



AMPHIBIANS OF MOUNT BAMBOUTOS, CAMEROON: DIVERSITY, DISTRIBUTION, CONSERVATION STATUS AND THREATS

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ABSTRACT:

Cameroon is home to a high number of amphibians (frogs and caecilians) for Central Africa, with over 200 species known to date, of which around 60 are endemic. The Bamenda Highlands, the focus of this study, form the northern portion of the Cameroon Volcanic Line, an area of high amphibian diversity and endemism. Unfortunately, this ecoregion is being altered by various anthropogenic activities due to the increasing human population and land demand and settlement, with potentially adverse effects on amphibians. In order to obtain essential data on and better understand of the ecologies and life histories of these species, we surveyed three mountains in the Bamenda Highlands; comprising Mt Oku, Mt Bamboutos and Mt Mbam. In these areas, human activities are increasing and amphibian populations are thought to be decreasing drastically.

BACKGROUND:

The biological importance of the Cameroon highlands are outstanding at an international level as one of the biodiversity hotspots of the world¹ (Myers et al., 2000). This amphibian decline has many causes, but one of the most important is habitat destruction^{2,3,4}. High elevation amphibians confined to flowing water have been a substantial component of the world wide amphibian decline (Lips et al., 2003, Lötters et al., 2004). Cameroon harbors a high diversity of amphibian species compared to adjacent countries: about 3 % of the world's currently recognised amphibian species reside in Cameroon. In Cameroon, endemics are especially concentrated in the highlands. The knowledge of the ecology and distribution of amphibians in the Bamenda Highlands (North West Cameroon) remains very poor, due to the lack of studies in this zone. Land-use has been found to have a profound effect on some herpetofaunal communities (), but little information on the response of amphibian assemblages to land-use has been gathered within the Cameroon highlands.

The aim of this study was to obtain updated information on the amphibian assemblage and their threats on Mount Bamboutos. This mountain has endemic and globally threatened amphibian species and has no official protection.

METHODS:

We conducted surveys on Mt Bamboutos every 3 months over 15 day periods from 2014-2015 to detect all species possible during seasonal fluctuations. Surveys took place at night from 19h30 to 00h00. A combination of survey techniques were used, including visual and acoustic encounter survey (VES & AES). We used 6 transect-lines, evenly spaced and stretching from the mountain foot to the top. Every "transect" was walked at least four times by a team of two experienced observers (principal investigator and assistant) using high-powered flashlights. In addition opportunistic surveys covered areas and habitats not included on the defined transects. Human use of the landscape was documented.

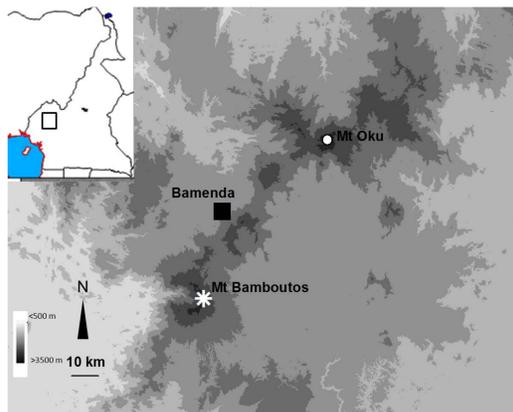


Figure 1: Map of the study area showing Mt Bamboutos. Also shown is Mt Oku. Bamenda is a large city in North West Cameroon.

RESULTS:

A list of amphibian species encountered during our survey period are presented (Table 1). Regarding their altitudinal distribution ranges, we separated our species into three level of elevation: the Lower zone (XXX=XXX m)– Mid-elevation zone (XXX=XXX m)– Upper zone (XXX=XXX m) due to their overlapping distribution ranges. The endemic species observed were restricted to the upper zones. The main threats at these zones was observed to be livestock grazing, with clearance for cultivation for crops occurring as high as 2,500 m a.s.l. Agrochemical application was observed to occur at all seasons in cultivated areas. At mid elevation zones downward, no natural forest was found, with land use dominated by either cultivation or Eucalyptus plantation.

No species new to the published inventory were found in these surveys. However, rare Cameroon endemic species known to Bamboutos were not observed, especially the toads *Werneria bambutensis* (IUCN: EN) and *Wolterstorffina mirei* (IUCN: EN). The previously common montane Puddle Frogs *Phrynobatrachus steindachneri* (IUCN: VU) were also not observed, as noted on neighbouring mountains (Hirschfeld et al 2016). Some species apparently persisted in habitat altered by human activity, especially farm bush or derived savannah. These were species with Pan-African distributions (e.g. *Amietophrynus maculatus*, *Ptychadena mascareniensis*). Our observation of the caecilian *Herpele squalostoma* is the highest elevation recorded for this species so far.



Figure 2. *Herpele squalostoma* from Mount Bamboutos at around 2000 m a.s.l.



Figure 3. *Asystosternus ranoides* from Mount Bamboutos at around 2460 m a.s.l.



Figure 4. *Cardioglossa oreas* from Mount Bamboutos at around 2450 m a.s.l.



Figure 5. *Leptodactylodon perreti* from Mount Bamboutos at 2500 m a.s.l.



Figure 6. *Leptopelis nordequatorialis* from Mount Bamboutos at 2300m a.s.l.



Figure 7. *Leptodactylodon axillaris* at around 2400m a.s.l. Mt Bamboutos



Figure 2. Agriculture on the Mount Bamboutos ~2500 m a.s.l.



Figure 3. Herd of cattle disturbing stream with breeding *Asystosternus* frogs



Figure 4. Range of toxic products (Herbicides, Pesticides and Fertilizers) most often used.

Species & Altitude (m a.s.l.) observed at	Habitat observed	IUCN Red list category	Threats
<i>Cardioglossa oreas</i> (2450)	Montane Gallery forest, secondary forest	EN Endangered	FL+OF
<i>Leptodactylodon axillaris</i> (2400 – 2600)	Secondary forest, gallery forests	CR Critical endangered	FL+OF
<i>Asystosternus ranoides</i> (2350 – 2560)	Montane grassland, Montane Gallery forest	EN Endangered	FL+OV
<i>Asystosternus rheophilus</i> (2300 – 2650)	Forest, Montane Gallery forest	VU Vulnerable	FL+OV
<i>Leptopelis nordequatorialis</i> (2200 – 2370)	Montane grassland	LC Least Concern	OF
<i>Leptodactylodon perreti</i> (1200 – 3000)	Pristine forest, Montane Gallery forest	EN Endangered	FL
<i>Herpele squalostoma</i> (2000)	Forest, gallery forest, Marshy areas	LC Least Concern	-
<i>Arhroleptis variabilis</i> (2000)	Cultivated areas	LC Least Concern	-
<i>Ptychadena mascareniensis</i> (2000)	Cultivated areas	LC Least Concern	-

Abbreviations hypothesised threats: FL – forest loss and degradation; OF– threats to overgrazing and fire; OV – Overexploitation, all inferred based on IUCN assessments and field observations of the authors.

Major threats on endemic amphibians on Mount Bamboutos:

- Livestock grazing and encroaching agriculture is the primary threat to endemic montane amphibians on Mt Bamboutos, especially the endemic *Leptodactylodon axillaris* (IUCN: CR);
- Several montane amphibian species endemic to the Highlands of Cameroon known to Bamboutos were not observed in these surveys, including previously common species such as *Phrynobatrachus*. Further surveys need to be carried out to determine if these species have either moved to other parts of the mountain, declined to low populations or become extirpated.
- Tolerances of these species to agrochemicals is possible, but magnitude of impact is not clear in relation to other threats.
- Other possible threats, such as amphibian chytrid fungus and climate change are unknown and should be monitored.

FUTURE DIRECTIONS:

- We plan to increase awareness about the amphibian crisis in local communities and general public through activities, exhibitions;
- We intend to change negative attitudes about amphibians and neutralise certain negative practices of indigenous peoples in each of our three study sites.
- From using field-data, conservation action plans will be prepared to protect and restore the remaining habitats on Mt Bamboutos.

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LITERATURE CITED:

¹Myers et al 2000, ²Knutson et al 1999, ³Vallan 2002, ⁴Stuart et al 2004 *Science*



Mountain toad, Mt Oku

Tadpoles are young frogs

What is an amphibian?

Animals with:

- Bones
- Permeable skin (wet skin)
- Usually have larvae (tadpoles)
- Live in many habitats, but generally linked to freshwater

Include:

- Frogs
- Toads
- Caecilians
- Salamanders (not known in Africa south of the Sahara Desert)



Caecilian from Dja, East Region

Are Amphibians

Important?



Hairy Frog in basket



Frog eating insect

- Amphibians consume many insects and other invertebrates
- Tadpoles consume algae in streams, as well as many other resources
- Amphibians are prey for many larger animals, such as birds and monkeys
- Amphibians are also a food source for people, including in Cameroon;
- Amphibians are a resource for scientific research, especially biomedical science.
- Amphibians can indicate a healthy environment (stable climate, pollution free, disease free).

Who are we?

We are a group of Cameroonian and international environmental workers

Where we work:



What we do:

- Surveys to find which amphibians live where;
- Research critical amphibian habitats (lakes, forests, streams);
- Engage with communities;
- Provide training on amphibian ecology and conservation;
- Plan conservation actions for threatened species.



Conservation workshop with teachers, students coming from universities and colleges, North West Region

- Amphibians are sentinels for the environment:

If amphibians suffer, we all suffer!

- Cameroon has **at least 202 species** of amphibian (195 frogs, 7 caecilians) more species are being described
- At least 32% of these are threatened with extinction
- Threats include changing land use, disease, climate change, introduced species.



Dead Lake Oku Clawed Frog, a "Critically Endangered" species

Around the world, frogs have been found dying or disappearing in large numbers – now Cameroon is witnessing this!

Forests need protection

Water resources need care

Want to know more? Have your frogs gone missing?



Leptopelis nordequatorialis from Mt Bamboutos

Contact Details

For information on the Project, amphibians and other biodiversity of the region email:

tommy_dbone@yahoo.com
arnaudchasse@yahoo.fr



Leptodactylodon bicolor from Bali Nguembat

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- * Cameroon Herpetology-Conservation Biology Foundation (CAMHERP-CBF)
- * Conservation Research and Action for Amphibians of Cameroon (CRAAC)



Hieroglyphic Reed Frogs: *Hyperolius riggenbachi*

More than just frogs!

Capacity building

Water quality

Forest conservation

Lake Oku:
Only home of the LAKE OKU CLAWED FROG (*Xenopus longipes*)



One of only two lakes in world to hold the rare plant *Isoetes biafrana*



Lake Oku Clawed Frog, *Xenopus longipes*:

- **ONLY RECORDED IN LAKE OKU**
- **Described as a species by science in 1991.**
- **Rare genetic characteristics: 6 times more chromosomes than normal.**
- **Exclusively restricted to water.**
- **Thought to fill the niche of fish in the lake.**
- **A significant predator in the lake.**
- **Threatened by fish introduction.**
- **CRITICALLY ENDANGERED.**

Lake Oku is a crater lake formed long ago by volcanic activity, with great cultural significance to the Oku community.



Isolated by its high elevation, and steep slopes, a wealth of different plants and animals have persisted in and around this lake:



Puddle Frog



Night Frog



Freshwater Sponge, which cleans the lake's water



Dragonfly larvae

Map of Lake Oku:



The Lake Oku is a unique ecosystem, characterised by the rare plants and animals dwelling within. It is still barely understood. This means that should its plants and animals become lost, it will become just a piece of water.

The Lake and surrounding forest are officially designated as a protected area:

The Kilum-Ijim Plantlife Sanctuary



Lake Oku Clawed Frog tadpole – these eat small particles in water, keeping it clean

VISITING LAKE OKU

To ensure a low impact visit that keeps the lake beautiful, please follow these guidelines:

- Respect the indigenous culture.
- Do not wash clothes in the lake, or use soap in the lake, it pollutes it.
- Check with the Oku Tourist Office to make sure it is an appropriate time to visit – it could be that one day a week when visiting is forbidden by the Oku culture.
- Pay your visitation fees – they pay for the protection of the lake and forest.
- **DO NOT LEAVE RUBBISH -**
Take your litter back with you!
- Do not collect any plants or animals in the area.
- Do not start fires without an experienced guide.
- Do not walk or swim in the lake without an experienced guide.
- Report any concerns, *e.g.* dead frogs, pollution.



Contact Details Information on visiting:

Oku Tourist Centre,
Fon's Palace,
Elak-Oku

Phone #: okufonspalace@yahoo.com

Email: (+237) 9672 59 55

Or/and

Government Conservator, MINFOF

Phone: (+237) 70687853

For information on the amphibians and other biodiversity of the region email:

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N.B. – Visitors to the lake and forest will be expected to pay fees. Please call in advance to avoid disappointment. For visitors, fees are not extravagant, and pay for the protection of the Lake and the forest.

This information leaflet is part of an environmental conservation and research project, CRAAC (Conservation Research and Action for Amphibians of Cameroon), an initiative of the Oku Community and the Royal Zoological Society of Scotland, UK



Lake Oku



A Wealth of Culture and Biodiversity



Beds of aquatic vegetation in the lake