am and 6 pm. Dragonfly larvae were also collected from the water, supplemented by catches from Thies Geertz and Tom Kirschey. In most cases, dragonflies were identified in the field using a hand lens and the identification book by Dijkstra & Clausnitzer (2014).

Table 1: Sample localities. KBR zone: cz: core zone; bz: buffer zone; ccz: candidate core zone. All dates are for December 2014.

Area	Site	KBR	PFM	Code	Date	Habitat	Alt.	Lat.	Long.
Bonga	Bonga	-	-	BG1	03.12.	Small stream behind guesthouse	1832	7.25420°N	36.25762°E
Bonga	Bonga	-	-	BG2	03.12.	Hill behind guesthouse	1980	7.25358°N	36.22633°E
Boka	Boka	cr	-	BK1	04.12.	Stream in wetlands below Boka Forest	2414	7.29467°N	36.37604°E
Boka	Boka	cr	-	BK2	04.12.	Swamp along stream below Boka Forest	2414	7.29467°N	36.37604°E
Bamboo	Bamboo	cr	-	BA1	04.12.	River in bamboo forest	2595	7.24118°N	36.45182°E
Bamboo	Bamboo	cr	-	BA2	04.12.	River in bamboo forest	2650	7.24331°N	36.49564°E
Bonga	Awurada Valley	cr	yes	AW1	05.12.	Gummi River, large river	1293	7.09281°N	36.23154°E
Bonga	Awurada Valley	cr	yes	AW2	05.12.	Floodplain (swampy forest) along Gummi River	1293	7.09281°N	36.23154°E
Bonga	Alemgono	bz	-	AG	06.12.	Wetland, heavily grazed	1706	7.36428°N	36.22602°E
Bonga	Shoriri	bz	yes	SHO1	06.12.	Wetland, undisturbed	1626	7.35707°N	36.20437°E
Bonga	Shoriri	bz	yes	SHO2	06.12.	Stream along forest edge and Shoriri Wetlands	1626	7.35707°N	36.20437°E
Komba	Komba Forest	cz	-	KO1	07.12.	Clear stream in Komba Forest	1847	7.30803°N	36.12201°E
Komba	Komba Forest	-	-	KO2	06.12.	Forest edge	1900	7.10176°N	36.13277°E
Boginda	Gojeb Wetlands	ccz	-	GO-wet1	09.12.	Large river	1530	7.55448°N	36.05687°E
Boginda	Gojeb Wetlands	ccz	-	GO-wet2	09.12.	Gallery forest and wetlands along Gojeb	1530	7.55448°N	36.05687°E
Boginda	Gojeb Wetlands	bz	-	GO-wet3	10.12.	Swampy floodplain north of Gojeb	1516	7.55444°N	36.05209°E
Boginda	Gojeb Wetlands	ccz	-	GO-wet4	10.12.	Stream in floodplain south of Gojeb	1518	7.55442°N	36.05213°E
Boginda	Boginda Forest	cz	-	BO	11.12.	Stream with swamps in Boginda Forest, partly open (grazed glades)	2074	7.50175°N	36.09118°E

2.3 Data analysis

Data analysis was performed using the PAST software package (Hammer et al. 2001). Genetic analysis will be performed in cooperation with Dr K-D Dijkstra from Naturalis, Leiden. Samples were properly prepared and exported in accordance with the national regulations of the Ethiopian Biodiversity Institute (EBI), with the main objective of further identifying species and completing the species list. Collected specimens were put in acetone for 1-2 hours, dried and then kept in labelled envelopes. For genetic analysis, a leg from the specimen was immersed in pure alcohol. The voucher

specimens were labelled and kept in the dry collection, as described above. The barcoding gene COI has already been sequenced for over 1,700 dragonfly species globally as part of the All Odonata Barcode Initiative at Naturalis: more than 4,260 sequences for 585 African species were completed as of 2015 (Dijkstra & Stokvis 2012; Dijkstra et al. 2015). COI is suitable for phylogeographic analysis, and the results from the material collected in Ethiopia will be compared with material from across Africa.

3. Results and Discussion

A total of 33 species were recorded, which is 31.1% of those previously reliably recorded in the country plus three new records for Ethiopia, making a total of 106 dragonfly species recorded in Ethiopia to date (Dijkstra & Clausnitzer 2014 and this report). This is also 65% of the species reliably recorded for the Kafa BR (Tables 4 and 5). Twelve species were recorded in the Kafa BR for the first time, including the endemic *Notogomphus ruppeli*, which is listed as an endangered species. The species accumulation curve indicates the heterogeneity in species composition among the sites, along with a correlation between sampling effort and number of species found (Fig. 1).

The 33 species recorded in December 2014 include eight endemic species (out of 11 known endemics in Ethiopia). The collected larvae were identified to the genus level and genetic analysis will be done at Naturalis, Leiden, to see whether they match species in the DNA database.

The sites with the highest number of recorded species were Gojeb, Shoriri and Boginda, while the sites with the highest number of endemic species (Fig. 2a) were Boka (Fig. 6a and b), Bamboo (Fig. 6c), Komba (Fig. 6d) and Boginda. The sample sites with the highest number of species (ten, nine and eight species, respectively) were Boginda Forest (BO), the open wetlands in the Gojeb River floodplain (GO-wet2) and the Gichi River in Komba Forest (KO1) (Fig. 2b). These were followed by three sites with seven species each: the site at Alemgono (AG) and the two sites in the Shoriri Wetlands (SHO1 and SHO2) (Fig. 2b).

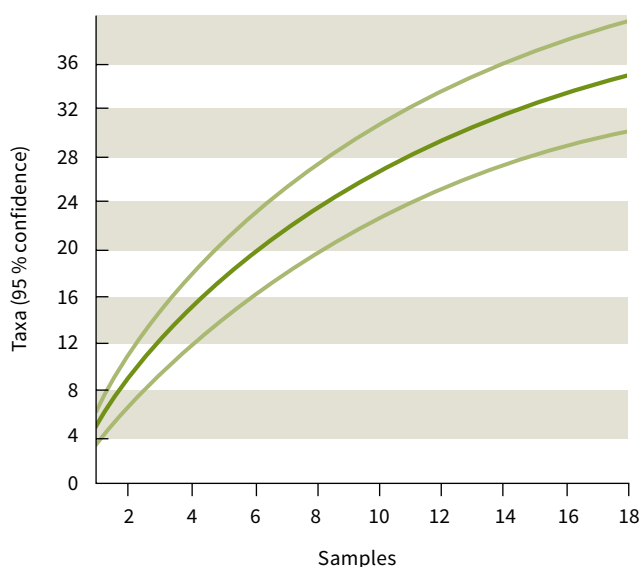


Figure 1: Species accumulation curve (Mao tau) for the 18 sampling sites (see Table 1), blue line indicating the 95% confidence interval

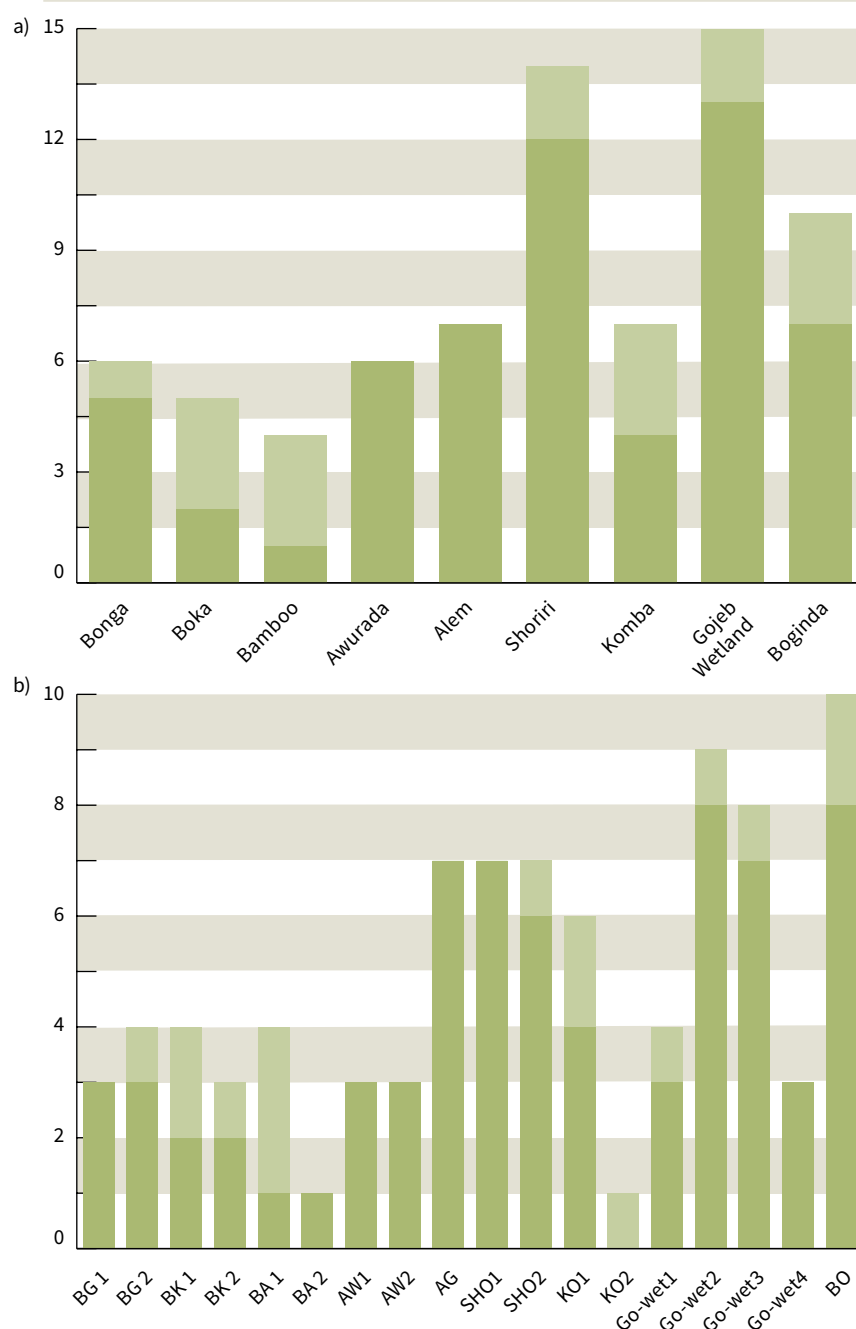


Figure 2: Total number of species (light green: Ethiopian endemics) a) per study site, b) per sampling site

Similar to what has been noted by Dijkstra & Clausnitzer (2005) the following points are notable:

- The high proportion of endemic species recorded (24.2%).
- The low total number of species recorded (33).
- The low average of 4.9 species recorded per locality (Table 3).
- The low average proportion of sites at which each species was recorded (2.8%). 32.4% of species were found at a single site.

- The scarceness of species known to be common in similar habitats further south (Kenya, Uganda, Tanzania, and Malawi).

As already discussed by Clausnitzer & Dijkstra (2005), this might be an effect of the season, so a survey during the rainy season in April or May is needed urgently. Nevertheless, 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 climatic changes, which might be responsible for the relatively high level of adaptiveness.

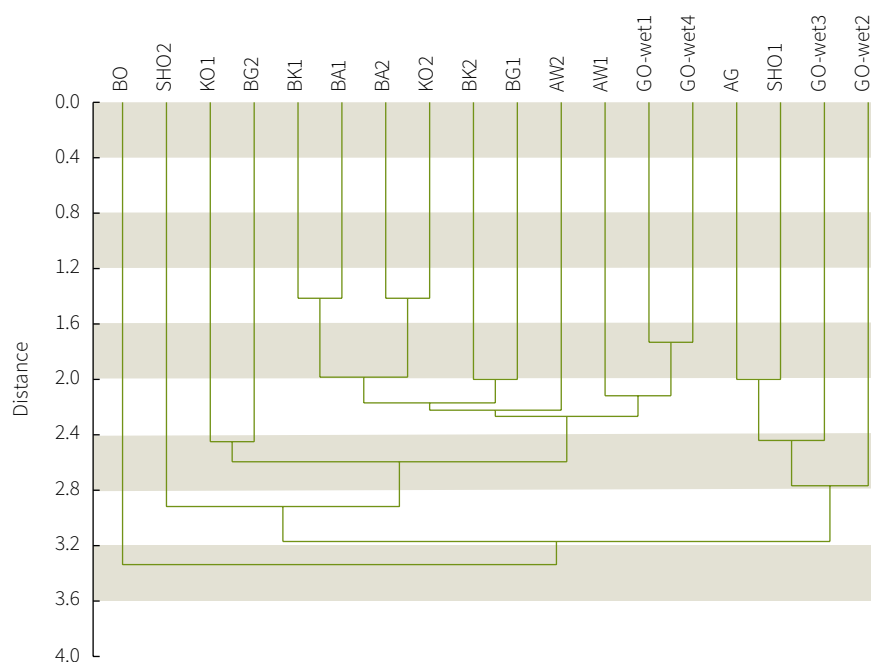


Figure 3: Cluster analysis (Euclidean distance) for the different sampling sites

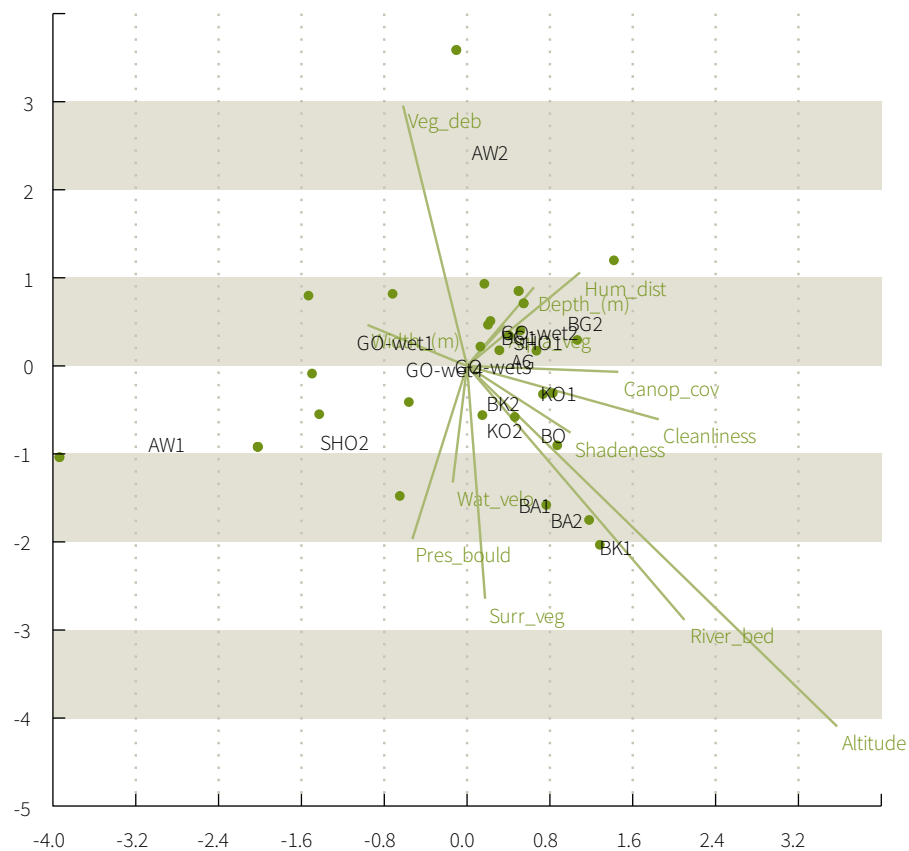


Figure 4: CCA showing sampling sites (see Table 1) and environmental variables

The mostly natural plots (BA1, BA2, BK1, KO2) are clustered together (Fig. 3), mostly due to altitude, water quality and surrounding vegetation (Fig. 4). Likewise, wetlands with stagnant bodies of water only cluster with each other (AG, SHO1, GO-wet2, GO-wet3). The undisturbed stream in the Shoriri Wetlands, which is a PFM site (SHO2), is a long way from any other plot (Fig. 3). SHO2 is at a comparatively low altitude and hence has a high number of common and widespread species, in addition to endemic species otherwise found only in undisturbed habitats at higher elevations. This suggests that the endemic species may have once been more widespread, but nowadays largely survive in the relatively natural refugia of higher elevations.

Endemism

While species numbers in Ethiopia are low, endemism is high (12%, versus between 1 and 3% for each of Kenya, Tanzania and Uganda). Most of Ethiopia's endemic species originate from genera which are dominant in tropical Africa, in terms of both species and individual numbers. The forests of Ethiopia are more impoverished

than similar biomes elsewhere, for example Kenya. Similar patterns – deviant species sets due to impoverishment, a high level of endemism and extra-Afrotropical elements – have been reported for Ethiopia's flora (Hedberg 1969, Q. Luke, pers. com.), butterflies (Carcasson 1964; de Jong et al. 1993) and montane forest avifauna (Stuart et al. 1993). All show fewer affinities to the central African forests than would be expected. Ethiopian montane forest butterfly and bird fauna do not group closely with those of any other Afrotropical area (de Jong & Congdon 1993; Stuart et al. 1993). The greatest phytogeographical disjunction in the eastern African montane flora occurs between Ethiopia and more southern sites (Hedberg 1969).

Ethiopia's endemic Odonata seem to be relatively tolerant to anthropogenic habitat change, although the level of deforestation may be unprecedented. The habitat changes to the Ethiopian Highlands due to climate changes, volcanism and long-term human impact seem to have encouraged these species to adapt to shifts in habitat.

4. Conclusions and Recommendations for Conservation and Monitoring

Deforestation and environmental degradation due to human disturbance, along with a drastic increase in water pollution due to economic growth, even in remote areas, pose a major threat to Ethiopia's environmental wealth. With few exceptions, 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. But even species adaptable to altered landscapes, such as the Kaffa Sprite or Ethiopian skimmer, will disappear in the face of ongoing loss of their

habitats due to water pollution, water extraction and large-scale reforestation with eucalyptus.

The endemic species which require forested and clear rocky streams or rivers, such as the Ethiopian Sprite (Fig. 7a), Cottarelli's Longlegs (Fig. 7b), Rüppell's Longlegs (Fig. 7c) and the Ethiopian Highlander (Fig. 7d) are of conservation concern and can act as monitoring species for the core zones of the Kafa BR. Because they are easy to see and endemic to the montane habitats, the Ethiopian Highlander, Ethiopian Skimmer (Fig. 7e), Ethiopian Sprite (Fig. 7a) and Kaffa Sprite could act as flagship species for the Kafa BR.

Table 2: Species suggested as monitoring and flagship species (see Table 5 for author and family)

Genus	Species	English name	Endemic	RL	Monitoring species	Flagship species
<i>Atoconeura</i>	<i>aethiopica</i>	Ethiopian Highlander	Yes	VU	Yes	Yes
<i>Notogomphus</i>	<i>cottarellii</i>	Cottarelli's Longlegs	Yes	EN	Yes	No
<i>Notogomphus</i>	<i>ruppeli</i>	Rüppell's Longlegs	Yes	EN	Yes	No
<i>Orthetrum</i>	<i>kristenseni</i>	Ethiopian Skimmer	Yes	LC	No	Yes
<i>Pseudagrion</i>	<i>guichardi</i>	Ethiopian Sprite	Yes	VU	Yes	Yes
<i>Pseudagrion</i>	<i>kaffinum</i>	Kaffa Sprite	Yes	VU	No	Yes

As can be seen in Figures 2a and 2b, the study sites with the highest number of species are not the same as those with the highest number of endemic species. Most species found at disturbed sites are common and widespread across tropical Africa, whereas the montane forest sites are home to a set of globally threatened and locally endemic species.

Conservation efforts in the Kafa BR have thus far largely focused on the threatened montane upland habitats, which explains why core zones have not yet been established in the wetlands. The huge wetlands of the Gojeb

River should be considered a core zone, as well as the wetlands in the Afroalpine zone, i.e. beyond Boka Forest.

Further studies

The most important goal for future studies is to conduct surveys in different seasons. The rainy season from April to May could be perfect, and would likely increase the number of species recorded at all sites, especially in the Awurada Valley and Gojeb Wetland. Two British odonatologists were scheduled join an expedition in April 2015 and sample the same habitats as in this study.

5. Conserving, Restoring and Monitoring Wetlands: The Global Challenge for the 21st Century

Globally, freshwater habitats are being disturbed, polluted and destroyed at an alarming rate. Access to clean water is essential to human health, with the United Nations declaring it a fundamental human right in 2010. Freshwater habitats are some of the most threatened ecosystems globally (Vörösmarty et al. 2010). They containing 10% of all known species in an area making up just 1% of the earth's surface (Strayer & Dudgeon 2010) and provide ecosystem services valued at several trillion USD per year (Postel & Carpenter 1997). More than half of the earth's wetlands have been degraded (Russi et al. 2013), and more than two-thirds of our upland watersheds remain unprotected (Thieme et al. 2010). In general, protection for terrestrial ecosystems is much better than for wetlands, because conservation efforts mainly focus on large terrestrial mammals. Wetlands and their associated watersheds provide valuable ecosystem services such as water catchment, retention and purification, provide habitats for a large range of specialised flora and fauna and serve as important longitudinal and transversal corridors for dispersal of biota (Alvarez-Mieles et al. 2013). Freshwater ecosystems and freshwater biodiversity are in great peril, and urgent measures are needed (Garcia-Moreno et al. 2014). Wetlands need to be protected, and their status must be monitored. This is especially true for countries like Ethiopia, where the economy is growing despite water sanitation being virtually non-existent, vastly increasing the pollution and destruction of wetlands and their ecosystem services.

Due to their popularity, manageable diversity and relatively well-resolved taxonomy, dragonflies are the only insect order for which a global status assessment has been performed (Clausnitzer et al. 2009) and for which conservation actions can be outlined beyond the local level (Clausnitzer et al. 2012). Because of their amphibiotic ecology, dragonflies reflect the diversity of both freshwater (molluscs, crabs, fishes, amphibians) and terrestrial (birds, mammals) groups. Recent studies on the continental scale in Africa have shown that dragonflies in Africa display remarkably similar patterns for diversity and centres of threatened species to other freshwater groups such as fish, molluscs and crabs (Darwall et al. 2011a), while congruence with birds has also been recorded (Tushabe et al. 2006). Hence, dragonflies are a good tool for assessing aquatic systems and have been used as indicators of ecological health (Carle 1979; Clausnitzer 2003; Sahlen & Ekestubbe 2001; Trevino 1997), ecological integrity (Clark & Samways 1996; Von Ellenrieder 2000; Smith et al. 2007) and environmental changes such as climatic change (Bush et al. 2013). They are therefore valuable indicators for prioritising conservation planning across Africa's freshwater systems and can help minimise or mitigate the impact of future development (Darwall et al. 2011b; Dijkstra et al. 2011; Simaika et al. 2013). Species-level dragonfly assessments can be used to monitor climate change and be correlated with more labour- and expertise-intensive macroinvertebrate surveys (Bush et al. 2013, Simaika & Samways 2011).

6. References

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7. Appendix

7.1. Tables

Table 3: Odonata species recorded during the December 2014 NABU survey of the Kafa BR (in alphabetical order)

Genus	Species	English name	Endemic	New	Bonga	Boka	Bamboo	Awurada	Alemgono	Shoriri	Komba	Gojeb Wetlands	Boginda
<i>Anax</i>	<i>imperator</i>	Blue Emperor			0	0	0	0	1	1	0	0	0
<i>Atoconeura</i>	<i>aethiopica</i>	Ethiopian Highlander	Yes		1	0	0	0	0	0	1	0	0
<i>Crocothemis</i>	<i>erythraea</i>	Broad Scarlet			0	0	0	0	0	1	0	0	0
<i>Gynacantha</i>	<i>nigeriensis</i>	Yellow-legged Duskhawker			0	0	0	1	0	0	0	0	0
<i>Gynacantha</i>	<i>villosa</i>	Brown Duskhawker			0	0	0	0	0	0	1	1	1
<i>Notogomphus</i>	<i>cottarellii</i>	Cottarelli's Longlegs	Yes		0	0	1	0	0	1	0	0	0
<i>Notogomphus</i>	<i>ruppeli</i>	Rüppell's Longlegs	Yes		0	1	1	0	0	0	0	0	0
<i>Notogomphus</i>	<i>spec. (larvae)</i>	? Longlegs			0	0	0	0	0	0	0	0	1
<i>Orthetrum</i>	<i>abbotti</i>	Little Skimmer			0	0	0	0	1	0	0	1	0
<i>Orthetrum</i>	<i>caffrum</i>	Two-striped Skimmer			0	0	0	0	1	0	1	0	1
<i>Orthetrum</i>	<i>julia</i>	Julia Skimmer			1	0	0	1	0	0	0	1	1
<i>Orthetrum</i>	<i>kristenseni</i>	Ethiopian Skimmer	Yes		0	1	0	0	0	0	0	0	1
<i>Orthetrum</i>	<i>stemmale</i>	Tough Skimmer			0	0	0	0	0	1	0	0	0
<i>Palpopleura</i>	<i>jucunda radiata</i>	Ethiopian yellow-veined Widow	Yes		0	0	0	0	0	0	1	1	0
<i>Palpopleura</i>	<i>lucia</i>	Lucia Widow			0	0	0	0	1	1	0	1	0
<i>Palpopleura</i>	<i>portia</i>	Silver-winged Widow			1	0	0	0	1	1	0	1	1
<i>Phyllomacromia</i>	<i>spec.</i>	? African Cruiser		Yes	1	0	0	0	0	0	0	0	1
<i>Phyllomacromia</i>	<i>spec. (larvae)</i>	? African Cruiser		Yes	0	0	0	0	0	0	0	0	1
<i>Tetrathemis</i>	<i>polleni</i>	Black-splashed Elf		Yes	0	0	0	1	0	0	0	0	0
<i>Trithemis</i>	<i>arteriosa</i>	Red-veined Dropwing			0	0	0	0	0	1	0	1	0
<i>Trithemis</i>	<i>furva</i>	Navy Dropwing			0	0	0	0	0	0	0	1	0
<i>Trithemis</i>	<i>ellenbeckii</i>	Ethiopian Dropwing	Yes		0	0	0	0	0	1	0	0	0
<i>Nesiothemis</i>	<i>farinosa</i>	Eastern Blacktail			0	0	0	0	0	1	0	0	0
<i>Trithemis</i>	<i>stictica</i>	Jaunty Dropwing			0	0	0	0	0	1	0	0	0
<i>Zosteraeschna</i>	<i>elliotti</i>	Northern Highland Hawker			1	0	0	0	0	0	1	0	0
<i>Zygonyx</i>	<i>torridus</i>	Ringed Cascader			0	0	0	1	0	0	0	0	0
<i>Aciagrion</i>	<i>gracile</i>	Graceful Slim			0	0	0	0	0	0	0	1	0
<i>Ceriagrion</i>	<i>glabrum</i>	Common Waxtail			0	0	0	0	1	1	0	1	0
<i>Lestes</i>	<i>virgatus</i>	Smoky Spreadwing			0	0	0	0	0	0	0	1	0
<i>Platycypha</i>	<i>caligata</i>	Common Dancing-jewel			0	0	0	1	0	1	0	1	0
<i>Proischnura</i>	<i>subfurcata</i>	Fork-tailed Bluet			1	1	0	0	1	1	0	1	1
<i>Pseudagrion</i>	<i>guichardi</i>	Ethiopian Sprite	Yes		0	1	1	0	0	0	1	0	1
<i>Pseudagrion</i>	<i>kaffinum</i>	Kaffa Sprite	Yes		0	0	0	0	0	0	0	1	0
<i>Pseudagrion</i>	<i>kersteni</i>	Powder-faced Sprite			0	0	0	1	0	0	0	0	0
<i>Pseudagrion</i>	<i>spernatum</i>	Highland Sprite			0	1	1	0	0	1	1	1	0

Table 4: Odonata species reliably recorded for the Kafa BR. **Record** (only most recent is given): **1:** obtained by the author in December 2014, **2:** old record (Clausnitzer & Dijkstra 2005); **Red List:** IUCN Threat Status according to the global Red List of Threatened Species (LC: Least Concern, NT: Near Threatened, V: Vulnerable, EN: Endangered, CR: Critically Endangered,); **Endemism:** E=Endemic to Ethiopia; **New for KBR:** First record at the Kafa BR

Family	Species	Author	Record	Red List	Endemism	New for KBR
Calopterygidae	<i>Phaon iridipennis</i>	Burmeister 1839	2	LC		
Chlorocyphidae	<i>Platycypha caligata</i>	Selys 1853	2	LC		
Lestidae	<i>Lestes virgatus</i>	Burmeister 1839	1	LC		
Platycnemididae	<i>Elatoneura pasquinii</i>	Consiglio 1978	2	VU	E	
Coenagrionidae	<i>Aciagrion gracile</i>	Sjöstedt 1909	1	LC		1
Coenagrionidae	<i>Africallagma elongatum</i>	Pinhey 1950	2	LC		
Coenagrionidae	<i>Africallagma subtile</i>	Ris 1921	2	LC		
Coenagrionidae	<i>Agriocnemis exilis</i>	Selys 1872	2	LC		
Coenagrionidae	<i>Ceriagrion glabrum</i>	Burmeister 1839	1	LC		1
Coenagrionidae	<i>Pinheyschna waterstoni</i>	Peters & Theischinger 2011	2	NT		
Coenagrionidae	<i>Proischnura subfurcata</i>	Selys 1876	1	LC		
Coenagrionidae	<i>Pseudagrion gamblesi</i>	Pinhey 1978	2	LC		
Coenagrionidae	<i>Pseudagrion guichardi</i>	Kimmins, 1988	1	VU	E	
Coenagrionidae	<i>Pseudagrion kaffinum</i>	Consiglio 1980	1	VU	E	
Coenagrionidae	<i>Pseudagrion kersteni</i>	Gerstäcker 1869	1	LC		
Coenagrionidae	<i>Pseudagrion spernatum</i>	Hagen in Selys 1885	1	LC		
Aeshnidae	<i>Anax ephippiger</i>	Burmeister 1839	2	LC		
Aeshnidae	<i>Anax imperator</i>	Leach 1815	1	LC		
Aeshnidae	<i>Anax speratus</i>	Hagen 1867	2	LC		
Aeshnidae	<i>Gynacantha nigeriensis</i>	Gambles 1956	1	LC		
Aeshnidae	<i>Gynacantha villosa</i>	Grünberg, 1902	1	LC		1
Aeshnidae	<i>Zosteraeschna ellioti</i>	Kirby 1896	1	LC		
Gomphidae	<i>Notogomphus cottarellii</i>	Consiglio 1978	1	EN	E	
Gomphidae	<i>Notogomphus dorsalis</i>	Sély 1857	2	LC		
Gomphidae	<i>Notogomphus ruppeli</i>	Sély 1858	1	EN	E	1
Gomphidae	<i>Onychogomphus indet.</i>		2			
Gomphidae	<i>Paragomphus alluaudi</i>	Martin 1915	2	LC		
Gomphidae	<i>Paragomphus crenigomphoides</i>	Clausnitzer & Dijkstra 2005	2	DD	E	
Libellulidae	<i>Atoconeura aethiopica</i>	Kimmins 1958	1	VU	E	
Libellulidae	<i>Chalcostephia flavifrons</i>	Kirby 1889	2	LC		
Libellulidae	<i>Crocothemis erythraea</i>	Brullé 1832	1	LC		1
Libellulidae	<i>Nesciothemis farinosa</i>	Förster 1898	1	LC		1
Libellulidae	<i>Orthetrum abbotti</i>	Calvert 1892	1	LC		
Libellulidae	<i>Orthetrum cafferum</i>	Burmeister 1839	1	LC		
Libellulidae	<i>Orthetrum guineense</i>	Ris 1910	2	LC		
Libellulidae	<i>Orthetrum julia</i>	Kirby 1900	1	LC		
Libellulidae	<i>Orthetrum kristenseni</i>	Ris 1911	1	LC	E	
Libellulidae	<i>Orthetrum stemmale</i>	Burmeister 1839	1	LC		
Libellulidae	<i>Palpopleura jucunda radiata</i>		1	LC	E	1
Libellulidae	<i>Palpopleura lucia</i>	Drury 1773	1	LC		
Libellulidae	<i>Palpopleura portia</i>	Drury 1773	1	LC		
Libellulidae	<i>Pantala flavesceus</i>	Fabricius 1798	2	LC		
Libellulidae	<i>Tetrathemis polleni</i>	Selys 1869	1	LC		1

Family	Species	Author	Record	Red List	Endemism	New for KBR
Libellulidae	<i>Trithemis aconita</i>	Lieftinck 1969	2	LC		
Libellulidae	<i>Trithemis arteriosa</i>	Burmeister 1839	1	LC		1
Libellulidae	<i>Trithemis ellenbeckii</i>	Förster 1906	1	LC	E	
Libellulidae	<i>Trithemis furva</i>	Karsch 1899	1	LC		
Libellulidae	<i>Trithemis stictica</i>	Burmeister 1839	1	LC		
Libellulidae	<i>Zygonyx natalensis</i>	Martin 1900	2	LC		
Libellulidae	<i>Zygonyx torridus</i>	Kirby 1889	1	LC		1
Macromiidae	<i>Phyllomacromia picta</i>	Hagen in Selys 1871	2	LC		
Macromiidae	<i>Phyllomacromia spec.</i>		1			1

Table 5: Reliable Odonata records for the Kafa BR (for family, Red List status and endemism, see Table 4)

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Aciagrion gracile</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Africallagma elongatum</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Africallagma elongatum</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	collection
<i>Africallagma elongatum</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	collection
<i>Africallagma elongatum</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	collection
<i>Africallagma elongatum</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	collection
<i>Africallagma elongatum</i>	20.03.2004	March	2004	Bonga, 5 km N	1710		7.31626°N	36.24148°E	collection
<i>Africallagma elongatum</i>	20.03.2004	March	2004	Bonga, N	1727		7.32987°N	36.24733°E	collection
<i>Africallagma subtile</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Africallagma subtile</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Africallagma subtile</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Agriocnemis exilis</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Agriocnemis exilis</i>	17.03.2004	March	2004	Gore to Gordomo, 10 km S of Gore	1775		8.05941°N	35.52376°E	collection
<i>Anax ephippiger</i>		September	1885	Scioa Ghimira			6.9666667°N	35.7666667°E	literature
<i>Anax imperator</i>	17.03.2004	March	2004	Gore to Gordomo, 10 km S of Gore	1775		8.05941°N	35.52376°E	collection
<i>Anax imperator</i>	06.12.2014	December	2014	Alemgono Wetlands, wetlands, heavily grazed	1706		7.36428°N	36.22602°E	collection

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Anax imperator</i>	06.12.2014	December	2014	Shoriri Wetlands, wetlands, undisturbed	1626		7.35707°N	36.20437°E	collection
<i>Anax speratus</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Anax speratus</i>	20.03.2004	March	2004	Bonga, N	1727		7.32987°N	36.24733°E	collection
<i>Atoconeura aethiopica</i>	26.10.1973	October	1973	Deccio Forest, W of Bonga, loc. 20	1840	20 km	7.28032°N	36.19031°E	literature
<i>Atoconeura aethiopica</i>	17.03.2004	March	2004	Gecha, stream near Gecha			7.08333°N	35.5°E	collection
<i>Atoconeura aethiopica</i>	17.03.2004	March	2004	Gecha			7.5589415°N	35.445515°E	literature
<i>Atoconeura aethiopica</i>	17.03.2004	March	2004	Baro-Tepi, near Gecha	1630		7.876°N	35.479°E	collection
<i>Atoconeura aethiopica</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Atoconeura aethiopica</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Atoconeura aethiopica</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Atoconeura aethiopica</i>	17.03.2004	March	2004	Baro river			7.9189224°N	35.4561132°E	literature
<i>Atoconeura aethiopica</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Atoconeura aethiopica</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	collection
<i>Atoconeura aethiopica</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	literature
<i>Atoconeura aethiopica</i>	21.03.2004	March	2004	Borkana River near Yayu	1290		8.37093°N	35.8847°E	collection
<i>Atoconeura aethiopica</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Atoconeura aethiopica</i>	21.03.2004	March	2004	Borkana river			8.3795591°N	35.8605468°E	literature
<i>Atoconeura aethiopica</i>	03.12.2014	December	2014	Bonga, hill W of Bonga	1980		7.25358°N	36.226332°E	collection
<i>Atoconeura aethiopica</i>	04.12.2014	December	2014	Boka Forest, stream in wetlands below Boka Forest	2414		7.29467°N	36.37604°E	collection
<i>Ceriagrion glabrum</i>	06.12.2014	December	2014	Alemgono Wetlands, wetlands, heavily grazed	1706		7.36428°N	36.22602°E	collection
<i>Ceriagrion glabrum</i>	06.12.2014	December	2014	Shoriri Wetlands, wetlands, undisturbed	1626		7.35707°N	36.20437°E	collection
<i>Ceriagrion glabrum</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Ceriagrion glabrum</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Chalcostephia flavifrons</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Chalcostephia flavifrons</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Crocothemis erythraea</i>	06.12.2014	December	2014	Shoriri Wetlands, wetlands, undisturbed	1626		7.35707°N	36.20437°E	collection
<i>Elatoneura pasquini</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Elatoneura pasquini</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Gynacantha nigeriensis</i>	16.03.2004	March	2004	Gaba Forest, 35 km W of Bedele	1507		8.36872°N	36.03405°E	collection
<i>Gynacantha nigeriensis</i>	21.03.2004	March	2004	Bedele, forest near Gaba River	1510		8.3652°N	36.0348°E	collection
<i>Gynacantha nigeriensis</i>	05.12.2014	December	2014	Awurada Valley, floodplain (swamp forest) along Gummi River	1293		7.09281°N	36.23154°E	observation
<i>Gynacantha villosa</i>	07.12.2014	December	2014	Komba Forest, clear and rocky forest stream in Komba Forest	1847		7.30803°N	36.12201°E	collection
<i>Gynacantha villosa</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Gynacantha villosa</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Lestes virgatus</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Lestes virgatus</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Lestes virgatus</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Nesciothemis farinosa</i>	06.12.2014	December	2014	Shoriri Wetlands, stream along forest edge and Shoriri Wetlands	1626		7.35707°N	36.20437°E	collection
<i>Notogomphus cottarellii</i>	28.10.1973	October	1973	Bonga	1710	10 km	7.264216°N	36.251372°E	literature
<i>Notogomphus cottarellii</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Notogomphus cottarellii</i>	19.03.2004	March	2004	Forest close to Wushwush tea plantation			7.3036039°N	36.1308388°E	not specified
<i>Notogomphus cottarellii</i>	04.12.2014	December	2014	Bamboo Forest, River in Bamboo Forest	2595		7.24118°N	36.45182°E	observation

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Notogomphus cottarellii</i>	06.12.2014	December	2014	Shoriri Wetlands, stream along forest edge and Shoriri Wetlands	1626		7.35707°N	36.20437°E	collection
<i>Notogomphus cottarellii</i>		April	1947	Abessinien, Gore			8.1496°N	35.5355°E	collection
<i>Notogomphus dorsalis</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Notogomphus ruppeli</i>	04.12.2014	December	2014	Bamboo Forest, River in Bamboo Forest	2595		7.24118°N	36.45182°E	collection
<i>Notogomphus ruppeli</i>	04.12.2014	December	2014	Boka Forest, stream in wetlands below Boka Forest	2414		7.29467°N	36.37604°E	collection
<i>Notogomphus spec. (larvae)</i>	04.12.2014	December	2014	Bamboo Forest, River in Bamboo Forest	2650		7.24331°N	36.49564°E	collection
<i>Notogomphus spec. (larvae)</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Onychogomphus indet.</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	literature
<i>Onychogomphus indet.</i>	18.03.2004	March	2004	Tepi, between Tepi and Mizan Tafari (M. Tefari)			7.08333°N	35.5°E	literature
<i>Orthetrum abbotti</i>	06.12.2014	December	2014	Alemgono Wetlands, wetlands, heavily grazed	1706		7.36428°N	36.22602°E	collection
<i>Orthetrum abbotti</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection
<i>Orthetrum caffrum</i>	25.10.1973	October	1973	Baca, Jimma-Bonga Road, loc. 16	1730	10 km	7.393049°N	36.253403°E	literature
<i>Orthetrum caffrum</i>	27.10.1975	October	1975	Bedelle Forest, loc 77	1747	5 km	8.449572°N	36.475853°E	literature
<i>Orthetrum caffrum</i>	06.12.2014	December	2014	Alemgono Wetlands, wetlands, heavily grazed	1706		7.36428°N	36.22602°E	collection
<i>Orthetrum caffrum</i>	07.12.2014	December	2014	Komba Forest, clear and rocky forest stream in Komba Forest	1847		7.30803°N	36.12201°E	collection
<i>Orthetrum caffrum</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Orthetrum caffrum</i>		November	1885	Scioa Ghimira			6.9666667°N	35.7666667°E	literature
<i>Orthetrum guineense</i>	26.10.1973	October	1973	Anderrica Forest, loc. 18	1660	20 km	7.195405°N	36.285317°E	literature
<i>Orthetrum julia</i>	26.10.1973	October	1973	Amaia Road, near Anderrica, loc. 19	2231	20 km	7.167305°N	36.3213°E	literature
<i>Orthetrum julia</i>	26.10.1973	October	1973	Anderrica Forest, loc. 18	1660	20 km	7.195405°N	36.285317°E	literature

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Orthetrum julia</i>	26.10.1973	October	1973	Deccio Forest, W of Bonga, loc. 20	1840	20 km	7.28032°N	36.19031°E	literature
<i>Orthetrum julia</i>	27.10.1973	October	1973	Bonga mission, loc. 17	1710	10 km	7.282654°N	36.242887°E	literature
<i>Orthetrum julia</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Orthetrum julia</i>	20.03.2004	March	2004	Bonga, 5 km N	1710		7.31626°N	36.24148°E	collection
<i>Orthetrum julia</i>	20.03.2004	March	2004	Bonga, N	1727		7.32987°N	36.24733°E	collection
<i>Orthetrum julia</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Orthetrum julia</i>	03.12.2014	December	2014	Bonga, stream near Bonga Town	1832		7.2542°N	36.25762°E	collection
<i>Orthetrum julia</i>	03.12.2014	December	2014	Bonga, hill W of Bonga	1980		7.25358°N	36.226332°E	collection
<i>Orthetrum julia</i>	05.12.2014	December	2014	Awurada Valley, floodplain (swamp forest) along Gummi River	1293		7.09281°N	36.23154°E	collection
<i>Orthetrum julia</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Orthetrum julia</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection
<i>Orthetrum julia</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1518		7.55442°N	36.05213°E	collection
<i>Orthetrum julia</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Orthetrum kristenseni</i>	25.10.1973	October	1973	Baca, Jimma-Bonga Road, loc. 16	1730	10 km	7.393049°N	36.253403°E	literature
<i>Orthetrum kristenseni</i>	28.10.1973	October	1973	2km W of Baca, Jimma-Bonga Road, loc. 21	1779	5 km	7.398385°N	36.232171°E	literature
<i>Orthetrum kristenseni</i>	17.03.2004	March	2004	Masha, near Masha			7.08333°N	35.5°E	collection
<i>Orthetrum kristenseni</i>	17.03.2004	March	2004	Baro-Tepi, near Masha	1630		7.73333°N	35.4833°E	collection
<i>Orthetrum kristenseni</i>	20.03.2004	March	2004	Bonga, N	1727		7.32987°N	36.24733°E	collection
<i>Orthetrum kristenseni</i>	04.12.2014	December	2014	Boka Forest, swamp along stream below Boka Forest	2414		7.29467°N	36.37604°E	collection
<i>Orthetrum kristenseni</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Orthetrum stemmale</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Orthetrum stemmale</i>	06.12.2014	December	2014	Shoriri Wetlands, wetlands, undisturbed	1626		7.35707°N	36.20437°E	collection
<i>Palpopleura jucunda radiata</i>	06.12.2014	December	2014	Komba Forest, forest edge	1900		7.10176°N	36.13277°E	collection
<i>Palpopleura jucunda radiata</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection
<i>Palpopleura lucia</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Palpopleura lucia</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Palpopleura lucia</i>	06.12.2014	December	2014	Alemgono Wetlands, wetlands, heavily grazed	1706		7.36428°N	36.22602°E	collection
<i>Palpopleura lucia</i>	06.12.2014	December	2014	Shoriri Wetlands, wetlands, undisturbed	1626		7.35707°N	36.20437°E	collection
<i>Palpopleura lucia</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Palpopleura lucia</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection
<i>Palpopleura portia</i>	26.10.1973	October	1973	Anderrica Forest, loc. 18	1660	20 km	7.195405°N	36.285317°E	literature
<i>Palpopleura portia</i>	27.10.1973	October	1973	Bonga mission, loc. 17	1710	10 km	7.282654°N	36.242887°E	literature
<i>Palpopleura portia</i>	03.12.2014	December	2014	Bonga, stream near Bonga Town	1832		7.2542°N	36.25762°E	collection
<i>Palpopleura portia</i>	06.12.2014	December	2014	Alemgono Wetland, wetlands, heavily grazed	1706		7.36428°N	36.22602°E	collection
<i>Palpopleura portia</i>	06.12.2014	December	2014	Shoriri Wetlands, wetlands, undisturbed	1626		7.35707°N	36.20437°E	collection
<i>Palpopleura portia</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Palpopleura portia</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection
<i>Palpopleura portia</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Pantala flavescens</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Paragomphus alluaudi</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Paragomphus crenigomphoides</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Paragomphus</i> sp.		October	1973	Kaffa, forest between Belleta and Bonga	1630	10 km	7.3707°N	36.3591°E	literature
<i>Phaon iridipennis</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Phaon iridipennis</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Phyllomacromia picta</i>	21.03.2004	March	2004	Borkana River near Yayu	1290		8.37093°N	35.8847°E	collection
<i>Phyllomacromia</i> spec.	03.12.2014	December	2014	Bonga, hill W of Bonga	1980		7.25358°N	36.226332°E	observation
<i>Phyllomacromia</i> spec.	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Phyllomacromia</i> spec. (larvae)	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Pinheyschna waterstoni</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Platycypha caligata</i>	26.10.1973	October	1973	Anderrica Forest, loc. 18	1660	20 km	7.195405°N	36.285317°E	literature
<i>Platycypha caligata</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection
<i>Platycypha caligata</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Platycypha caligata</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Platycypha caligata</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Platycypha caligata</i>	05.12.2014	December	2014	Awurada Valley, Gummi River, large river	1293		7.09281°N	36.23154°E	observation
<i>Platycypha caligata</i>	06.12.2014	December	2014	Shoriri Wetlands, stream along forest edge and Shoriri Wetlands	1626		7.35707°N	36.20437°E	collection
<i>Platycypha caligata</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, Gojeb River, large river	1515		7.55448°N	36.05688°E	observation
<i>Platycypha caligata</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1518		7.55442°N	36.05213°E	collection
<i>Proischnura subfurcata</i>	25.10.1973	October	1973	Baca, Jimma-Bonga Road, loc. 16	1730	10 km	7.393049°N	36.253403°E	literature
<i>Proischnura subfurcata</i>	26.10.1973	October	1973	Amaia Road, near Anderrica, loc. 19	2231	20 km	7.167305°N	36.3213°E	literature

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Proischnura subfurcata</i>	26.10.1973	October	1973	Deccio Forest, W of Bonga, loc. 20	1840	20 km	7.28032°N	36.19031°E	literature
<i>Proischnura subfurcata</i>	27.10.1973	October	1973	Bonga Mission, loc. 17	1710	10 km	7.282654°N	36.242887°E	literature
<i>Proischnura subfurcata</i>	17.03.2004	March	2004	Gore to Gordomo, 10 km S of Gore	1775		8.05941°N	35.52376°E	collection
<i>Proischnura subfurcata</i>	20.03.2004	March	2004	Bonga, 5 km N	1710		7.31626°N	36.24148°E	collection
<i>Proischnura subfurcata</i>	20.03.2004	March	2004	Bonga, N	1727		7.32987°N	36.24733°E	collection
<i>Proischnura subfurcata</i>	03.12.2014	December	2014	Bonga, stream near Bonga Town	1832		7.2542°N	36.25762°E	collection
<i>Proischnura subfurcata</i>	04.12.2014	December	2014	Boka Forest, swamp along stream below Boka Forest	2414		7.29467°N	36.37604°E	collection
<i>Proischnura subfurcata</i>	06.12.2014	December	2014	Alemgono Wetlands, wetlands, heavily grazed	1706		7.36428°N	36.22602°E	collection
<i>Proischnura subfurcata</i>	06.12.2014	December	2014	Shoriri Wetlands, wetlands, undisturbed	1626		7.35707°N	36.20437°E	collection
<i>Proischnura subfurcata</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Proischnura subfurcata</i>	09.12.2014	December	2014	Gawata, Gojeb Wetland, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection
<i>Proischnura subfurcata</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Pseudagrion gamblesi</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion gamblesi</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion gamblesi</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion gamblesi</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion gamblesi</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion gamblesi</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion gamblesi</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion guichardi</i>	27.10.1973	October	1973	Bonga mission, loc. 17	1710	10 km	7.282654°N	36.242887°E	literature
<i>Pseudagrion guichardi</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	collection
<i>Pseudagrion guichardi</i>	19.03.2004	March	2004	Wushwush tea plantation	1900		7.3036039°N	36.1308388°E	collection
<i>Pseudagrion guichardi</i>	19.03.2004	March	2004	Wushwush			7.3036039°N	36.1308388°E	not specified

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Pseudagrion guichardi</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Pseudagrion guichardi</i>	04.12.2014	December	2014	Bamboo Forest, river in Bamboo Forest	2595		7.24118°N	36.45182°E	collection
<i>Pseudagrion guichardi</i>	04.12.2014	December	2014	Boka Forest, stream in wetlands below Boka Forest	2414		7.29467°N	36.37604°E	collection
<i>Pseudagrion guichardi</i>	07.12.2014	December	2014	Komba Forest, clear and rocky forest stream in Komba Forest	1847		7.30803°N	36.12201°E	collection
<i>Pseudagrion guichardi</i>	11.12.2014	December	2014	Boginda Forest, stream with swamps in Boginda Forest, partly open (grazed glades)	2074		7.50175°N	36.09118°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Pseudagrion kaffinum</i>	17.03.2004	March	2004	Gore to Gordomo, 10 km S of Gore	1775		8.05941°N	35.52376°E	collection
<i>Pseudagrion kaffinum</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, Gojeb River, large river	1515		7.55448°N	36.05688°E	collection
<i>Pseudagrion kaffinum</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, gallery forest and wetlands along Gojeb	1530		7.55448°N	36.05687°E	collection
<i>Pseudagrion kersteni</i>	18.03.2004	March	2004	Tepi, between Tepi and Mizan Tafari (M. Tefari)			7.08333°N	35.5°E	collection
<i>Pseudagrion kersteni</i>	18.03.2004	March	2004	Tepi to Mizan Tafari	1000		7.112°N	35.428°E	collection
<i>Pseudagrion kersteni</i>	05.12.2014	December	2014	Awurada Valley, floodplain (swamp forest) along Gummi River	1293		7.09281°N	36.23154°E	collection
<i>Pseudagrion sparnatum</i>	25.10.1973	October	1973	Baca, Jimma-Bonga Road, loc. 16	1730	10 km	7.393049°N	36.253403°E	Literature
<i>Pseudagrion sparnatum</i>	26.10.1973	October	1973	Amaia Road, near Anderrica, loc. 19	2231	20 km	7.167305°N	36.3213°E	Literature
<i>Pseudagrion sparnatum</i>	16.03.2004	March	2004	Gaba River, 35 km W of Bedele	1467		8.36387°N	36.04116°E	collection

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Pseudagrion spernatum</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion spernatum</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion spernatum</i>	17.03.2004	March	2004	Baro River between Gordomo and Masha	1630		7.87622°N	35.4788°E	collection
<i>Pseudagrion spernatum</i>	19.03.2004	March	2004	Wushwush tea plantation, 13 km W of Bonga	1845		7.3036039°N	36.1308388°E	collection
<i>Pseudagrion spernatum</i>	20.03.2004	March	2004	Bonga, 5 km N	1710		7.31626°N	36.24148°E	collection
<i>Pseudagrion spernatum</i>	20.03.2004	March	2004	Bonga, N	1727		7.32987°N	36.24733°E	collection
<i>Pseudagrion spernatum</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Pseudagrion spernatum</i>	04.12.2014	December	2014	Bamboo Forest, River in Bamboo Forest	2595		7.24118°N	36.45182°E	collection
<i>Pseudagrion spernatum</i>	04.12.2014	December	2014	Boka Forest, swamp along stream below Boka Forest	2414		7.29467°N	36.37604°E	collection
<i>Pseudagrion spernatum</i>	06.12.2014	December	2014	Shoriri Wetlands, stream along forest edge and Shoriri Wetlands	1626		7.35707°N	36.20437°E	collection
<i>Pseudagrion spernatum</i>	07.12.2014	December	2014	Komba Forest, clear and rocky forest stream in Komba Forest	1847		7.30803°N	36.12201°E	collection
<i>Pseudagrion spernatum</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, Gojeb River, large river	1515		7.55448°N	36.05688°E	collection
<i>Pseudagrion spernatum</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1518		7.55442°N	36.05213°E	collection
<i>Tetrathemis polleni</i>	05.12.2014	December	2014	Awurada Valley, Gummi River, large river	1293		7.09281°N	36.23154°E	observation
<i>Trithemis aconita</i>	21.03.2004	March	2004	Borkana River near Yayu	1290		8.37093°N	35.8847°E	collection
<i>Trithemis aconita</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Trithemis arteriosa</i>	06.12.2014	December	2014	Shoriri Wetlands, stream along forest edge and Shoriri Wetlands	1626		7.35707°N	36.20437°E	collection
<i>Trithemis arteriosa</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, swampy floodplain N of Gojeb	1516		7.55444°N	36.05209°E	collection
<i>Trithemis ellenbeckii</i>	26.10.1973	October	1973	Amaia Road, near Anderrica, loc. 19	2231	20 km	7.167305°N	36.3213°E	literature
<i>Trithemis ellenbeckii</i>	26.10.1973	October	1973	Anderrica Forest, loc. 18	1660	20 km	7.195405°N	36.285317°E	literature
<i>Trithemis ellenbeckii</i>	28.10.1973	October	1973	2km W of Baca, Jimma-Bonga Road, loc. 21	1779	5 km	7.398385°N	36.232171°E	literature

Species	Date	Month	Year	Locality	Altitude	Accuracy	Latitude	Longitude	Record
<i>Trithemis ellenbeckii</i>	17.03.2004	March	2004	Gore, between Gore and Gordomo	1775		8.0594°N	35.5238°E	collection
<i>Trithemis ellenbeckii</i>	17.03.2004	March	2004	Gore to Gordomo, 10 km S of Gore	1775		8.05941°N	35.52376°E	collection
<i>Trithemis ellenbeckii</i>	06.12.2014	December	2014	Shoriri Wetlands, stream along forest edge and Shoriri Wetlands	1626		7.35707°N	36.20437°E	collection
<i>Trithemis ellenbeckii</i>		November	1885	Scioa Ghimira			6.9666667°N	35.7666667°E	literature
<i>Trithemis furva</i>	26.10.1973	October	1973	Anderrica Forest, loc. 18	1660	20 km	7.195405°N	36.285317°E	literature
<i>Trithemis furva</i>	21.03.2004	March	2004	Borkana River near Yayu	1290		8.37093°N	35.8847°E	collection
<i>Trithemis furva</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Trithemis furva</i>	09.12.2014	December	2014	Gawata, Gojeb Wetlands, Gojeb River, large river	1515		7.55448°N	36.05688°E	observation
<i>Trithemis stictica</i>	17.03.2004	March	2004	Gore to Gordomo, 10 km S of Gore	1775		8.05941°N	35.52376°E	collection
<i>Trithemis stictica</i>	06.12.2014	December	2014	Shoriri Wetlands, stream along forest edge and Shoriri Wetlands	1626		7.35707°N	36.20437°E	collection
<i>Zosteraeschna ellioti</i>	20.03.2004	March	2004	Bonga, N	1727		7.32987°N	36.24733°E	collection
<i>Zosteraeschna ellioti</i>	20.03.2004	March	2004	Bonga, stream near Bonga	1730		7.32988°N	36.2473°E	collection
<i>Zosteraeschna ellioti</i>	03.12.2014	December	2014	Bonga, hill W of Bonga	1980		7.25358°N	36.226332°E	observation
<i>Zosteraeschna ellioti</i>	07.12.2014	December	2014	Komba Forest, clear and rocky forest stream in Komba Forest	1847		7.30803°N	36.12201°E	collection
<i>Zosteraeschna ellioti</i>			1887	Scioa Ghimira			6.9666667	35.7666667°E	literature
<i>Zygonyx natalensis</i>	17.03.2004	March	2004	Gordomo-Masha, Baro River, 30 km S of Gore	1630		7.87622°N	35.4788°E	collection
<i>Zygonyx natalensis</i>	21.03.2004	March	2004	Meta, 35 km E, Borkana River	1288		8.37094°N	35.88472°E	collection
<i>Zygonyx torridus</i>	05.12.2014	December	2014	Awurada Valley, Gummi River, large river	1293		7.09281°N	36.23154°E	observation

Table 6: Current status of the study areas at the Kafa BR

Study areas	Habitat/forest type	Degree of habitat degradation	Main observed threats	Taxonomic group or species indicating good conditions
Bamboo Forests (BA)	Streams in bamboo	Little to none	None	<i>Notogomphus cottarelli</i>
Boka Forests (BK)	Wetlands beyond BK Forest	Little (grazing by live-stock resembles grazing by game in former times)	Ongoing deforestation along the stream	<i>Notogomphus ruppelli</i> , <i>Pseudagrion guichardi</i>
Komba forests	Clear river in forest/secondary forest	Selective logging, water pollution (washing of clothes, people and vehicles in river)	Water pollution, selective logging	<i>Atoconeura aethiopica</i> , <i>Pseudagrion guichardi</i>
Awurada valley	Floodplain	Considerable	Clear cutting of the understory and heavy poaching	<i>Gynacantha nigeriensis</i>
Alemgono	Wetlands	Large	Heavy grazing	none
Shoriri (SHO)	Undisturbed wetlands	little	Little grazing	<i>Notogomphus cottarelli</i>
Mankira (MA)				
Gojeb Wetlands (GO-wet)	Wetlands	Low	Grazing	
Gojeb River (GO-riv)				
Boginda (BO)	Forest	Medium	Selective logging	

Taxonomic group or species indicating poor conditions	Proposed indicator species	Proposed conservation measures for indicator species	Proposed monitoring for indicator species
None	<i>Notogomphus cottarelli</i>	Do not disturb	Larvae sampling (high densities in stream), observation of adults (potentially seasonal)
None	<i>Notogomphus ruppelli</i> , <i>Pseudagrion guichardi</i>	Do not enlarge open areas	Observation of adults
Many army ants	<i>Atoconeura aethiopica</i> , <i>Pseudagrion guichardi</i>	Water sanitation (raising awareness, washing areas should be further away from the river)	Observation of adults
Many army ants	<i>Gynacantha nigeriensis</i>	Stop poaching and understorey clear cutting	Observation of adults
A lot of widespread openland species	none	Do not increase grazing intensity	
		Leave as it is, perhaps extensive grazing could help retain high habitat diversity	
		Leave a broad riparian forest area along the river – no selective logging, clear cutting, fire or poaching	
High number of army ants		Stop selective logging, poaching and any other encroachment	

7.2. Photos

7.2.1 Sampling methods



Figure 5: Collecting dragonflies (here the Red-veined Dropwing, *Trithemis arteriosa*) in the Shoriri Wetlands (photo: Viola Clausnitzer)

7.2.2 Sampled habitats



Figure 6a: Forest stream in Boka Forest. This stream is populated by the Ethiopian Sprite (*Pseudagrion guichardi*) and Rüppell's Longlegs (*Notogomphus ruppeli*), both endemic to the southern Ethiopian highlands (photo: Viola Clausnitzer)



Figure 6b: Valley below Boka Forest (in the background), swampy areas are home to the endemic Ethiopian Skimmer (*Orthetrum kristensei*) (photo: Viola Clausnitzer)

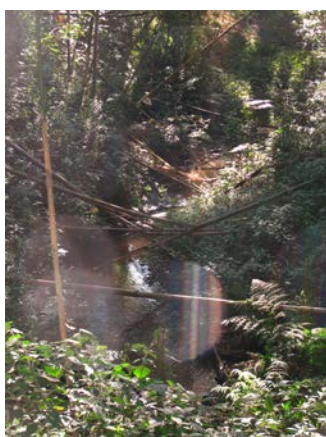


Figure 6c: Stream in the Bamboo Forest, where many larvae of the endemic Cottarelli's Longlegs (*Notogomphus cottarellii*) were found (photo: Viola Clausnitzer)

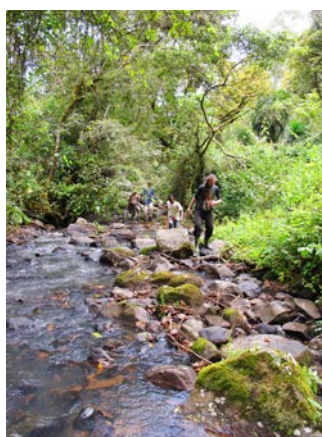


Figure 6d: Stream in Komba Forest with a good population of the Ethiopian Highlander (*Atoconeura aethiopica*) (photo: Viola Clausnitzer)

7.2.3 Species suggested for flagship and monitoring species



Figure 7a: The endemic Ethiopian Sprite (*Pseudagrion guichardi*), Boka. Suggested as a flagship and monitoring species (photo: Viola Clausnitzer)



Figure 7b: The endemic Cottarelli's Longlegs (*Notogomphus ruppeli*), Boka. Suggested as a flagship and monitoring species (photo: Viola Clausnitzer)



Figure 7c: The endemic Rüppell's Longlegs (*Notogomphus ruppeli*), Boka. Suggested as a flagship and monitoring species (photo: Viola Clausnitzer)



Figure 7d: The Ethiopian Highlander (*Atoconeura aethiopica*), Komba Forest (photo: Viola Clausnitzer)



Figure 7e: The Ethiopian Skimmer (*Orthetrum kristenseni*), Boginda. A widespread and common species in Ethiopia's highlands which would serve as a good flagship species for water quality (photo: Viola Clausnitzer)

7.2.3 Evidence of human encroachment into the core zone



Figure 8a: Awurada Floodplain: poached forest pig (5/12/2014) (photo: Viola Clausnitzer)



Figure 8b: Awurada Floodplain: understorey clearing for poaching? (5/12/2014) (photo: Viola Clausnitzer)



Figure 8c: Awurada Floodplain: poachers' fire (5/12/2014) (photo: Viola Clausnitzer)



Figure 8d: Boginda Forest: selective logging (11/12/2014) (photo: Viola Clausnitzer)



Figure 8e: Boginda Forest: small clearings, probably for beekeeping (11/12/2014) (photo: Viola Clausnitzer)



Figure 8f: Komba Forest: selective logging (7/12/2014) (photo: Viola Clausnitzer)



Figure 8g: Boginda forests: selective logging (photo: Viola Clausnitzer)



Figure 8h: Boginda forests: selective logging (photo: Viola Clausnitzer)



Figure 8i: Komba forest (core zone): selective logging (photo: Viola Clausnitzer)