

African biodiversity hotspots: the amphibians of Mt. Nlonako, Cameroon

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Abstract. The amphibians of Mt. Nlonako, a mountain at the southeastern edge of the Cameroon mountain range (“Dorsale camerounaise”), were inventoried continually over a six year period from 1998 to 2004. This area encompasses 150 km² of lowland, submontane and montane rainforest with an elevation up to 1,825 m. This inventory proved Mt. Nlonako, with 93 amphibian species, to be the most species rich single-locality area in amphibian and especially anuran fauna in Africa. Accounts of all species are provided based on collected material and literature reviewed. Analysis showed the species composition to be most similar within Cameroon to that of Korup National Park. In an African context the amphibian fauna of Mt. Nlonako is most related to the Central African fauna as opposed to the West African fauna. The high species richness and endemism is discussed from a paleoclimatic perspective. Conservation status and threats to the amphibian fauna are noted.

Keywords. Amphibians: Gymnophiona, Anura; Mt. Nlonako; Cameroon; species richness; endemism; biogeography; conservation.

Introduction

Despite recent efforts in surveying the amphibian fauna of the rain forests of tropical Africa (LARGEN & DOWSETT-LEMAIRE 1991, LAWSON 1993, BÖHME 1994a,b, SCHMITZ 1998, EUSKIRCHEN et al. 1999, SCHMITZ et al. 1999, LÖTTERS et al. 2001, RÖDEL & BRANCH 2002, RÖDEL 2003, RÖDEL & AGYEI 2003, RÖDEL & ERNST 2003) the knowledge on African rainforest amphibian faunas falls far behind that of its equivalents in tropical Middle and South America and in tropical Asia (DUELLMAN 1999). Within the rainforest zones of Africa however, Cameroon has the best studied amphibian faunas (PARKER 1936, SANDERSON 1936, PERRET 1959a, 1966, AMIET & PERRET 1969, AMIET 1971a, 1972b, 1973a, 1975, 1978a, 1978b, 1983b, 1989, LEBRETON 1999). LAWSON (1993) lists 88 species of amphibians for the Korup National Park (Korup NP), this represents by far the highest single-locality amphibian species richness in Africa (RÖDEL & AGYEI 2003). AMIET (1975) records

100 anuran species from the 10,000 km² region around Nkongsamba including Mt. Kupe, the Bakossi Mtns., the Manengouba Mtns., Mt. Ekomane, Mt. Nlonako and parts of the Bamileke Plateau.

In Cameroon, the western and southwestern Cameroon highlands, also known as “Dorsale camerounaise”, extend from Mt. Cameroon in the south to Tchabal Mbabo in the north. They are characterized by a high amphibian species richness and an extraordinary high proportion of endemic species; a veritable hotspot of African amphibian diversity (DUELLMAN 1999, POYNTON 1999, unpubl. data).

Contrary to the high biodiversity value of such areas, especially those in West and Central Africa, most have no formal conservation status protection (STUART et al. 1990) and are endangered by habitat destruction, mainly by logging activities and human encroachment. Due to such changes in closed forest environments the number of species which exploit such disturbed patches is in-

creasing (SCHIÖTZ 1967, LAWSON 1993), this leads towards a “savanisation” of forest habitats as already observed in Madagascar (BLOMMERS-SCHLÖSSER & BLANC 1993).

Amphibian species have a high potential as indicator species (RÖDEL 2000). Their bi-phasic lifestyle, together with their high sensitivity towards environmental changes (global amphibian population declines, see BLAUSTEIN et al. 1994, ALFORD & RICHARDS 1999, HOULAHAN et al. 2000) makes them predestined tools in the assessment of habitat quality. However, this necessitates an in-depth knowledge of their natural history. Amphibian inventories in African tropical rainforest habitats are a first step. Quantitative ecological studies have only recently begun (PLATH 2003, SOLBACH 2003, PLATH et al. 2004). Ultimately, in-depth species studies would complete the picture. This paper presents a comprehensive amphibian species list for Mt. Nlonako, which was derived over a period of six years, in which we present the largest number of amphibian species – 93 – for any single-locality on the African continent.

Methods

Study sites

We surveyed the Mt. Nlonako area (Fig. 1) which extends roughly from 4°49'–4°56'N and from 9°56'–10°01'E and encompasses approximately 15,000 ha. The western and northern flanks face the town of Nkongsamba, and the busy road between Douala and Bamenda. The slopes on this side are heavily cultivated with the forest destroyed up to an elevation of approximately 1,100 m. To the South and East however, the forest slopes are much less influenced by human activities. A vast lowland rainforest, encompassing several thousand km², extends from the foothills of Mt. Nlonako reaching past Nkondjock in the East and past Yabassi in the South. This area is divided by some unpaved roads and settlements. Logging is or has been carried out in many places within this area. Al-

though hunting pressure is imminent, forest elephants, gorillas, chimpanzees, drills and other large mammals persist. Mt. Nlonako itself rises from approximately 400 m elevation on the southern side to 1,825 m on its peak. The highest and central part of the mountain forms a cuvette, approximately 1.5 km in diameter, with much grass/bracken in its center and with forested rims at 1,600 m on the north, east and south sides and the peak on the western side (DOWSETT-LEMAIRE & DOWSETT 1999).

The forest above 1,100 m is pristine with a tall canopy (25–30 m). The forest here seems to be drier and warmer than forests on the close-by Manengouba and Bakossi mountains or Mt. Kupe at comparable altitudes. Botanically, Guttiferae (*Allanblackia* sp.) and Burseraceae (*Santiria trimera*) are especially common. Caelaspiniaceae (incl. *Tessmannia anomala*), Ebenaceae (*Diospyros*), Meliaceae, Mimosaceae (*Albizia*), Moraceae, Olacaceae (*Strombosia*), Sapotaceae (incl. *Chrysophyllum albidum*), Steruliaceae (*Cola*) and Apocynaceae (*Tabernaemontana* sp.) are recorded (DOWSETT-LEMAIRE & DOWSETT 1999). Above 1,450 m some rare montane species such as *Polyscias fulva* can be found locally. Many small to medium-sized creeks, often fast flowing and rocky, are in the forest. Swamps and pools are rare.

The climate is warm and humid. Over a period of 34 years Nkongsamba (882 m elevation) received an average of 2,762 mm rainfall per year (Table 1, AMIET 1975). During that period the peak dry season extended from December to February with less than 50 mm precipitation per month. The peak rainy season extended from July to September with up to 482 mm precipitation per month. We recorded temperatures and relative humidity on Mt. Nlonako with Hobo® 08 t/rh data loggers over a period of three years at several elevations (Table 2, Fig. 2). Measurements were taken at one hour intervals. Figure 2 shows the climatic conditions at an altitude of 1,140 m (Nguéngué campsite).

Fieldwork initiated in November 1998 and continual sampling extended to June 2004. Sampling occurred in all seasons.

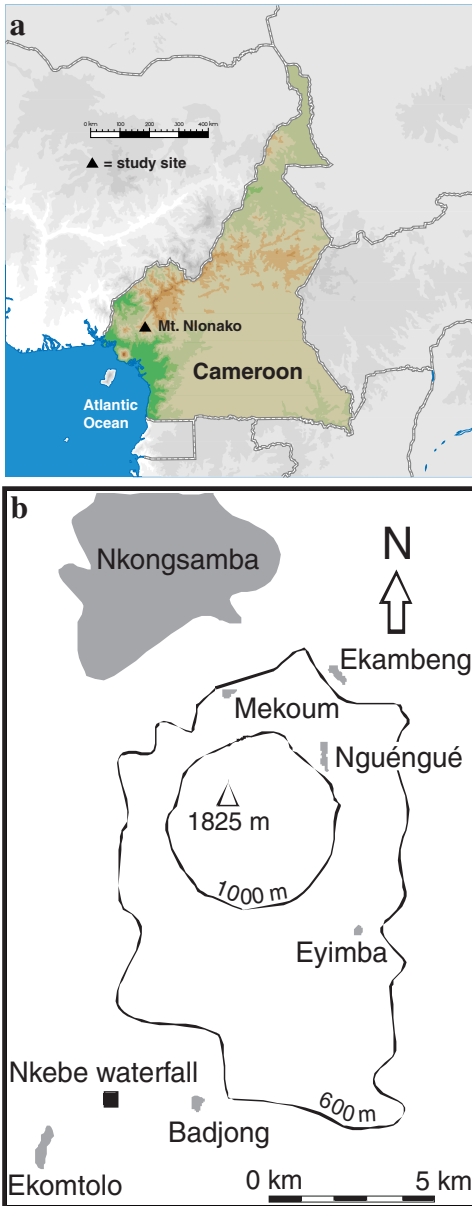


Fig. 1. Survey locations (a) in Cameroon and (b) at Mt. Nlonako. Shaded areas are rural communities.

Our survey efforts concentrated on the northern, eastern and southern slopes of Mt. Nlonako with the following localities being the main points of collecting:

Ekambeng (EKA): village at the foot of the northern slopes in the vicinity of Nkong-samba, many coffee plantations, no primary forest

Mekoum (MEK): village on northern side of the mountain, many coffee plantations, no primary forest

Nguéngué (NGU): village on the rim between northwest-facing and southeast-facing slopes, N 4°55'02'', E 9°59'21'', 1,140 m elevation, some coffee plantations, secondary and predominately primary forest

Summit (SUM): eastern side of the cuvette, N 4°54'47'', E 9°57'93'', 1,660 m elevation, rock outcrops, primary montane forest, some areas with grass and bushes

Eyimba (EYI): very small village on the eastern side of the mountain, N 4°52'92'', E 9°59'19'', 710 m elevation, small cultivated areas, much primary forest

Nkebe waterfall (NWF): between the villages Ekomtolo and Badjong, N 4° 49'83'', E 9°55'49'', 470 m elevation, coffee, oil palm and food crop plantations, predominately secondary forest, area with previous and current logging.

Sampling methods

We used Y-shaped drift fence/pitfall trap arrays (CORN 1994) with segments of 5 m length during the initial phase of the project at several localities. Catching success was very low to nil. This method was abandoned after some weeks.

We applied quadrat sampling with 8 × 8 m quadrats (JAEGER & INGER 1994) at several localities at various elevations. Quadrats worked satisfactorily to gain quantitative data but are work intensive. For the quantitative results see HERRMANN et al. 2000.

Transects of several hundred meters in length were surveyed along a creek between Ekomtolo and Badjong for several months during the dry and the rainy season. For details see PLATH 2003, SOLBACH 2003, and PLATH et al. 2004.

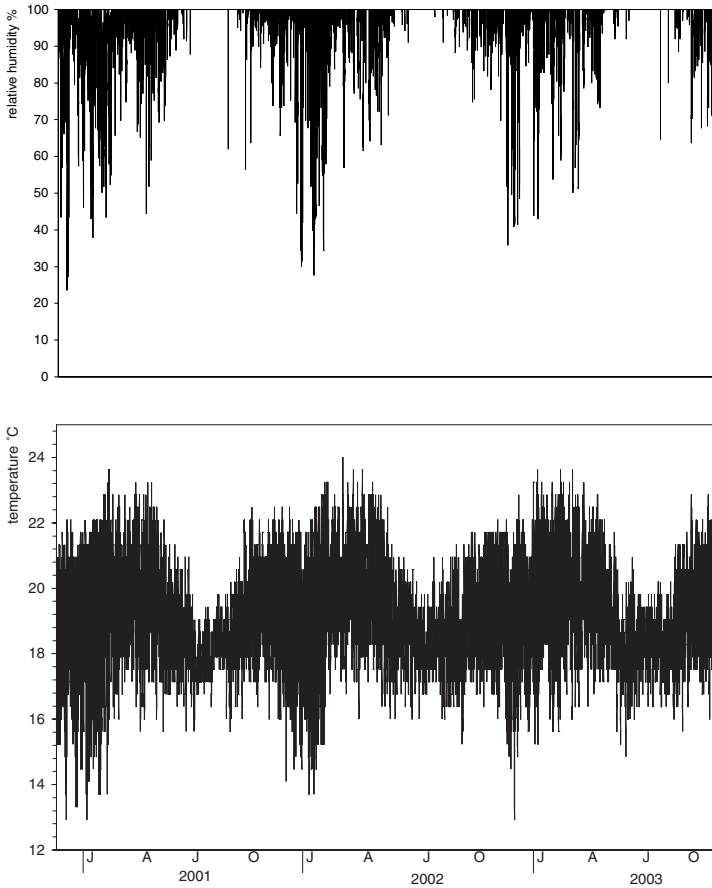


Fig. 2. Temperature and relative humidity at the Nguengué survey site (1,140 m elevation) from December 2000 to November 2003.

Visual encounter surveys along transects (CRUMP & SCOTT 1994) or opportunistic searches during the day and at night were the dominant methods used. The number of persons surveying varied, but was usually two or three; this method yielded the best success and was carried out throughout the study periods.

Acoustic monitoring was also applied but only species represented by at least one voucher specimen are included in the species list.

Our data was complemented by donated specimens which were encountered by villagers during their daily movements.

Voucher specimens are housed in the herpetological collection of the Zoologisches Museum Alexander Koenig (ZFMK), Bonn, of the Muséum d'Histoire Naturelle de Genève (MHNG) or in the collection of the senior author (HWH) in Cameroon. The latter collection will be transferred to the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). All specimens were either fixed in 10 % buffered formalin or 75 % ethanol and subsequently preserved in 75 % ethanol. Some freshly metamorphosed specimens and tadpoles proved to be difficult to determine; such specimens are excluded from the following species account.

	J	F	M	A	M	J	J	A	S	O	N	D	annually
precipitation	16	43	151	199	226	261	431	482	476	345	103	19	2,762
temperature	22.9	23.5	23.6	23.5	23.1	22.0	20.9	20.8	21.9	22.2	22.0	23.4	22.5

Tab. 1. Mean monthly precipitation (mm) over a period of 34 years and mean temperature (°C) in Nkongsamba (882 m elevation) (AMIET 1975 with precipitation after SUCHEL 1972).

Biogeographic analysis

To compare the species composition of Mt. Nlonako with other areas in West and Central Africa we calculated the “coefficient of biogeographic resemblance” (CBR) after DUELLMAN (1990) with the formula

$$CBR = 2C / (N_1 + N_2)$$

in which C is the number of shared taxa (here species) in two compared areas, N_1 is the number of taxa (here species) in area 1 and N_2 is the number of taxa (here species) in area 2. A CBR value of 0 would mean that Mt. Nlonako shares no amphibian species with the compared area, a CBR value of 1 would mean that the species inventories in both areas are identical. JANSEN and KÖHLER (2002) excluded ubiquitous species from their analysis arguing that those species are not primary inhabitants of the mountain forest habitats they compared and thus do not bear any information on the biogeographic relationships of those areas. We do not follow this approach for (1) we do not know if ubiquitous species are or are not primary inhabitants of the areas in question, (2) possible “noise” by such species should be similar over the areas analyzed and (3) they are low in number and thus have a limited effect on the analysis.

Results

Species account

In the following we present a systematic list of amphibian species encountered during our survey. We list localities and voucher specimens for each taxon. Nomenclature follows FROST (2002), unless otherwise noted. For habitat we differentiate between forest (F) and farmbush (FB). We apply SCHIØTZ’s

(1967) definition for farmbush species as species which live within the former forest zone but are not dependent upon closed canopy forest and are not able to reproduce successfully in savanna habitats.

Gymnophiona Caeciliidae

Geotrypetes seraphini (DUMÉRIL, 1859)

Localities: EKA, NGU. Voucher specimens: ZFMK 69121, 77675, 78025, 78809-13, HWH 1039. Habitat: FB.

Herpele squalostoma (STUTCHBURY, 1836)

Localities: EKA, NGU. Voucher specimens: ZFMK 77676, 78024. Habitat: F.

Anura Pipidae

Hymenochirus boettgeri boettgeri (TORNIER, 1897)

Locality: NWF. Voucher specimen: ZFMK 81133. Habitat: F.

Remarks: This species was suspected to occur in Western Cameroon (PERRET 1966, LAWSON 1993); our finding confirms this and represents the first voucher for Southwestern Cameroon.

Silurana tropicalis GRAY, 1864

Locality: NWF. Voucher specimens: HWH 33, 1019. Habitat: F.

Remarks: One specimen was found in a rock pool in the river Nkebe together with a large number of *Conraua goliath* tadpoles.

Xenopus fraseri BOULENGER, 1905

Locality: NWF. Voucher specimens: ZFMK 78220, 81134, 81695. Habitat: F.

locality		temperature °C			relative humidity %	
		min	max	\bar{x}	min	max
Nkebe WF	470 m	16.4	31.5	23.4	12	100
Eyimba	710 m	16.8	28.7	22.1	(74)	100
Nguéngué	1,140 m	12.9	29.1	18.7	14	100
Summit	1,660 m	12.9	24.8	17.9	17	100

Tab. 2. Temperature and relative humidity at different elevations on Mt. Nlonako. Parentheses indicate that the data collecting period did not cover a complete dry season.

Bufo

Bufo latifrons BOULENGER, 1900

Localities: NWF, EYI. Voucher specimens: ZFMK 68967, 78221-8, 81135-6, HWH 49, 1019. Habitat: F.

Bufo maculatus HALLOWELL, 1854

Localities: NWF, NGU. Voucher specimens: ZFMK 69149-51, 69555, 75442-5, 81137. Habitat: FB.
Remarks: Reported by AMIET (1975) for Ebone (650 m).

Bufo superciliaris BOULENGER, 1888 "1887"

Locality: NWF. Voucher specimen: HWH 885. Habitat: F.
Remarks: This species is feared by local people as it is considered to transmit leprosy. It plays, however, an important role in traditional medicine. Specimens are killed, dried and then used as ingredients for a number of concoctions. Although considered rare, specimens were brought to us several times by villagers and others were observed along river banks.

Bufo tuberosus GÜNTHER, 1858

Localities: NWF, NGU, SUM. Voucher specimens: ZFMK 69152-4, 69442-3, 75441, 78244, 81579, HWH 1014. Habitat: F.
Remarks: Reported by AMIET (1975) for Ekomtolo and the western flank of Mt. Nlonako at an elevation of 950-1,000 m.

Nectophryne afra BUCHHOLZ & PETERS, 1875

Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 69485-9, 75439-40, 78229-30, 81551-2, HWH 15. Habitat: F.

Nectophryne batesi BOULENGER, 1913

Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 69122-6, 69421, 69446-53, 69490, 78231-9, HWH 164, 1059-61, 1172. Habitat: F.

Werneria mertensiana AMIET, 1976

Locality: NGU. Voucher specimens: ZFMK 69127-44, 75395-437, 78243, 78251-2, HWH 1062-3, 1169-71. Habitat: F.
Remarks: This locality represents the type locality for this species. Reported by AMIET (1975) for the western flank of Mt. Nlonako at an elevation of 950-1,000 m. We follow the nomenclature proposed by FROST (2002) and as discussed in RÖDEL et al. (2004) using the species name *mertensiana*.

Wolterstorffina parvipalmata (WERNER, 1898)

Locality: NGU. Voucher specimens: ZFMK 69145-8, 69397, 69491-6, 75438, 78240-2, HWH 2, 69-72, 154. Habitat: F.

Petropedetidae

Dimorphognathus africanus (HALLOWELL, 1858)

Localities: NWF, NGU. Voucher specimens: ZFMK 69259-62, 69533-4, 75490-6, 75626-7, 78003-5, 78433-59, 78672, 78686-92, 81141-4, 81665-8, 81705-6, HWH 3, 78-80, 87-90, 161, 175, 1016. Habitat: F.
Remarks: Reported by AMIET (1975) for Ekomtolo and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU. Advertisement calls were frequently heard from mid-February to the beginning of May.

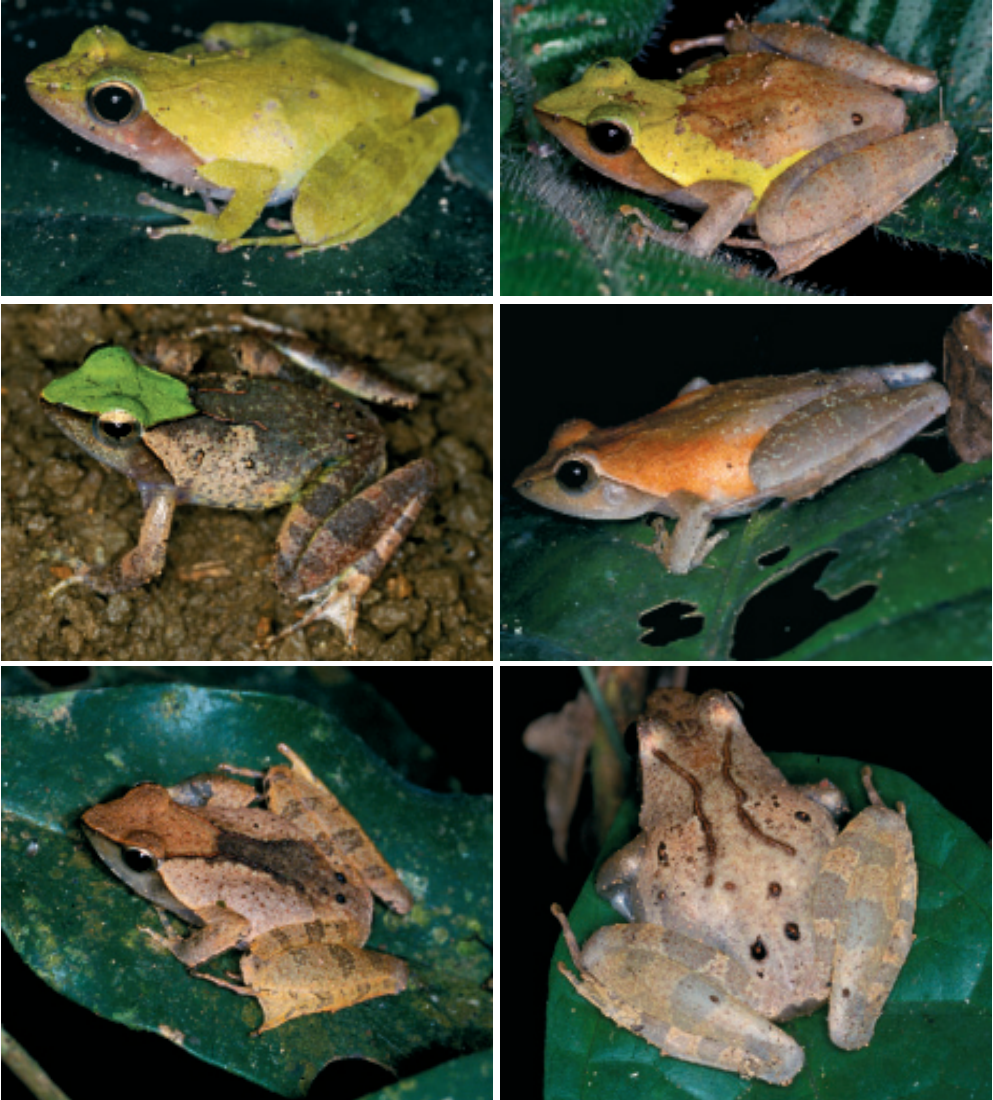


Fig. 3. Some colour morphs of *Phrynobatrachus auritus* at the Nkebe waterfall site at Ekomtolo.

Petropedetes cameronensis REICHENOW, 1874
Localities: NWF, NGU. Voucher specimens:
ZFMK 69233, 78355-63, 81153-4, 81614-9,
HWH 19, 102-3, 105-8, 155, 167, 1021-4.
Habitat: F.

Remarks: Reported by AMIET (1975) for
Ekomtolo and by DOWSETT-LEMAIRE & DOW-

SETT (1999) for NGU. Specimens guarding
clutches were observed from February to
May.

Petropedetes johnstoni (BOULENGER, 1888)
Locality: NWF. Voucher specimen: HWH
104. Habitat: F.

Petropedetes newtoni (BOCAGE, 1895)

Localities: NWF, NGU. Voucher specimens: ZFMK 78364, 81553-5, 81711, HWH 6, 47. Habitat: F.
Remarks: Reported by AMIET (1975) for Ekomtolo.

Petropedetes parkeri AMIET, 1983

Localities: NWF, NGU. Voucher specimens: ZFMK 69207-11, 69288, 69497, 75539-52, 75625, 78365-6, 81167-8, 81622-3, HWH 48, 101, 1069, 1179-89. Habitat: F.

Petropedetes perreti AMIET, 1973

Localities: NWF, NGU. Voucher specimens: ZFMK 69212-32, 75519-38, 78017-23, HWH 117, 1178. Habitat: F.
Remarks: Reported by AMIET (1975) for the western flank of Mt. Nlonako at an elevation of 950-1,000 m.

Phrynobatrachus auritus BOULENGER, 1900

Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 68968-9, 69289-93, 75480-3, 77988-96, 78506-653, 78673-5, 78698-9, 78701-4, 81139-40, 81687-94, HWH 24-6, 123-47, 157, 168, 173-4, 1025-32. Habitat: F.
Remarks: Reported by AMIET (1975) for Ekomtolo and the western flank of Mt. Nlonako at an elevation of 950-1,000 m and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU as "*Phrynobatrachus* sp. prob. *auritus*". Especially at NWF we observed a large number of different colour and pattern morphs for this species (Fig. 3). It remains open if this reflects polymorphism within the species or indicates distinct genetic units.

Phrynobatrachus batesii (BOULENGER, 1906)

Localities: NWF, NGU. Voucher specimens: ZFMK 75459-79, 75623-4, 78503-5. Habitat: F.
Remarks: Reported by AMIET (1975) for Ekomtolo.

Phrynobatrachus cornutus (BOULENGER, 1906)

Remarks: Reported by AMIET (1975) for Ekomtolo. Not found by us.

Phrynobatrachus cricogaster PERRET, 1957

Localities: NGU, SUM. Voucher specimens: ZFMK 69294-302, 69444, 69505, 75488-9, 78460-72, HWH 151. Habitat: F.
Remarks: Reported by AMIET (1975) for the western flank of Mt. Nlonako at an elevation of 950-1,000 m and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU.

Phrynobatrachus hylaios PERRET, 1959

Locality: NGU. Voucher specimen: HWH 81. Habitat: F.
Remarks: This species is known from the southern lowland forest of Cameroon (LEBRETON 1999) and western Congo (LARGEN & DOWSETT-LEMAIRE 1991); SCHMITZ (1998) recorded one specimen from Mt. Kupe, approximately 30 km SW of Mt. Nlonako.

Phrynobatrachus wernerii (NIEDEN, 1910)

Locality: NGU. Voucher specimens: ZFMK 69303-17, 69393, 69506-12, 69539-46. Habitat: F.
Remarks: Reported by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU.

Phrynobatrachus sp.

Locality: NWF. Voucher specimens: ZFMK 78693-7, 81647-8. Habitat: F.
Remarks: Possibly an undescribed species which will be discussed in a separate publication.

Phrynodon sandersoni PARKER, 1935

Localities: NWF, NGU. Voucher specimens: ZFMK 69263-87, 69513-6, 78473-502, 81637-40, HWH 8, 84-6. Habitat: F.

Phrynodon sp.

- colour morph 1 sensu SCHMITZ, 1998

Localities: NWF, NGU. Voucher specimens: HWH 83, 1034. Habitat: F.
Differs from *P. sandersoni* by a white stripe which extends from the tip of the snout, over the upper lip, ending above the arm.

- colour morph 2 sensu SCHMITZ, 1998 (Fig. 4 top)

Locality: NWF. Voucher specimen: HWH 1033. Habitat: F.

Dark-brown to black dorsal colouration with two dorso-lateral white-grey stripes. Reported by AMIET (1975) for the western flank of Mt. Nlonako at an elevation of 950-1,000 m and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU.

• colour morph 3 sensu SCHMITZ, 1998

Locality: NGU. Voucher specimen: HWH 162. Habitat: F.

Dark-brown to black dorsal colouration with two light, broad, irregular shaped spots of greenish or reddish colouration. Reported by AMIET (1975) for Ekomtolo.

• colour morph 4 sensu SCHMITZ, 1998 (Fig. 4 middle)

Locality: NGU. Voucher specimen: HWH 82, 163. Habitat: F.

Broad, light red, longitudinal stripe on dorsum.

• other colour morphs

Localities: NWF, NGU. Voucher specimen: ZFMK 81138, HWH 160, 179. Habitat: F.

Remarks: Additional to these colour morphs we found specimens with a narrow yellow dorsal stripe (Fig. 4 bottom). As all these specimens cannot be distinguished morphologically, except by their colour and dorsal pattern, we treat them as one species with different colour morphs. Further taxonomic resolution will likely depend on analysis of the advertisement calls and molecular genetics.

Ranidae

Amnirana albolabris (HALLOWELL, 1856)

Reported by AMIET (1975) for Ebone (650 m) and Badjoki (550 m) as *Hylarana albolabris*.

Amnirana amnicola (PERRET, 1977)

Locality: NWF. Voucher specimens: ZFMK 78314-32, 81675-6. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo as *Hylarana* sp. 1.

Amnirana asperrima (PERRET, 1977)

Locality: NWF. Voucher specimens: ZFMK 77977-87, 78002, 78333-54, 81677-81, 81700-1, 81703, 81708, 81713, HWH 28-9, 109-10, 165. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo as *Hylarana* sp. 2. We heard advertisement calls from the end of February to the beginning of May and observed two amplecting specimens on 3 April 2001.

Amnirana lepus (ANDERSSON, 1903)

Locality: NWF. Voucher specimens: ZFMK 77975-6, 81657. Habitat: F.

Amnirana sp. indet.

Locality: NWF. Voucher specimens: ZFMK 81145-6, 81700-1. Habitat: F.

Remarks: Juvenile specimens which could not be identified to the species level.

Conraua crassipes (BUCHHOLZ & PETERS, 1875)

Localities: NWF, NGU. Voucher specimens: ZFMK 69351-8, 75446-52, 77934-6, 78273-83, 81624, 81684-6, HWH 1, 111, 1017. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo.

Conraua goliath (BOULENGER, 1906)

Localities: NWF, EYI. Voucher specimens: ZFMK 69369, 77927-33, HWH 51, 176, 190-1, 235-9. Habitat: F.

Remarks: *Conraua goliath* is the largest anuran species and can reach a weight of more than three kilograms. It is considered a delicacy in Cameroon and is heavily hunted in the study area and sometimes found in the local bush-meat markets.

Conraua robusta NIEDEN, 1908

Localities: NWF, NGU. Voucher specimens: ZFMK 69359-68, 77923-6, HWH 30, 193. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo and the western flank of Mt. Nlonako at an elevation of 950-1,000 m. Locally known as “le petit frère de grenouille Goliath“ (= *C. goliath*) it plays a similar important role as bush-meat. Specimens are readily found in villages and at markets during the dry season where they are sold for consumption.

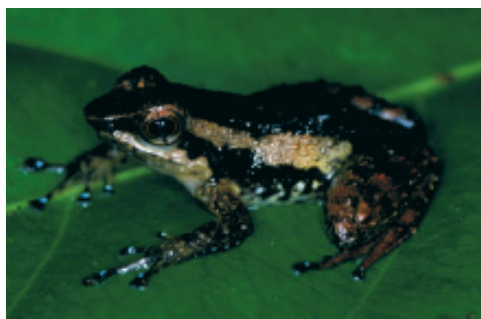


Fig. 4. Some colour morphs of *Phrynodon* sp. at Mt. Nlonako. Top: colour morph 2 sensu SCHMITZ, 1998; middle: colour morph 4 sensu SCHMITZ, 1998; bottom: colour morph with narrow dorsal stripe.

Ptychadena aequiplicata (WERNER, 1898)
Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 81147-8, 81669-70, HWH 4, 11, 1018. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo. Many advertisement calls were heard in mid-February.

Ptychadena cf. *mascareniensis* (DUMÉRIL & BIBRON, 1841)

Locality: NWF. Voucher specimens: ZFMK 77997-9, 81149, 81710. Habitat: FB.

Remarks: LAMOTTE & OHLER (1997) rediscovered the syntypes of *Ptychadena bibroni* HALLOWELL, 1845 and synonymize *P. macCarthyensis* with *P. bibroni*. We tentatively assign our specimens to *P.* cf. *mascareniensis* which is likely to be a species complex rather than a single species (VENCES et al. 2004).

Ptychadena superciliaris (GÜNTHER, 1858)
Locality: NWF. Voucher specimens: ZFMK 78000-1, 81150-2. Habitat: F.

Remarks: GUIBÉ & LAMOTTE (1958) reported this species for Cameroon and PERRET (1966) from Foulassi. However, LEBRETON (1999) notes that “according to AMIET (in litt., 1998) the species is absent from Cameroon”.

Arthroleptidae

Arthroleptis adelphus PERRET, 1966
Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 69251-7, 69392, 69480-2, 78416-23, 78657, 78661-4, 78678, 78705, 81171-5, 81641-4. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo.

Arthroleptis cf. *adolffriederici* NIEDEN, 1911 “1910” (Fig. 5)

Localities: NWF, NGU, SUM. Voucher specimens: ZFMK 78405, 81645-6, HWH 1066-8. Habitat: F.

Remarks: The discovery of this species at NWF is somewhat surprising due to the low elevation. LAWSON (1993), however, reports two specimens from the lowlands near the Ikenge Research Station in the Korup National Park, Southwest Cameroon. Reported by DOWSETT-LEMAIRE & DOWSETT (1999) between NGU and SUM above 1,350 m. Our material differs from topotypic material from Rwanda (type locality).

Arthroleptis variabilis MATSCHIE, 1893
Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 69238-50, 69390-1, 69457, 75497-503, 78010-2, 78406-15, 78654-6, 78665, 81181-2, HWH 7. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo.

Arthroleptis sp.

AMIET (1975) lists a possibly undescribed species of *Arthroleptis* from Ekomtolo.

Cardioglossa elegans BOULENGER, 1906

Locality: NWF. Voucher specimens: ZFMK 78256, 78671, 81660, 81664. Habitat: F. Remarks: Reported by AMIET (1975) for Ekomtolo and Ebone (650 m). ZFMK 81664 is a female with a snout-vent-length (SVL) of 39 mm and represents the largest known specimen.

Cardioglossa gracilis BOULENGER, 1900

Localities: NWF, NGU. Voucher specimens: ZFMK 69195, 75455, 78008-9, 78254-5, 81661-3, HWH 10, 75-6, 153, 159, 182. Habitat: F. Remarks: Reported by AMIET (1975) for Ekomtolo.

Cardioglossa leucomystax (BOULENGER, 1903)

Localities: NWF, NGU. Voucher specimens: ZFMK 78257-72, 78666-70, 78679, 78685, 78708-10, 81169-70, 81625-31, HWH, 9, 27, 73-4, 152, 158, 178, 180-1. Habitat: F. Remarks: Reported by AMIET (1975) for Ekomtolo.

Cardioglossa melanogaster AMIET, 1972

Locality: NGU. Voucher specimen: ZFMK 69532. Habitat: F.

Cardioglossa nigromaculata NIEDEN, 1908

Locality: NWF. Voucher specimens: ZFMK 81658-9. Habitat: F. Remarks: This species appears to be locally rare; LAWSON (1993) also reports only one specimen from the Korup NP survey. Reported by AMIET (1975) for Ekomtolo.

Cardioglossa venusta AMIET, 1972

Locality: NGU. Voucher specimens: ZFMK 69194, 75453-4, 75572, 78253. Habitat: F.

Schoutedenella poecilonota (PETERS, 1863)

Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 68970-2, 69234-7, 69404, 69460-5, 69475-9, 75504-8, 75573-4,

78013-4, 78424-32, 78680-1, 81176-80, 81649-56, HWH 177. Habitat: F.

Schoutedenella sylvatica LAURENT, 1954

Mentioned by AMIET (1975) for Ekomtolo.

Schoutedenella taeniata BOULENGER, 1906

Localities: EYI, NGU. Voucher specimens: ZFMK 69258, 69405, 69458-9. Habitat: F. Remarks: AMIET (1975) mentions this species also from Ekomtolo. PERRET (1991) restricts the occurrence of *S. bivittata* to Guinea and assigns all Cameroonian “*bivittata*” to *taeniata*.

Astylosternidae

Astylosternus diadematus WERNER, 1898

Localities: NWF, NGU. Voucher specimens: ZFMK 69159-64, 69548, 77962-5, 78303-6, 81165-6, 81702, HWH 5, 22, 166. Habitat: F. Remarks: Reported by AMIET (1975) for Ekomtolo and the western flank of Mt. Nlonako at an elevation of 950-1,000 m and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU. Advertisements calls were heard at the end of February.

Astylosternus fallax AMIET, 1978 “1977”

Locality: NWF. Voucher specimens: ZFMK 78310, 81163-4, 81607-13. Habitat: F. Remarks: Reported by AMIET (1975) for Ekomtolo as *Astylosternus* sp. 3.



Fig. 5. *Arthroleptis* cf. *adolffriederici* from the summit area of Mt. Nlonako.

- Astylosternus laurenti* AMIET, 1978 "1977"
 Remarks: Reported by AMIET (1975) for Ekomtolo as *Astylosternus* sp. 2. Ekomtolo is the type locality for the species (AMIET 1977).
 Locality: NWF. Voucher specimens: ZFMK 77941-7, 81156-7. Habitat: F.
 Remarks: Reported by AMIET (1975) for Ekomtolo.
- Astylosternus montanus* AMIET, 1978 "1977"
 Localities: NGU, SUM. Voucher specimens: ZFMK 69165-71, 69445, 69498-9, 69547, 78307-8. Habitat: F.
- Astylosternus perreti* AMIET, 1978 "1977"
 Localities: NWF, NGU. Voucher specimens: ZFMK 78309, 81000, 81040, HWH 117. Habitat: F.
- Leptodactylodon bicolor* AMIET, 1971
 Reported by AMIET (1975) for the western flank of Mt. Nlonako at an elevation of 950-1,000 m. Not found by us.
- Leptodactylodon bouleengeri bamilekianus* AMIET, 1971
 Localities: NWF, NGU. Voucher specimens: ZFMK 69187-92, 69500, 78287, HWH 36, 91. Habitat: F.
- Leptodactylodon mertensi* PERRET, 1959
 Locality: NGU. Voucher specimens: ZFMK 69193, 69396, 69501-2, 69535-6, 75457-8, HWH 1071-2. Habitat: F.
- Leptodactylodon ornatus* AMIET, 1971
 Locality: NGU. Voucher specimen: HWH 1070. Habitat: F.
 Remarks: Mt. Nlonako (Nkongsamba) is the type locality for this species. Reported by AMIET (1975) for the western flank of Mt. Nlonako at an elevation of 950-1,000 m.
- Leptodactylodon ovatus orientalis* AMIET, 1971
 Localities: NWF, NGU. Voucher specimens: ZFMK 68181-6, 78015-6, 78284-6, 78683, 81155, 81620-1, 81712. Habitat: F.
 Remarks: *Leptodactylodon ovatus* is reported by AMIET (1975) for Ekomtolo. Calls were heard in May.
- Nyctibates corrugatus* BOULENGER, 1904
 Localities: NWF, NGU. Voucher specimens: ZFMK 69155-6, 77948-61, 78288-302, 78682, 78706-7, 81158-61, 81697-9, 81704, HWH 21, 118-22, 169. Habitat: F.
 Remarks: Reported by AMIET (1975) for Ekomtolo. Advertisement calls were heard in late April and a clutch with eight eggs was found in early May.
- Scotobleps gabonicus* BOULENGER, 1900
 Localities: NWF, NGU. Voucher specimens: ZFMK 69155-6, 77948-61, 78288-302, 78682, 78706-7, 81158-61, 81697-9, 81704, HWH 21, 118-22, 169. Habitat: F.
 Remarks: Reported by AMIET (1975) for Ekomtolo. This species is consumed as bushmeat but to a lower extent than *Conraua robusta*.
- Trichobatrachus robustus* BOULENGER, 1900
 Localities: NWF, EYI, NGU, MEK. Voucher specimens: ZFMK 68973, 69157-8, 75068, 77938-9, 81162, HWH 37-8, 92-6, 887, 985, 1064-5. Habitat: F.
 Remarks: Reported by AMIET (1975) for Ekomtolo. This species is consumed as bushmeat but to a lower extent than *Conraua robusta*.
- Rhacophoridae
- Chiromantis rufescens* (GÜNTHER, 1869)
 Localities: NWF, NGU. Voucher specimens: ZFMK 77966-70, 78245-50, 81682-3, HWH 97, 150, 1015, 1073-4. Habitat: FB.
 Remarks: Reported by AMIET (1975) for Ekomtolo, Ebone (650 m) and Badjoki (550 m). We observed foam nests from January to May. Advertisement calls were heard in January and April.
- Hyperoliidae
 Hyperoliinae
- Acanthixalus spinosus* (BUCHHOLZ & PETERS, 1875)
 Locality: NWF. Voucher specimen: ZFMK 78313. Habitat: F.
- Afrixalus dorsalis* (PETERS, 1875)
 Locality: NGU. Voucher specimens: ZFMK 75553-4, HWH 149. Habitat: FB.

Afrivalus lacteus PERRET, 1976

Locality: NGU. Voucher specimen: HWH 1079. Habitat: F.

Afrivalus laevis (AHL, 1930)

Localities: NWF, NGU. Voucher specimens: ZFMK 69319, 81188-9, 81566-71. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo. Females filled with eggs were found in April and May. We found a clutch on the tip of a leaf approximately 30 cm above the ground on 10 April 2003.

Afrivalus paradorsalis PERRET, 1960

Localities: NWF, NGU. Voucher specimens: ZFMK 77940, 81183-4, 81674, HWH 13, 1081, 1173-6. Habitat: FB.

Remarks: Reported by AMIET (1975) for Ekomtolo, Ebone (650 m) and Badjoki (550 m).

Alexteroon obstetricans (AHL, 1931)

Locality: NWF. Voucher specimens: ZFMK 81190, 81559-61. Habitat: F.

Remarks: A ring-like clutch with the female in the middle was observed on a leaf on 4 May 2003. SCHIØTZ (1999) describes such egg guarding behaviour.

Chlorolius koehleri (MERTENS, 1940)

Locality: NWF. Voucher specimen: ZFMK 81051, 81191. Habitat: F, FB.

Hyperolius acutirostris BUCHHOLZ & PETERS, 1875

Recorded by AMIET (1975) for Ekomtolo as *Hyperolius* sp. 4.

Hyperolius bolifambae MERTENS, 1938

Locality: NWF. Voucher specimens: ZFMK 81187, 81572-8. Habitat: FB.

Remarks: Recorded by AMIET (1975) for Ebone (650 m) and Badjoki (550 m). Advertisement calls were heard in the beginning of May 2003.

Hyperolius cf. *camerunensis* AMIET, 2004

Locality: NGU. Voucher specimens: ZFMK 81203-4, MHNG 2645.35. Habitat: FB.

Hyperolius guttulatus GÜNTHER, 1858

Locality: NWF. Voucher specimens: ZFMK 81673, HWH 34, 1165-8. Habitat: FB.

Remarks: Recorded by AMIET (1975) for Badjoki (550 m).

Hyperolius kuligae MERTENS, 1940

Localities: NWF, NGU. Voucher specimen: ZFMK 78367, HWH 1083. Habitat: F.

Hyperolius ocellatus GÜNTHER, 1858

Localities: NWF, NGU. Voucher specimens: ZFMK 75516-8, 78006-7, 78368-80, 81632-6, HWH 14, 17, 98-100, 156, 1035, 1084, 1177. Habitat: FB.

Remarks: Reported by AMIET (1975) for Ekomtolo and Ebone (650 m). We observed amplexus in this species in November and April. End of January 2003 we found a clutch on a leaf above a creek.

Hyperolius pardalis LAURENT, 1948 "1947"

Locality: NGU. Voucher specimens: ZFMK 69320-49. Habitat: FB.

Hyperolius sylvaticus nigeriensis SCHIØTZ, 1967

Locality: NWF. Voucher specimens: ZFMK 78381-3. Habitat: F.

Hyperolius sp. 6 sensu AMIET 1975 & 1978

Localities: NWF, NGU. Voucher specimens: HWH 172, 1085. Habitat: F.

Remarks: This species exhibits an overall similarity to *Hyperolius riggenbachii*. Recorded by AMIET (1975) for Ebone (650 m).

Leptopelinae

Leptopelis aubryi (DUMÉRIL, 1856)

Locality: NWF. Voucher specimens: ZFMK 81193-5, HWH 114, 1037-8. Habitat: FB.

Remarks: Reported by AMIET (1975) for Ekomtolo, for Ebone (650 m) and Badjoki (550 m).

Leptopelis boulengeri (WERNER, 1898)

Locality: NWF, EYI. Voucher specimens: ZFMK 77974, 78399-401, 81592-4, 81707, HWH 192. Habitat: F.

taxon	abundance ¹	altitudinal distribution ²				zoogeographic		distribution ³	
		500m	700m	1,100m	1,700m	CE	WA	CA	SSA
Gymnophiona									
Caeciliidae									
<i>Geotrypetes seraphini</i>	+	---	- -	---			+	+	
<i>Herpele squalostoma</i>	+	---	- -	---					+
Anura									
Pipidae									
<i>Hymenochirus boettgeri boettgeri</i>	+	---							+
<i>Silurana tropicalis</i>	+	---					+	+	
<i>Xenopus fraseri</i>	+	---							+
Bufonidae									
<i>Bufo latifrons</i>	++	---	---				+	+	
<i>Bufo maculatus</i>	+++	---	- -	---					+
<i>Bufo superciliaris</i>	+	---					+	+	
<i>Bufo tuberosus</i>	++	---	---	---	---				+
<i>Nectophryne afra</i>	++	---	---	---					+
<i>Nectophryne batesi</i>	++	---	---	---					+
<i>Werneria mertensiana</i>	+++			---			+		
<i>Wolterstorffina parvipalmata</i>	++			---			+ ⁴		
Petropedetidae									
<i>Dimorphognathus africanus</i>	+++	---	---	---					+
<i>Petropedetes cameronensis</i>	+++	---	---	---			+ ⁴		
<i>Petropedetes johnstoni</i>	+	---					+		
<i>Petropedetes newtoni</i>	+	---	- -	---					+
<i>Petropedetes parkeri</i>	++	---	- -	---					+
<i>Petropedetes perreti</i>	++	---	- -	---			+		
<i>Phrynobatrachus auritus</i>	+++	---	---	---					+
<i>Phrynobatrachus batesii</i>	++	---	- -	---			+		
<i>Phrynobatrachus cornutus*</i>	(+)	---							+
<i>Phrynobatrachus cricogaster</i>	++			---	---		+ ⁴		
<i>Phrynobatrachus hylaios</i>	+			---					+
<i>Phrynobatrachus wernerii</i>	+++	---	---	---			+ ⁴		
<i>Phrynobatrachus</i> sp.	+	---					+		
<i>Phrynodon sandersoni</i>	+++	---	- -	---					+
<i>Phrynodon</i> sp.	+	---	- -	---			+		
Ranidae									
<i>Amnirana albolabris*</i>	(+)	---						+	+
<i>Amnirana amnicola</i>	++	---							+
<i>Amnirana asperrima</i>	+++	---					+		
<i>Amnirana lepus</i>	+	---							+
<i>Conraua crassipes</i>	+++	---	- -	---					+
<i>Conraua goliath</i>	+	---							+
<i>Conraua robusta</i>	++	---	---	---			+		
<i>Ptychadena aequiplicata</i>	++	---	---	---				+	+
<i>Ptychadena</i> cf. <i>mascareniensis</i>	++	---						+	+
<i>Ptychadena perreti</i>	+	---							+
<i>Ptychadena superciliaris</i>	+	---						+	
Arthroleptidae									
<i>Arthroleptis adelphus</i>	+++	---	---	---					+
<i>Arthroleptis</i> cf. <i>adolffriedericici</i>	+	---	- -	---	---				+
<i>Arthroleptis variabilis</i>	+++	---	---	---				+	+
<i>Arthroleptis</i> sp.*	(+)	---					+		
<i>Cardioglossa elegans</i>	+	---							+
<i>Cardioglossa gracilis</i>	++	---	- -	---					+
<i>Cardioglossa leucomystax</i>	+++	---	- -	---				+	+
<i>Cardioglossa melanogaster</i>	+			---			+		
<i>Cardioglossa nigromaculata</i>	+	---					+ ⁴		
<i>Cardioglossa venusta</i>	++			---			+		
<i>Schoutedenella poecilonota</i>	+++	---	---	---				+	+

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<i>Schoutedenella sylvatica</i> *	(+)	---						+
<i>Schoutedenella taeniata</i>	+		---	---				+
Astylosternidae								
<i>Astylosternus diadematus</i>	+++	---	-	-	---			+
<i>Astylosternus fallax</i>	++	---						+
<i>Astylosternus laurenti</i> *	+	---						+
<i>Astylosternus montanus</i>	++				---			+
<i>Astylosternus perreti</i>	+	---	-	-	---			+
<i>Leptodactylodon bicolor</i> *	(+)				(--)			+ ⁴
<i>Leptodactylodon boulengeri bamilekianus</i>	++	---	-	-	---			+
<i>Leptodactylodon mertensi</i>	++				---			+
<i>Leptodactylodon ornatus</i>	+				---			+
<i>Leptodactylodon ovatus orientalis</i>	++	---	-	-	---			+
<i>Nyctibates corrugatus</i>	++	---						+
<i>Scotobleps gabonicus</i>	+++	---	-	-	---			+
<i>Trichobatrachus robustus</i>	++	---	---	---	---			+
Rhacophoridae								
<i>Chiromantis rufescens</i>	+++	---	-	-	---			+ +
Hyperoliidae								
Hyperoliinae								
<i>Acanthixalus spinosus</i>	+	---						+
<i>Afrixalus dorsalis</i>	+				---		+	+
<i>Afrixalus lacteus</i>	+				---		+	+
<i>Afrixalus laevis</i>	++	---	-	-	---			+
<i>Afrixalus paradorialis</i>	++	---	-	-	---			+
<i>Alexeroon obstetricans</i>	+	---						+
<i>Chlorolius koehleri</i>	+	---					+ ⁴	
<i>Hyperolius acutirostris</i> *	(+)	---					+	
<i>Hyperolius bolifambae</i>	++	---						+
<i>Hyperolius cf. camerunensis</i>	+				---		+	
<i>Hyperolius guttulatus</i>	++	---					+	
<i>Hyperolius kuligae</i>	+	---	-	-	---			+
<i>Hyperolius ocellatus</i>	+++	---	-	-	---			+
<i>Hyperolius pardalis</i>	++				---			+
<i>Hyperolius sylvaticus nigeriensis</i>	+	---					+	
<i>Hyperolius sp. 6 sensu AMIET 1975 & 1978</i>	+	---	-	-	---		+	
Leptopelinae								
<i>Leptopelis aubryi</i>	++	---						+
<i>Leptopelis boulengeri</i>	++	---	---					+
<i>Leptopelis brevirostris</i>	++	---	-	-	---			+
<i>Leptopelis calcaratus</i>	+++	---	---	---	---			+
<i>Leptopelis millsoni</i>	++	---	-	-	---			+
<i>Leptopelis modestus</i>	+				---			+
<i>Leptopelis notatus</i>	+	---						+
<i>Leptopelis cf. ocellatus</i>	+	---						+
<i>Leptopelis omissus</i>	++	---	---					+
<i>Leptopelis rufus</i>	++	---	-	-	---			+
Kassininae								
<i>Opisthoxylax immaculatus</i>	++	---	-	-	---			+

Tab. 3. Abundance, altitudinal distribution at Mt. Nlonako and zoogeographic distribution in Africa of amphibian species of Mt. Nlonako.

*after AMIET (1975), not found by us; ¹based on voucher specimens and observations, + = rare, ++ = moderately abundant, +++ = abundant; ²based on voucher specimens and observations, elevation in meters corresponds to the major study sites; ³based on FROST (2002), CE = Cameroon endemic (but see ⁴), WA = West Africa, CA = Central Africa, SSA = Sub-Saharan Africa; ⁴distributed in Cameroon and westernmost Nigeria.

	Mt. Nlonako	Korup NP	Dja FR	Nkongsamba area
area in km ²	150	1,240	8,400	10,000
amphibian species	93 (86)	88 (78)	70 (10)	100
amphibian species/km ²	0.62	0.07	0.01	0.01
anuran species	91 (86)	83 (76)	68 (10)	100
source	this study	LAWSON 1993	LEBRETON 1999	AMIET 1975

Tab. 4. Amphibian species richness of three different rainforest areas in southwestern and southern Cameroon. Numbers in parentheses are the number of species directly recorded by the authors for the areas. NP = National Park; FR = Faunal Reserve. Nkongsamba area includes Mt. Nlonako. Species recorded from Yaounde are excluded from the list of LEBRETON (1999).

Remarks: Reported by AMIET (1975) for Ekomtolo. Advertisement calls were heard end of February; a clutch was found end of March.

Leptopelis brevirostris (WERNER, 1898)

Localities: NWF, NGU. Voucher specimens: ZFMK 69375-8, 69385-88, 77971, 78392-8, 81197, 81709, HWH 32, 1078. Habitat: F. Remarks: Reported by AMIET (1975) for Ekomtolo.

Leptopelis calcaratus (BOULENGER, 1906)

Localities: NWF, EYI, NGU. Voucher specimens: ZFMK 69379-83, 69389, 69399-402, 69454-56, 69470-4, 69503-4, 72857, 75509-13, 75570-1, 77972, 78386-91, 81196, 81562-5, HWH 12, 113, 148, 1036, 1076-7. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo and Ebone (650 m) and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU.

Leptopelis millsoni (BOULENGER, 1895)

Localities: NWF, NGU. Voucher specimens: ZFMK 78403-4, 81671-2, HWH 171, 1181-2. Habitat: F.

Leptopelis modestus (WERNER, 1898)

Locality: NGU. Voucher specimen: ZFMK 75456. Habitat: F.

Leptopelis notatus (PETERS, 1875)

Locality: NWF. Voucher specimen: ZFMK 69374, 81199, HWH 112. Habitat: F.

Leptopelis cf. ocellatus (MOCQUARD, 1902)

Locality: NWF. Voucher specimen: HWH 35. Habitat: F.

Leptopelis omissus AMIET, 1992 "1991"

Localities: NWF, EYI. Voucher specimens: ZFMK 69384, 78311-2, 81192, 81595-81606, HWH 170. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo as *Leptopelis* sp. 1 and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU. Amplexus was observed in late April.

Leptopelis rufus REICHENOW, 1874

Localities: NWF, NGU. Voucher specimens: ZFMK 69371-3, 75514-5, 77973, 78402, 81198, 81696, HWH 20, 115-6, 1075. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo and Ebone (650 m). Amplexing specimens were seen in January and February. This species regularly feigned death when handled.

Kassininae

Opisthoxylax immaculatus (BOULENGER, 1903)

Localities: NWF, NGU. Voucher specimens: ZFMK 69318, 78384-5, 81185-6, 81556-8, HWH 1080. Habitat: F.

Remarks: Reported by AMIET (1975) for Ekomtolo and Ebone (650 m) and by DOWSETT-LEMAIRE & DOWSETT (1999) for NGU. Advertisement calls were heard on 21 February 2003.

country	locality	species	CBR	source
Cameroon	Nkongsamba area	100	0.77	AMIET 1975
Cameroon	Korup National Park	88	0.72	LAWSON 1993
Cameroon	Mt. Kupe & Bakossi Mtns.	49	0.62	SCHMITZ 1998
Cameroon	Dja Faunal Reserve	70	0.59	LEBRETON 1999
Equatorial Guinea	Mt. Alén NP	49	0.52	DE LA RIVA 1994
Congo (RC)	Kouilou River basin	39	0.35	LARGEN & DOWSETT-LEMAIRE 1991
Guinea	Zima forest	27	0.17	BÖHME 1994 a, b
Ivory Coast	Haute Dodo	42	0.15	RÖDEL & BRANCH 2002
Ivory Coast	Cavally forests	42	0.14	RÖDEL & BRANCH 2002
Ivory Coast	Mt. Peko NP	33	0.14	RÖDEL & ERNST 2003
Ivory Coast	Marahoué NP	34	0.14	RÖDEL & ERNST 2003
Ivory Coast	Mt. Sangbé NP	33	0.10	RÖDEL 2003
Ghana	Togo-Volta highlands	33	0.10	RÖDEL & AGYEI 2003

Tab. 5. West and Central African rainforest amphibian faunas and their relationships with the Mt. Nlonako amphibian fauna. CBR = coefficient of biogeographic resemblance (DUELLMAN 1990).

Discussion

We recorded a total of 93 amphibian species from Mt. Nlonako (table 3). Thirty-nine percent of all 236 amphibian species recorded for Cameroon (LEBRETON 1999) occur at Mt. Nlonako. Mt. Nlonako hosts the most species rich single-locality amphibian fauna in Africa (RÖDEL & AGYEI 2003). The subsequent area of species richness is represented by Korup NP approximately 130 km W of Mt. Nlonako with 88 amphibian species (LAWSON 1993). This is followed by Mt. Nimba in the Guinea-Liberia-Ivory Coast triangle (57 species, GUIBÉ & LAMOTTE 1958, GUIBÉ 1963, SCHIØTZ 1967), Mt. Alén in Equatorial Guinea (49 species, DE LA RIVA 1994) and Haute Dodo and Cavally forests in Ivory Coast (42 species, RÖDEL & BRANCH 2002). These results may not only represent the actual pattern of amphibian species richness in the rainforest areas of West and Central Africa but may also represent survey activities and gaps as many areas with a very high potential for exceptional species richness have not been sampled adequately.

Within Cameroon, our data shows not only the highest species richness for a single locality, but also the highest number of species per area (km²) as shown in Table 4.

The number of yet undescribed species (five species: *Phrynobatrachus* sp., *Phrynodon* sp., *Arthroleptis* sp., *Hyperolius* sp. 1, *H.* sp. 6) at first is surprising. However, considering the large number of anuran species described from Cameroon by PERRET (1957, 1959b, 1960, 1971, 1977) and AMIET (1970, 1971b, 1972a, 1972c, 1973b, 1977, 1980a, 1980b, 1981, 1983a, 1991, 2001, 2004a, b) during the past five decades, it is surprising that a considerable number of undescribed species still seems to exist. This underlines the relevance of the area relative to the amphibian diversity.

Of the 93 species recorded from Mt. Nlonako, two species are caecilians. Of the 91 anuran species three are Pipidae (3 %), eight are Bufonidae (9 %), 15 are Petropedetidae (16 %), eleven are Ranidae (12 %), 13 are Arthroleptidae (14 %), 13 are Astylosternidae (14 %), one is Rhacophoridae (1 %) and 27 are Hyperoliidae (30 %) with 16 Hyperoliinae species, ten Leptopelinae species and one Kassiniinae species.

The distribution of species along an elevational gradient shows that most species are found at lower elevations (table 3). Only a few species can be considered purely montane such as *Phrynobatrachus cricogaster* and *Astylosternus montanus* which are exclusively found above 1,000 m elevation.

In a broader biogeographic context, 44 of the amphibian species of Mt. Nlonako can be considered Central African in distribution (Table 3). Only four species have a West African distribution; twelve are distributed in West and Central Africa. Thirty-one of the recorded species are endemic to Cameroon and seven occur in the West Cameroon mountains and the mountains of westernmost Nigeria (i. e. Obudu plateau), which form a zoogeographical unit. Only one species, *Bufo maculatus*, has a wider distribution in sub-saharan Africa.

The closer biogeographic relationship with Central Africa as compared with West Africa is underlined by the coefficient of biogeographic resemblance (CBR) as demonstrated in table 5. Here, the amphibian fauna of the south Cameroonian Dja Faunal Reserve, the Kouilou River basin in Congo and Mt. Alén NP in Equatorial Guinea show a much higher degree of resemblance than areas in Guinea, Ivory Coast or Ghana. Thus the Mt. Nlonako amphibian fauna can be regarded as endemic and/or Central African.

The exceptional species richness and high degree of endemism of Mt. Nlonako and the West Cameroonian mountain range can be explained by palaeogeographic events. Historically this area has served as a refuge during drastic climate fluctuations. During the Pleistocene until circa 20,000 years ago, African wet forests were restricted to a few isolated areas (LIVINGSTONE 1982). Those fluctuations and refuges played an important role in the evolution of the high number of (endemic) amphibian species as LAWSON (1993) also describes for the Korup NP.

Bufo superciliaris is the only species listed in CITES appendices and thus for which international trade is regulated. The only species listed as threatened is *Conraua goliath* (vulnerable, IUCN 2003). This species is the only amphibian species protected by Cameroonian law. Threats to the Mt. Nlonako amphibian fauna are (1) habitat destruction by logging in the eastern and southern parts of the area, (2) habitat destruction

by human encroachment as notable on the northern and western slopes of Mt. Nlonako adjacent to the town Nkongosamba and (3) the hunting and consumption as food of species like *Conraua goliath*, *C. robusta* and *Trichobatrachus robustus*. Another threat might be posed by agro-chemicals, which are frequently used in the extensive coffee farms of the area and to poison fish in the rivers for subsequent sale at the local bush-meat markets. The effect of such substances on amphibian eggs, larvae and adults warrants additional research.

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