



Herpetofauna (Amphibia, Reptilia) at the Kafa Biosphere Reserve

Tom Kirschey

Highlights

- A total of 17 amphibian species from four families were recorded (Table 2).
- A total of five squamate reptile species (two Sauria, three Serpentes) from four families were recorded (Table 3).
- One species of Hyperoliidae (genus *Leptopelis*) is probably new to science.
- Eight species of amphibians and two species of reptiles were recorded the first time for the Kafa BR (Amphibia: *Leptopelis ragazzii*, *Leptopelis* sp., *Hyperolius kivuensis*, *Phrynobatrachus inexpectatus*, *Ptychadena schillukorum*, *P. erlangeri*, *P. mascareniensis*, *Xenopus clivii*, Reptilia: *Trachylepis wingatii*, *Megatyphlops brevis*).
- Six (perhaps seven) of the recorded amphibian species are endemic to the Ethiopian Highlands (*Leptopelis ragazzii*, *L. vannutellii*, *L. spec.*, *Afrixalus clarkeorum*, *A. enseticola*, *Phrynobatrachus inexpectatus*, *Ptychadena erlangeri*).
- One of the recorded reptile species is endemic to the southwestern Ethiopian Highlands (*Pseudoboodon boehmei*).
- Three species are threatened according to the updated global IUCN Red List of Threatened Species (two ‘vulnerable’, one ‘endangered’: *Leptopelis ragazzii*, *Afrixalus clarkeorum*, *A. enseticola*). All three are endemic to Ethiopia. Another species (*Leptopelis vannutellii*) was previously listed as ‘vulnerable’, but has been redesignated as ‘least concern’.
- Beccari’s giant frog (*Conraua beccarii*), Largen’s dwarf puddle frog (*Phrynobatrachus inexpectatus*) and Clarke’s banana frog (*Afrixalus clarkeorum*) are flagship species for amphibians.
- This report includes the first picture of the tadpole mouthpart of the previously undescribed and highly rheophile Beccari’s giant frog (*Conraua beccarii*).
- Wetland sites, particularly inside or near the natural forest, show the highest level of diversity. The lowest diversity is found in the bamboo forest.
- Arboreal and running water habitats require more research.
- Endemic species are exclusively bound to forest habitats (canopy).

1. Introduction

According to Kingdon (1990) there are four major centres of endemism in Africa: the Cape flora, the moist coasts flora and fauna, the arid zone flora and fauna and the mountain flora and fauna. In Eastern Africa, the Afromontane ecosystems show an exceptionally high degree of endemism. For example, the degree of endemism among frogs in Ethiopia is 40%. This is largely due to the vast highlands being isolated by the surrounding dry lowlands. Biogeographically, there are several different speciation centres between the two vertebrate classes within Ethiopia. There are several provinces within the so-called "Intertropical Montane Region"¹, of which the Ethiopian Highlands form the largest Afromontane area. The Ethiopian Intertropical Montane Region and the rest of tropical Africa tend to only share the most versatile and mobile species. These are mainly montane species. Most of Ethiopia's endemic species also belong to the Afro-tropical Highlands biome (Kingdon 1990). The most comprehensive and up-to-date overview of Ethiopian herpetofauna is provided by Largen & Spawls (2010). Mazuch (2013) focuses on the Eastern Ethiopian regions, where savanna and other Afromontane dryland habitats predominate.

¹ The term "intertropical" is not used in the cartographic sense, but describes the mountainous areas in the Tropics which are not tropical according to climatic criteria (see Poynton 1999).

More than 30 amphibian and reptile species new to science have been described from Ethiopia (and Eritrea) since 1970, indicating that knowledge of Ethiopian herpetofauna has improved substantially in recent decades; however, apart from the taxonomical identification of species, very little is known about the distribution, biology and ecology of a significant portion of the known taxa. Thus there is still huge potential for new distribution records and discovery of new species.

In spring 2015, another survey was conducted by a Russian and Kazakh team (Milto et al. 2015), confirming several records and observing some species which were not detected in the biodiversity assessment. This report does not include the analysis of all the collected material, e.g., most tadpoles from the genus *Ptychadena* still need to be analysed, and their microhabitat data has not been sufficiently processed. The preserved collection material is split between the Ethiopian Biodiversity Institute (EBI) and the Alexander Koenig Zoological Research Museum (ZFMK) in Bonn and could be used for further research. The author is grateful to the EBI for research and export permits for samples, which allowed species to be identified. The survey likely only covered a range of herpetofaunal diversity in the Kafa BR (especially for reptiles). During the rainy season, the detectability of nearly all species should increase significantly.

2. Materials and Methods

2.1 Study area

Amphibians and reptiles were recorded at different study sites according to the project's needs: core zones, Participatory Forest Management (PFM) sites and wetlands (Tab. 1). Our Wetland Taxagroups Team consisted of Dr Viola Clausnitzer, collecting dragonflies and damselflies, Thies Geertz, collecting land and freshwater molluscs, and the field assistants Tizita Tamiru, Mitiku Gebremariam and Admasu Asefa. The sample sites were usually selected based on the presence of aquatic habitats (streams, rivers, headwaters, swamps, etc.). This report contains one species which was not seen personally but for which there is photographic evidence.

2.2 Sampling methods

Visual encounter surveys (VESs) are primarily used to inventory the presence of taxa at particular sites. Visual and auditory sampling of adult and subadult/juvenile animals at the sample sites, including tadpole sampling, was conducted with bare hands, snake hooks and a sweep net. With minor modifications, our methods followed contemporary standard methods for sampling reptiles (McDiarmid et al. 2012) and amphibians (Heyer et al. 1994; Olson et al. 1997). The time of year (dry season) was not ideal for surveying herpetofauna. The weather (full sunshine, no rain at all) also made the search for herpetofauna difficult. The sampling was conducted between 5 am and 9 pm. It was highly

Table 1: Sample localities. KBR zone: cz: core zone, bz: buffer zone, ccz: candidate core zone. The number of species recorded at each locality is given. All dates are for December 2014.

Area	Site	KBR	PFM	Code	Date	Habitat	Alt.	Lat.	Long.
Bonga	Bonga	-	-	BG1	03.12.	Small stream behind KDA Guesthouse	1832	7.25420°N	36.25762°E
Bonga	Bonga	-	-	BG2	03.12.	Hill behind KDA Guesthouse	1980	7.25358°N	36.22633°E
Bonga	Bonga	-	-	BG3	entire period	KDA Guesthouse area	1955	7.24235°N	36.24090°E
Boka	Boka	cr	-	BK1	04.12.	Stream in wetland 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			
Boginda	Gojeb Wetlands	ccz	-	GO-wet2	09.12.	Gallery forest and wetlands along Gojeb River	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

valuable that supplementary bycatches, mostly from the Wetland Taxagroups Team, especially by Dr Viola Clausnitzer and Thies Geertz, were available for this assessment. The daytime survey was suboptimal but necessary because of logistic limitations (drivers who were used to working during the day were unable and unwilling to work at night). In addition, the entire expedition group reported herpetofauna roadkill, and several samples were collected at roads between the study sites (incidental road riding, no dedicated road riding), which proved highly valuable for the report, especially for the reptile sample.

For amphibians, forensic *Batrachochytrium dendrobatidis* (Bd) samples were taken from most specimens. The prevalence analysis is still unfinished. Knowledge about the prevalence and impact of Bd on species has important conservation implications, as the fungus has brought several amphibian taxa to extinction worldwide and has been classified as one of the major threats to worldwide amphibian populations.

2.3 Nomenclature and data analysis

Except for using the scincid genus name *Trachylepis* (instead of *Mabuya*) for both *maculilabris* and *wingatii*, the nomenclature follows Largen & Spawls (2010), but uncertainties in the taxonomic status of several taxa remain and are further described below. Data

on the presence/absence of species were insufficient for a more detailed analysis of the sample sites, but clustering them allowed a gradient of forest cover and site occupancy of some wetland complexes to be demonstrated.

3. Results and Discussion

A total of 22 species (17 amphibians, five reptiles) was recorded. Eight species of amphibians and two species of reptiles were recorded the first time at the Kafa BR (Amphibia: *Leptopelis ragazzii*, *Leptopelis* sp., *Hyperolius kivuensis*, *Phrynobatrachus inexpectatus*, *Ptychadena schillukorum*, *P. erlangeri*, *P. mascareniensis*, *Xenopus clivii*, Reptilia: *Trachylepis wingatii*, *Megatyphlops brevis*).

3.1 Amphibia

Of the 65 Amphibia species recorded in Ethiopia, these records only represent 26.2%. Excluding species with strong geographic restrictions in other parts of Ethiopia and considering methodological problems such as weather and season, this is a remarkably good result; however, it also has several notable gaps, e.g., not a

single Bufonid was recorded. Local villagers and guides have affirmed that the Aleku caecilian (*Sylvacaecilia grandisonae*) occurs in the area and is found frequently in gardens and agricultural land, but the species was not found during our assessment. We were also unable to record shovel-nosed frogs from the genus *Hemisus* or the foam-nest building Keller's frog (*Chiromantis kelleri*), both of which are said to occur in the area. In Bonga City, local traders apparently offer frogs for consumption, but the author was unable to find any. Table 2 shows all recorded amphibian species. The endemic species which are newly recorded in the Kafa BR and threatened species according to IUCN Red List are described further below.

Table 2: Recorded amphibian species

No.	Species	Family	Status
01	<i>Leptopelis ragazzii</i> , Boulenger 1896	Arthroleptidae	VU, endemic, new record for Kafa BR
02	<i>Leptopelis vannutellii</i> , Boulenger 1898	Arthroleptidae	Reclassified from VU to LC, endemic
03	<i>Leptopelis</i> sp.	Arthroleptidae	?, new record for Kafa BR
04	<i>Hyperolius viridiflavus</i> , Duméril & Bibron 1841	Hyperoliidae	LC
05	<i>Hyperolius kivuensis</i> , Ahl 1931	Hyperoliidae	LC, new record for Kafa BR
06	<i>Hyperolius nasutus</i> , Günther 1864	Hyperoliidae	LC
07	<i>Afrixalus clarkeorum</i> , Largen 1974	Hyperoliidae	Reclassified from VU to EN, endemic
08	<i>Afrixalus enseticola</i> , Largen 1974	Hyperoliidae	VU, endemic
09	<i>Conraua beccarii</i> , Boulenger 1911	Ranidae	LC
10	<i>Phrynobatrachus minutus</i> , Boulenger 1895	Ranidae	LC
11	<i>Phrynobatrachus inexpectatus</i> , Largen 2001	Ranidae	LC, endemic, new record for Kafa BR
12	<i>Phrynobatrachus natalensis</i> , Smith 1849	Ranidae	LC
13	<i>Ptychadena erlangeri</i> , Ahl 1924	Ranidae	LC, endemic, new record for Kafa BR
14	<i>Ptychadena schillukorum</i> , Werner 1907	Ranidae	LC, new record for Kafa BR
15	<i>Ptychadena mascareniensis</i> , Duméril & Bibron 1841	Ranidae	LC, new record for Kafa BR
16	<i>Ptychadena neumanni</i> , Ahl 1924	Ranidae	LC
17	<i>Xenopus clivii</i> , Peracca 1898	Pipidae	LC, new record for Kafa BR

3.1.1 Arthroleptidae

Ragazzi's tree frog or the Shoa Forest tree frog (*Leptopelis ragazzii*) was not seen as an adult during the survey, but could be identified in the form of tadpoles. This underlines the value of combined methods (searches for both terrestrial stages and larval aquatic stages). It is endemic to the Ethiopian Mountains and strictly bound to forests at elevations of about 1900 to 3100 m a.s.l. Massive deforestation in Ethiopia has destroyed suitable habitats, and some previously identified populations are declining or have been already become extinct. Thus it has been listed as 'vulnerable' (IUCN SSC 2013) on the IUCN Red List. It is also one of the species which was recently detected as a Bd host (Gower et al. 2012), but its impact is still unknown. The taxonomic status of this species is still a matter for discussion. Recent molecular data suggest that *L. ragazzii* comprises two or more distinct taxa. Remarkably, this is the first record of this species south of the Gojeb River and west of the Omo River. This species was also confirmed by Milto et al. (2015) as occurring at the Barta Waterfall, Barta River and in Mankira Forest.

A single female specimen of the Dime forest tree frog, or Vannutelli's tree frog (*Leptopelis vannutellii*), was discovered on a leaf in the garden of the KDA Guesthouse. *L. vannutellii* is also a prevalent species for Bd (see Gower et al. 2012). Its occurrence has been previously confirmed in the Kafa BR (pers. comm. S. Loader 2012, cited in IUCN SSC 2013) and subsequently found by Milto et al. (2015) in the Alemgono Wetlands. A photograph by Bianca Schlegel at the Alemgono Wetlands confirms the presence of the species there. Unfortunately, the specimen collected during the expedition escaped after being photographed and could not be recaptured.

L. ragazzii is endemic to Ethiopian Highland forests, and was previously classified as 'vulnerable' due to its limited known range and its vulnerability to deforestation. Nowadays it is classified as 'least concern' on the IUCN Red List (IUCN SSC 2013), a classification which the author disagrees with. No major new data on the distribution and status of recorded subpopulations was assessed, and it has been proven to be a strictly forest-bound species. Habitat loss due to forest clearance, human settlement, and both small- and large-scale agricultural encroachment puts a heavy and continued pressure on known populations.

The most exciting finding was a single tree frog specimen, which was distinguished as an Arthroleptidae by its size and appearance. It probably belongs to the genus *Leptopelis*, but some characteristics (especially the very special dorsal ornamental skin sculpturation and colour patterns) do not fit any of the species mentioned above, nor do they match *L. bocagii*, *L. gramineus* or *L. susanae*. It was found in the Boka Forest Wet-

lands on the very last day of the survey. In email correspondence with several colleagues (including Stephen Spawls) the author learnt that this type of tree frog had never been seen before, and probably represents an undescribed taxon. It is likely that this taxon is also endemic, because most of the people contacted for identification are experienced at least with Eastern African and especially with Afromontane amphibians. Unfortunately, as with the *L. vannutellii* specimen, the tree frog escaped after the picture was taken. Therefore, the author expresses his considerable interest in continuing the search for this frog.

The tadpole samples from the Boka Forest Wetlands also contained one species which could not be identified, but samples were taken and stored in ZFMK. So it is hoped that the tadpole from this species was found and it might be possible to characterise it both morphologically also using molecular methods.

3.1.2 Hyperoliidae

Clarke's banana frog (*Afrixalus clarkeorum*) is an endemic only known from moist tropical forest in southwestern Ethiopia (Largen 1974). According to Largen and Spawls (2010), the preferred terrestrial microhabitat of this species is the leaf axils of *Ensete ventricosum* plants found in forest clearings and tall grasses and reeds in recently flooded hollows at the edge of the forest. As an arboreal species, it is naturally bound to forests. Because the emendation by Largen (2001) is not accepted or described as "unjustified" by some databases, it is often named *Afrixalus clarkei*, e.g., in the IUCN Red List, where it is listed as 'endangered'. This species was found in or near BK2 and SHO1, but only in higher vegetation (bushes and shrubs). Deforestation and overgrazing by cattle seem to have a strong impact on this species, as it was not found in the intensively used Alemgono and Gojeb Wetlands. Milto et al. (2015) also managed to find this species in the Gojeb Wetlands, in the gallery riparian forest remnants near one of the small rivers. It was recently detected as a Bd host (Gower et al. 2012), but its impact on this species is still unknown.

The Ethiopian banana frog (*Afrixalus enseticola*) is another endemic of the Ethiopian Highland forests, but it also occurs in and around the Bale Mountains National Park on the other side of the Rift Valley. It was also described by Malcom Largen in 1974. The species is characterized as essentially sylvicolous, and all known breeding sites are in or close to forest glades. Its microhabitat is similar to that of *Afrixalus clarkeorum*. Both species exhibit site sympatry and syntopy. This supports the theory that they are distinct taxa and further research is necessary to define each species' ecological niche.

One of the species was recently detected as a Bd host (Gower et al. 2012), but its impact is still unknown. Because of its larger known distribution, it is listed as 'vulnerable' on the IUCN Red List. *A. enseticola* was found in the Boka Forest Wetlands, Alemgono and Shoriri Wetlands and in the Gojeb Wetlands. In the Gojeb Wetlands, it was found during daytime in the higher shrub and tree vegetation of the riparian galleries, but at night, numerous specimens were observed sitting on highly overgrazed wet meadows in small (300 mm high) shrubs. It was confirmed by Milto et al. (2015) to occur in the Alemgono Wetlands and was also found near Barta Waterfall.

Records for the Lake Kivu reed frog (*Hyperolius kivuensis*) were not expected in Kafa BR, as this was only the third record for this species in Ethiopia and was also approximately 100 km away from the known localities at the very southwestern edge of the country. Our occurrence data represent a huge extension of the most northeasterly part of its distribution range. It was only found in the Gojeb Wetlands and was confirmed by Milto et al. (2015) for the same locality.

The long-snouted reed frog (*Hyperolius nasutus* s.l.) and the variable reed frog (*Hyperolius viridiflavus* s.l.) are two abundant Hyperoliid species found at nearly all sample sites.

3.1.3 Ranidae

Beccari's giant frog (*Conraua beccarii*) was another species only recorded as a tadpole, which again shows the importance of tadpole searches to complete a site inventory. This was challenging, as there is no description of larval characteristics in literature to date (see Channing et al. 2012), even though this species has a very recognisable tadpole. The author was grateful to Mark-Oliver Rödel, from the Berlin Natural History Museum, who helped with the determination of the tadpole. Because of its highly rheophilous larval preference, and because it is reported to be eaten by the locals (which could lead to overexploitation of its natural population), it is proposed as a good indicator species for water quality, deforestation (which leads to unsuitable water temperatures) and the sustainable use of natural resources. Tadpoles of Beccari's giant frog were found in the Komba Forest stream and Bamboo Forest stream. This species ought to be distributed much more widely in the area, as Milto et al. (2015) reported it for several localities including a river near the KDA Guesthouse in Bonga, Barta Waterfall, God's Bridge and a river in Mankira Forest.

Largen's dwarf puddle frog (*Phrynobatrachus inexpectatus*) was described by Malcom Largen in 2001. It is an Ethiopian mountain endemic, which was previously only known from the terrain typical near Bore at 2650

m a.s.l. and a second population near Dorse in the margins of pools surrounded by *Schefflera-Hagenia* forests. It was found in sympatry with *P. minutus* in the Boka Forest Wetlands and Shorori Wetlands. These records are remarkable because they are the first from the west of Rift Valley and approximately 100 km northwest of the known distribution records near Arba Minch. Both of the other two *Phrynobatrachus* species – *P. natalensis* and *P. minutus* – were also recorded in the Kafa BR. Interestingly, *P. inexpectatus* was found in high abundance in a very special microhabitat, the headwaters mire formed by liverworts in the Boka Forest Wetlands on a site smaller than a hectare. A limited number of Ethiopian dwarf puddle frogs (*Phrynobatrachus minutus*) were recorded in this particular microhabitat. They seemed more abundant in reeds or near the small waterbodies, including the shores of the river itself. *P. minutus* was the predominant puddle frog in all the other wetland and forest sites, except for the Gojeb Wetlands, where *P. natalensis* predominated.

3.1.4 Pipidae

We recorded Peracca's clawed frog (*Xenopus clivii*) for the first time in Kafa BR, though this cannot be classified as a range extension due to the lack of previous distribution data.

3.2 Reptilia

Of the 214 reptile species known to occur in Ethiopia, only four were observed during the survey, plus one other determined based on a photograph taken by a member of the expedition. These five species represent only 2.34% of Ethiopian reptile fauna and 5.49% of the expected reptile diversity of the KBR. The paucity of results was mainly due to the season and the limited timeframe, but also because the study did not include any savanna and dryland habitats. In addition, several species seem to aestivate during the dry season.

The speckle-lipped skink (*Trachylepis maculilabris*) reaches the northwestern border of its range in Ethiopia. It inhabits a great variety of habitats, from urban areas to pristine natural habitats. It was found in relatively high abundance, including around the KDA Guesthouse by rocks and walls, near bushes and shrubs and on roofs. We also found several specimens in Boginda Forest, Awurada Valley and on riparian palm trees in the Gojeb Wetlands. A single specimen of Wingate's skink (*Trachylepis wingatii*) was recorded in the Boka Forest Wetlands, in relatively dry grassland at the edge of the forest. However, this does not seem to reflect a habitat preference, as it is known to inhabit a broad variety of habitats, from forest clearings to moist savanna (Largen & Spawls 2010). Böhme's Ethiopian snake (*Pseudoboodon boehmei*) was found by the mammal team as a single roadkill specimen on the road heading north to the bamboo forest east of Bonga.

Table 3: Recorded reptilian species

No.	Species	Family	Status
01	<i>Trachylepis maculilabris</i> , Gray 1845	Scincidae	LC
02	<i>Trachylepis wingatii</i> , Werner 1907	Scincidae	LC, new record for Kafa BR
03	<i>Pseudoboodon boehmei</i> , Rasmussen & Lagen 1992	Colubridae	Endemic
04	<i>Megatyphlops brevis</i> , Scortecci 1929	Typhlopidae	LC, new record for Kafa BR
05	<i>Naja melanoleuca</i> , Hallowell 1857	Elapidae	LC

The habitat this road crosses is characterised by intact forest with dense canopy. The Somali giant blind snake (*Megatyphlops brevis*) was found as a roadkill specimen on the road crossing the Gojeb Wetlands. This was the first report of this species for the Kafa BR.

The forest cobra (*Naja melanoleuca*) is the only species mentioned as a proper record in this report, although

it was not seen by the author. It was determined with full certainty from a mobile phone picture taken by a member of the expedition. It was spotted crossing a small river to the Gojeb Wetlands, while the ichthyology team was capturing fish. According to Lagen & Spawls (2010), it should be common in southwestern Ethiopia.

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.

Most Ethiopian Highlands forest endemics are extremely sensitive to changes in their habitat. Endemic species which require forested and clear rocky streams or rivers, such as Ragazzi's tree frog, Clarke's banana frog, the Ethiopian banana frog, the Ethiopian dwarf puddle frog and Lagen's Dwarf puddle frog are a conservation concern and can act as monitoring species for the core zones of the Biosphere Reserve. Unfortunately, the survey did not find some of the expected charismatic species such as the Ethiopian mountain adder (*Bitis parviocula*), and they therefore cannot be suggested as flagship species. Because they are easy to recognize and endemic to the montane habitats, only tree frogs such as *Leptopelis ragazzii*, *Leptopelis vannutellii* or the two banana frog species of the genus *Afrivalus* can act as flagship species for the Kafa BR. The more abundant and widely distributed species often are relatively tolerant to habitat disturbance. But even species quite adaptable to altered landscapes, such as Baccari's giant frog or the Natal dwarf puddle frog, will disappear with the ongoing loss of their habitats due to water pollution, water extraction and large scale reforestation with eucalyptus and pine trees.

The wetlands have thus far been neglected in the Kafa BR zonation. A protected zone should be established covering the huge wetlands of the Gojeb River as well as the wetlands in the Afroalpine zone, e.g., beyond Boka Forest.

4.1 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. They containing 10% of all known species in an area making up just 1% of the Earth's surface, and provide ecosystem services valued at several trillion USD per year (Butchart et al. 2005). More than half of the earth's wetlands have been degraded, and more than two-thirds of our upland watersheds remain unprotected. 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 transverse corridors for dispersal of biota. Freshwater ecosystems and freshwater biodiversity are in great peril,

Table 4: Species suggested as monitoring and flagship species

Species	Endemic	Red List	Monitoring species	Flagship species
<i>Leptopelis ragazzii</i>	Yes	VU	Yes	Yes
<i>Leptopelis vannutellii</i>	Yes		Yes	Yes
<i>Leptopelis sp.</i>	?	-	?	?
<i>Afrivalus clarkeorum</i>	Yes	EN	Yes	Yes
<i>Afrivalus enseticola</i>	Yes	VU	Yes	Yes
<i>Conraua beccarii</i>	No		Yes	No
<i>Phrynobatrachus minutus</i>	Yes		Yes	No
<i>Phrynobatrachus inexpectatus</i>	Yes		Yes	No
<i>Ptychadena erlangeri</i>	Yes		No	No
<i>Pseudoboodon boehmei</i>	Yes		No	No

and urgent measures are needed. 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.

Amphibians and reptiles are among the most threatened taxa groups worldwide. Because of their joint

aquatic and terrestrial ecology, amphibians in general are good indicators for freshwater and terrestrial habitats. The Kafa BR is one of the last remnants of Afromontane forest in Ethiopia, and only stronger conservation efforts for the cluster of wetlands and forests can secure favourable conservation status of endemic and typical herpetofauna assemblages.

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6. Appendix

6.1. Photos



Figure 1: *Leptopelis ragazzii* tadpole mouthpart, 1st anterior labial tooth row not visible, Komba Forest (photo: Tom Kirschey)



Figure 2: *Leptopelis vannutellii*, KDA Guesthouse, Bonga (photo: Tom Kirschey)



Figure 3: *Leptopelis spec.*, Boka Forest Wetlands (photo: Tom Kirschey)



Figure 4: *Leptopelis spec.*, Boka Forest Wetlands (photo: Tom Kirschey)



Figure 5: *Hyperolius kivuensis*, Gojeb Wetlands (photo: Tom Kirschey)



Figure 6: *Hyperolius viridiflavus*, Gojeb Wetlands (photo: Tom Kirschey)



Figure 7: *Hyperolius nasutus*, Alemgono Wetlands (photo: Tom Kirschey)



Figure 8: *Afixalus clarkeorum*, Boka Forest Wetlands (photo: Tom Kirschey)



Figure 9: *Afixalus enseticola* in atypical microhabitat, Gojeb Wetlands (photo: Tom Kirschey)



Figure 10: *Conraua beccarii* tadpole mouthpart, Komba Forest Stream (photo: Tom Kirschey)



Figure 11: *Conraua beccarii* tadpole, Komba Forest Stream (photo: Tom Kirschey)



Figure 12: *Phrynobatrachus minutus* (female) foot, Shoriri Wetlands (photo: Tom Kirschey)



Figure 13: *Phrynobatrachus minutus* ventral colour patterns, Boka Forest Wetlands (photo: Tom Kirschey)



Figure 14: *Phrynobatrachus inexpectatus*, Boka Forest Wetlands (photo: Tom Kirschey)



Figure 15: *Phrynobatrachus natalensis*, Alemgono Wetlands (photo: Tom Kirschey)



Figure 16: *Ptychadena* cf. *neumanni*, Gojeb Wetlands (photo: Tom Kirschey)



Figure 17: *Ptychadena* cf. *schillukorum*, Boka Forest Wetlands (photo: Tom Kirschey)



Figure 18: *Ptychadena erlangeri*, Gojeb Wetlands (photo: Tom Kirschey)



Figure 19: *Ptychadena erlangeri* foot, Gojeb Wetlands (photo: Tom Kirschey)



Figure 20: *Ptychadena mascareniensis* foot, Alemgono Wetlands (photo: Tom Kirschey)



Figure 21: *Ptychadena mascareniensis*, Shoriri Wetlands (photo: Tom Kirschey)



Figure 22: *Xenopus clivii*, Shoriri Wetlands (photo: Tom Kirschey)



Figure 23: *Trachylepis maculilabris*, KDA Guesthouse, Bonga (photo: Tom Kirschey)



Figure 24: *Trachylepis (Mabuya) wingatii*, Boka Forest Wetlands (photo: Tom Kirschey)



Figure 25: *Megatyphlops brevis*, roadkill, road between Gojeb Wetlands and Boginda Forest (photo: Tom Kirschey)



Figure 26: *Pseudoboodon boehmei*, roadkill, road north of Bamboo Forest (photo: Tom Kirschey)