

Journal of African Zoology

ISSN 0776-7943

Volume 108 (1)



15.III.1994

Edited by H. M. André

Published by



a nonprofit scientific publisher

Amphibians of the Impenetrable Forest, Southwest Uganda

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Drewes, R. C. & Vindum, J. V. 1994. Amphibians of the Impenetrable Forest, Southwest Uganda. *J. Afr. Zool.* 108: 55-70.

This report on the amphibians of the Impenetrable Forest, southwestern Uganda is based on a survey conducted October-December 1990 and on examination of preserved museum specimens. Twenty-eight species, four of which are new to Uganda, are shown to inhabit the Impenetrable Forest, including an unknown species of *Petropedetes*, a genus hitherto not known to occur east of Cameroun.

Les amphibiens de la Forêt Impénétrable, dans le sud-ouest de l'Ouganda. - Ce rapport sur les amphibiens de la Forêt Impénétrable dans le sud-ouest de l'Ouganda, est basé sur une expédition réalisée d'octobre à décembre 1993 et l'étude de spécimens conservés dans les musées. Vingt huit espèces, dont quatre sont nouvelles pour l'Ouganda, ont été découvertes dans la Forêt Impénétrable, y compris une espèce inconnue de *Petropedetes*, un genre non signalé jusqu'à présent à l'est du Cameroun.

Key words: forest amphibians, Anura, Uganda, Impenetrable Forest, biodiversity, new species.

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INTRODUCTION

The herpetofauna of Uganda's western highland forests remains poorly known. Although large collections were made by Belgian expeditions in the 1930's in eastern Zaire along the Uganda and Rwanda borders, few collections have been made from the highland forests of western Uganda.

Still fewer collections have been made in the Impenetrable Forest proper, and most were made incidental to the main purpose of the expeditions. Capt. C.R.S. Pitman collected some material in December, 1934; his material was

deposited in the British Museum (Natural History) and the Natural History Museum of Zimbabwe. In the 1960's three ornithological expeditions were made to the Impenetrable Forest in which amphibians and reptiles were also collected. Twomey and Williams collected 43 specimens for Carnegie Museum in August, 1960. Ronald Keith collected 39 anurans during an expedition for the American Museum of Natural History in June of 1962. In March, 1967 and July 1969 two collections of amphibians were made by Glenn during ornithological expeditions for the Los Angeles County Museum of Natural History. In April and May, 1968, Schiøtz and Duff-MacKay collected reptiles and anurans which have been deposited in

the Zoological Museum in Copenhagen and the National Museum of Kenya. Other than Pitman's work, this latter trip has been the only herpetologically oriented expedition to include the Impenetrable Forest until the present work. Schiøtz's field work was treated in the 1975 publication, *Treefrogs of Eastern Africa*. The following report is the result of the only expedition to focus on the herpetofauna of the Impenetrable Forest in general.

The Impenetrable Forest (Fig. 1) is located on the eastern escarpment of the Albertine Rift in extreme southwest Uganda, from 0° 53'S to 1° 09'S and 29° 35'E to 29° 50'E. The Impenetrable is appropriately named, consisting of 320 km² of dense tropical moist forest in an extremely rugged, much-dissected landscape. The terrain consists of narrow steep-sided valleys running in all directions, bordered by crests of mountains ranging in elevation from 2600 m in the South to 1400 m in the North. A rather steep gradient exists from the highest point in the southeast (Rwamanyoni Hill, 2607 m) to the lowest in the extreme north of the forest (1160 m, Butynski, 1984). The difficulty of the terrain is reflected in the fact that most published Impenetrable Forest localities are to be found on roads or on the periphery of the forest proper.

Mean annual rainfall at Ruhizha (2356 m) is 1440 mm; mean number of rainy days (at least 1 mm rainfall) is 148 per year (Butynski, 1984). Temperature data are unavailable for the Impenetrable; however Butynski (1984), using Kabale Forest data, extrapolated a mean daily temperature at Ruhizha (2365 m) of about 13°C, mean daily minima of 7°C and mean daily maxima of 20°C. The coolest period is June-July; there are two dry seasons, December-January, and June-August.

The forest is botanically among the richest in East Africa; at least 150 species

of trees have been identified thus far, including 10 species found nowhere else in Uganda. Likewise the bird fauna is remarkable with 337 species identified so far and listed by Butynski (1984). A preliminary list of mammals compiled by Butynski (1984) stands at 147 species (97 confirmed, including mountain gorilla and the rare L'Hoest monkey, and 49 "probable" species). An inventory of the Lepidoptera is presently in progress by J. Omading of Makerere University; a list of ferns has been prepared by R. Badaza and a survey of small mammals by Dr. J. Baranga. Dr. A. Cunningham has worked on the ethnobotany of the area, P. Scott has studied human utilization, and A. Katende of Makerere has made a number of botanical surveys.

Following a brief reconnaissance in February, 1990 (by R.C.D), the survey was carried out between 25 October and 13 December, 1990 at eight primary localities in the Impenetrable Forest. Collecting was primarily done by R. C. Drewes, J. V. Vindum, and J. P. O'Brien of the California Academy of Sciences, H. W. Greene of the University of California, Berkeley, and Dennis Babaasa and Edgar Buhanga of Makerere University in Kampala; additional material was brought in by Forest Guards accompanying the expedition.

LOCALITIES

The following is a description of the localities collected; the dates and the number of collectors involved are enclosed in parentheses following each date. They are listed in the order in which they were first sampled. Localities cited in the text in reference to specimens examined, but not visited by the CAS expedition are included at the end of each species account.

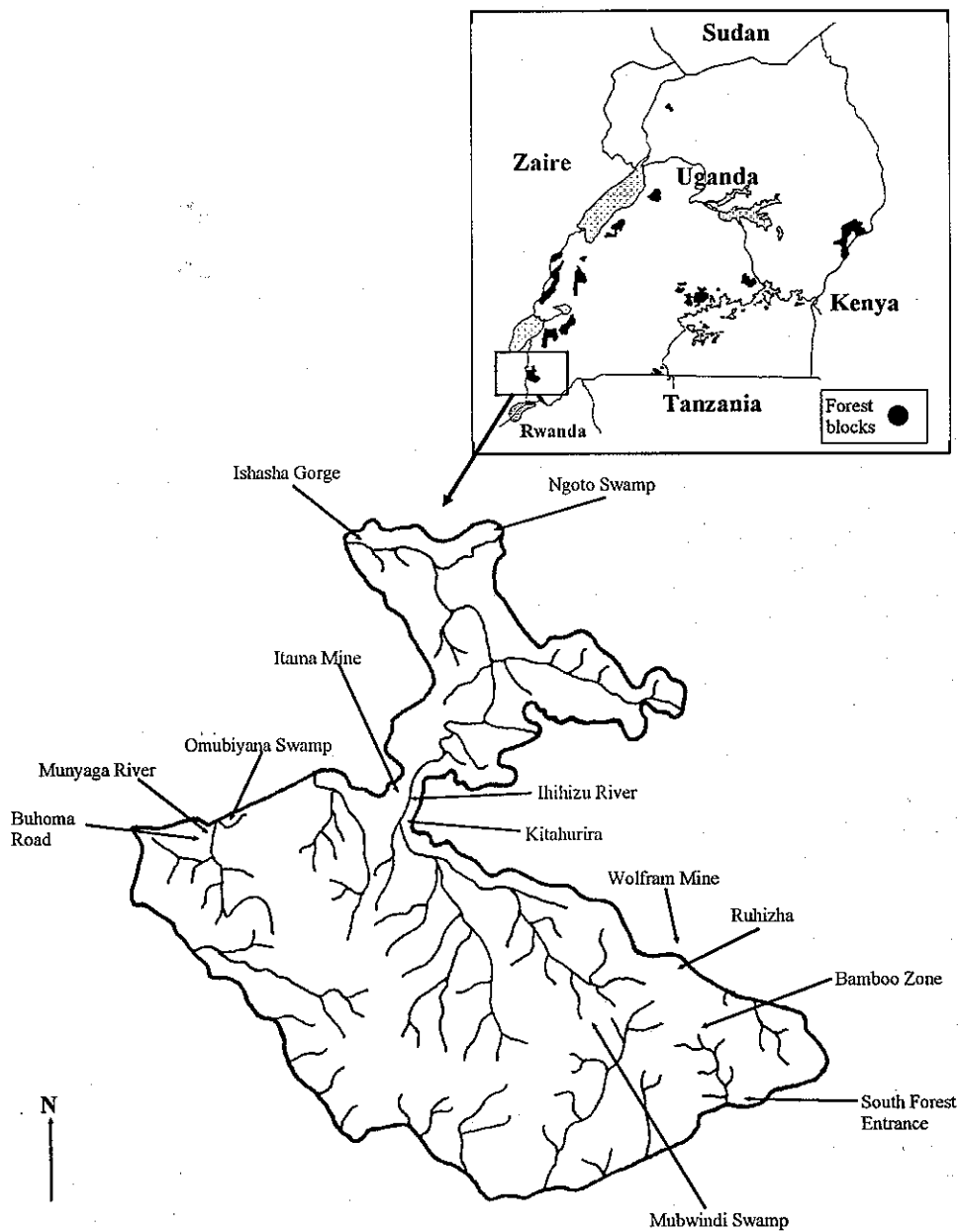


Fig. 1. - Map of the Impenetrable Forest, SW Uganda.

Ruhizha (2356 m)

The headquarters of the Impenetrable Forest Conservation Project lies on a high ridge at a western edge of the forest, just above the Kabale-Kayonza road which passes through the Impenetrable Forest from South to North. The Ruhizha area is largely disturbed, including road cuts, clearings, lawns, buildings, and tracks to a substantial abandoned dwelling on a nearby ridge and the Wolfram Mine. Some of our material was collected along this road within 1.5 km north and south of Ruhizha.

Dates : 25-26 Oct. 1990 (5); 30 Oct. 1990 (5); 12-18 Nov. 1990 (6); 2-5 Dec. 1990 (4); 11-13 Dec. 1990 (4).

Wolfram Mine

A rather unstable, ca. 5 ha² sedge-rush swamp, ca. 4 km NNE of Ruhizha at about 2130 m. Bordered by extremely steep-forested slopes, the swamp was created by the construction of a dam which was apparently involved in the wolfram mining process. The now abandoned mine is located ca. 50 m to the north of the dam. Collecting was limited to the periphery of the swamp, due to the instability of the sedge-rush vegetation growing in the water.

Dates : 26 Oct. 1990 (5).

Mubwindi Swamp

A long, narrow 1-2 km² sedge-rush swamp ca. 4 km. SW of Ruhizha at an elevation of 2070 m (Fig. 2). Surrounded by steep, densely forested slopes, the swamp vegetation was of sufficient density and maturity to provide safe footing, allowing collecting activity in the middle of the swamp as well as the peripheral slopes. Sedge and rush height reach 2 m above the swamp surface, and there are hummocks of *Lobelia* within the margins of the swamp. Trails and paths radiating from the swamp were

collected as well.

Dates : 14 Feb. 1990 (1); 27-29 Oct. 1990 (5); 6-10 Dec. 1990 (4).

Buhoma

Camp was established near the terminus of the Buhoma Road at 1580 m in dense forest dissected by small streams and several bends of the Munyaga River (Fig. 3). Dense secondary plant growth lined the Buhoma road. The Kihungye River lies nearby but was never visited by the party; however, a number of specimens were brought in from that locality by Forest Guards.

Dates : 1-5 Nov. 1990 (5); 21-23 Nov. 1990 (4); 27 Nov.-1 Dec. 1990 (4).

Omubiyanja (Two-Pond) Swamp

Located above Buhoma village in a saddle of the Ibare Hills at about 1830 m, this complex swamp is not dominated by sedges and rushes like Mubwindi and the Wolfram Mine. It consists of a 50 m² open water pond bordered by extensive swampy wetlands consisting of *Anthocleista*, *Cyperus*, *Thelypteris* and *Begonia* (Fig. 4). These shallow wetlands are in turn bordered by mature montane forest.

Dates : 3 Nov. 1990 (3); 24-26 Nov. 1990 (4).

Ishasha Gorge

Camp was established about 60 m. above the Ishasha River on the edge of the gorge at an elevation of 1160 m (Fig. 5). Due to the fact that the swiftly flowing river was dangerous and largely inaccessible, collecting was limited to side streams, nearby human habitations and cultivated fields above the river.

Dates : 6-8 Nov. 1990 (6).



Fig. 2. - Muirwindi Swamp, elevation : 2070 m. A fairly simple rush-sedge swamp surrounded by mature montane forest. Amphibian species present: *Arthroleptis adolfifriederici*, *Bufo kisoensis*, *Hyperolius castaneus*, *H. cinnamomeiventris*, *Leptopelis kivuensis*, *Petrophelis* sp., *Phrynobatrachus graueri*, *P. versicolor*, *Rana angolensis*.



Fig. 3. - Muryaga River at Bulsona, elevation 1580 m. Forest in this area is dominated by *Cyathea* and *Lobelia*. Amphibian species present: *Africanus laevis*, *Bufo kisoensis*, *Hylarana albolaris*, *Hyperolius albicola*, *H. cinnamomeiventris*, *H. frontalis*, *Leptopelis kivuensis*, *Phrynobatrachus dendrobates*, *P. graueri*, *P. versicolor*, *Rana angolensis*.

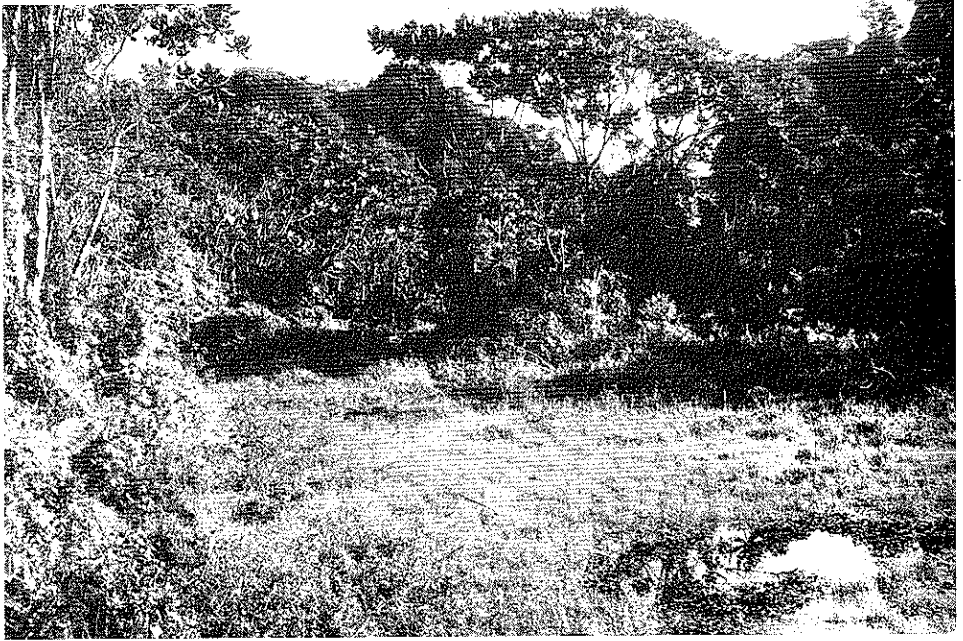


Fig. 4. - Omubiyanja ("Two-Pond") Swamp, elevation : 1824 m. A complex *Antboeleista-Cyperus-Thelypteris-Begonia* swamp forest surrounded by mature montane forest. Species breeding in this swamp reflect in part its complexity. Amphibian species present: *Afrixalus orophilus*, *A. osorioi*, *Bufo kisoloensis*, *Hyperolius castaneus*, *H. cinnamomeiventris*, *H. lateralis*, *H. platyceps*, *H. viridiflavus pitmani*, *Leptopeltis kivuensis*, *Pblyctimantis verrucosus*, *Pbrynobatrachus grateri*, *Rana angolensis*, *Xenopus wittei*.



Fig. 5. - Ngoto Swamp area, elevation : 1276 m. Right background is a *Papyrus* swamp; left background a mixed mature forest; foreground very recent secondary growth made up of *Pteridium aquilinum* and *Harungana madagascariensis*. Secondary growth was found to be devoid of vertebrate species. Amphibian species present in *Papyrus* swamp and mature forest: *Bufo kisoloensis*, *Hylarana albolaris*, *Hyperolius cinnamomeiventris*, *H. kivuensis*, *Pbrynobatrachus grateri*, *Rana angolensis*, *Xenopus wittei*.

Ngoto Swamp

Ngoto is a large, ca. 0.5 km² *Papyrus* swamp at 1280 m. which just penetrates the northeasternmost extent of the Impenetrable Forest. We learned that the block of forest in contact with Ngoto Swamp had been isolated from the main forest by illegal logging. Camp was located near the forest in an area comprised wholly of recent secondary growth, also present due to illegal clear-cutting. Dates: 8-10 Nov. 1990 (b).

Bamboo Zone

The only bamboo zone in the Impenetrable forest is ca. 7 km. SE of IFCP headquarters at Ruhizha on the Kabale- Kayonza Road at about 2400 m. elevation. It is less than 0.4 km², and the dominant bamboo species is *Arundinaria alpina*.

Dates : 16 Nov. 1990 (4); inclement weather prohibited additional sampling of this area.

Additional Localities (see Fig. 1) are Kitahurira (frequently misspelled "Kitahulira" in museum notes), Itama Mine, Kayonza Forest, Ishasha River. "Kayonza" is an old designation for the northern sector of the Impenetrable Forest; a number of museum specimens examined by us were collected at undisclosed localities along the Ishasha River.

SPECIES ACCOUNTS

(Table 1)

Family Pipidae

Genus *Xenopus* Wagler, 1837

Xenopus wittei Tinsley, Kobel & Fischberg, 1979

Remarks. - Distinguished from its nearest relative, *X. vestitus* Laurent by possession of a uniform, grey-green dorsal surface (Tinsley *et al.*, 1979), *X.*

wittei is the only wholly aquatic frog known from the Impenetrable Forest.

Material examined. - **Impenetrable Forest** : LACM 35176-77, 8 Mar. 1967; LACM 35179, 9 Mar. 1967, LACM 60654, Jul 1969. **Ishasha Gorge** : CAS 176941-43, 7 Nov. 1990. **Kayonza Forest** : CM 38119, 7 Aug. 1960. **Kitahurira** : AMNH 68506-09 (Paratypes), 6 Jun. 1962. **Ngoto Swamp** : CAS 176944-45, 9 Nov. 1990. **Omubiyanja Swamp** : CAS 176939, 4 Nov. 1990; CAS 176940, 3 Nov. 1990. **Ruhizha** : LACM 35178, 35180-82, 9 Mar. 1967.

Table 1. - Amphibians collected or identified by the California Academy of Sciences in the Impenetrable Forest, Uganda, 1990*.

| |
|--|
| <i>Xenopus wittei</i> |
| <i>Bufo kisoloensis</i> |
| <i>Bufo maculatus</i> |
| <i>Arthroleptis adolfifriderici</i> |
| <i>Arthroleptis stenodactylus</i> |
| <i>Phrynobatrachus dendrobates</i> |
| <i>Phrynobatrachus graueri</i> |
| <i>Phrynobatrachus parvulus</i> |
| <i>Phrynobatrachus versicolor</i> |
| <i>Petropedetes</i> sp.* |
| <i>Rana angolensis</i> |
| <i>Ptychadena chrysogaster</i> * |
| <i>Hylarana albolabris</i> |
| <i>Leptopelis kivuensis</i> |
| <i>Leptopelis christyi</i> |
| <i>Phlyctimantis verrucosus</i> |
| <i>Africalus laevis</i> * |
| <i>Africalus orophilus</i> |
| <i>Africalus osorioi</i> * |
| <i>Hyperolius alticola</i> |
| <i>Hyperolius castaneus</i> |
| <i>Hyperolius lateralis</i> |
| <i>Hyperolius platyceps</i> |
| <i>Hyperolius cinnamomeoventris</i> |
| <i>Hyperolius frontalis</i> |
| <i>Hyperolius kivuensis</i> |
| <i>Hyperolius viridiflavus pitmani</i> |
| <i>Hyperolius viridiflavus hayoni</i> |

*new record for Uganda

Family Bufonidae
Genus *Bufo* Laurenti, 1768

Bufo kisolensis Loveridge, 1932

Remarks. - *B. kisolensis* appears to be the only toad species inhabiting the forest proper (see *B. maculatus*, below). The striking dichromatism exhibited by this species is known in but two, perhaps three other toad species. Males of *Bufo leutkeni* from Nicaragua and Costa Rica turn yellowish during the night hours but darken in the warmer temperatures of the the day (Villa, 1972). *Bufo periglenes* males of Costa Rica are permanently bright yellowish-orange to orange-red while the females are dark with scarlet blotches. Savage (1966) suggested that as *B. periglenes* is voiceless, bright coloration of the male serves as a visual mechanism for mate selection. Such is probably not the case in the very vocal, *B. kisolensis*. Subsequent collection of specimens of *B. peripatetes* of Panama (hitherto known only from the type) suggests that males of this species may also be yellow during breeding (Savage & Donnelly, 1992). Tadpole tooth formula : 1+1/3 (Drewes, 1984, p. 4).

Material examined. - **Buhoma Road**: CAS 176984, 2 Nov. 1990; CAS 176985-89, 4 Nov. 1990; CAS 176990, 180664, 5 Nov. 1990; CAS 176991, 22 Nov. 1990; CAS 176992, 178288, 180666, 23 Nov. 1990; CAS 176993-99, 180667, 27 Nov. 1990; MVZ (HWG 2123), 5 Nov. 1990. **Impenetrable Forest** : LACM 35160, 8 Mar. 1967; LACM 60685-86, Jul 1969. **Itama Mine** : LACM 35161, 24 Mar. 1967. **Kayonza Forest** : CM 38100-02, Aug. 1960; CM 38103-09, 6 Aug. 1960. **Mubwindi Swamp** : CAS 177008-09, 28 Oct. 1990; CAS 177010-13, 29 Oct. 1990; CAS 177019-20, 7 Dec. 1990; CAS 177021, 8 Dec. 1990; CAS 177022-25, 9 Dec. 1990; LACM 35155-59, 20 Mar. 1967; MVZ (HWG 2106-07), 29 Oct. 1990. **Mubwindi Swamp Trail** : CAS 177014-16, 29 Oct. 1990; CAS 177017-18, 7 Dec. 1990; CAS 177026-28, 10 Dec. 1990.

Ngoto Swamp : CAS 177002, 10 Nov. 1990. **Omubiyanja Swamp** : CAS 177003-04, 24 Nov. 1990; CAS 177005, 25 Nov. 1990; CAS 177006, 26 Nov. 1990; MVZ (HWG 2119), 4 Nov. 1990. **Ruhizha**: AMNH 68483, 2 Jun 1962; CAS 177007, 27 Oct. 1990; LACM 35162-75, 9 Mar. 1967; MVZ (HWG 2111), 30 Oct. 1990.

Bufo maculatus *Hallowell, 1855*

Remarks. - These specimens are smaller and lighter in coloration than our *B. kisolensis* material. According to Hulselmans (pers. comm), *B. maculatus* is similar to *B. regularis* Reuss and is sympatric with that species throughout its range. Both our specimens are males in full breeding condition and do not exhibit the bright yellow coloration of *B. kisolensis*. We are convinced that *B. maculatus* is not an inhabitant of the Impenetrable Forest proper but rather of disturbed areas on its periphery. Our material was identified by Dr. J. Hulselmans of the University of Antwerp; one specimen will be retained by the Musée royal de l'Afrique centrale in Tervuren.

Material examined. - **Ishasha Gorge** : CAS 177000-01, 7 Nov. 1990.

Family Ranidae
Genus *Arthroleptis* Smith, 1849

Arthroleptis adolfifrideric *Nieden, 1910*

Remarks. - *Arthroleptis* is included in the Ranidae here because recognition of the family Arthroleptidae has yet to be justified by phylogenetic analysis. CAS 177029 was collected under a log during daylight hours; four additional specimens were active on a forest trail at night during light rainfall.

Material examined. - **Mubwindi Swamp** : CAS 177029-33, 7 Dec. 1990.

Arthroleptis stenodactylus *Pfeffer, 1893*

Remarks. - Both specimens were collected on the Kabale-Kayonza Rd. This species may inhabit disturbed farmbrush habitats in this area. Our specimens are consistent with *A. s. whytii* Boulenger; however the genus is in great need of systematic revision, and thus we are loathe to assign trinomials.

Material examined. - **Ruhizha**: CAS 177034, 14 Nov. 1990; CAS 178291, 11 Dec. 1990.

Genus *Phrynobatrachus* Gunther, 1862

Phrynobatrachus dendrobates (Boulenger, 1919)

Remarks. - We are following Loveridge (1952) and De Witte (1941) in assigning *Phrynobatrachus* with expanded digital tips from this area to *P. dendrobates*. Although Laurent (1972) has maintained there are consistent differences between this species and *P. petropedetoides*, we have been unable to discern them, even between specimens of both species collected and identified by Laurent. Our specimens were most frequently found at night perched on low leaves along the banks of small rivers.

Material Examined. - **Buhoma Road**: CAS 178287, 21 Nov. 1990; MVZ (HWG 2128-29), 5 Nov. 1990. **Impenetrable Forest**: LACM 60659-60, Jul 1969. **Kitahurira**: AMNH 68738-41, AMNH 68814-15, AMNH 102957-60, 5 Jun. 1962. **Munyaga River**: CAS 178240-43, 2 Nov. 1990; CAS 178244-47, 3 Nov. 1990; CAS 178248-53, 5 Nov. 1990; CAS 178287, 21 Nov. 1990; CAS 178254-62, 22 Nov. 1990; CAS 178274-86, 26 Nov. 1990; CAS 178263-73, 28 Nov. 1990; MVZ (JVV 963-64, JVV 970-72), 22 Nov. 1990; MVZ (JVV 1163), 28 Nov. 1990.

Phrynobatrachus graueri (Nieden, 1910)

Remarks. - This species is quite

similar to *P. bequaerti* (Barbour & Loveridge, 1929) from which it differs in having slightly less extensive webbing on the 5th toe.

Material examined. - **Buhoma Road**: CAS 180606, 22 Nov. 1990. **Ishasha River**: AMNH 68773, 28 Jun. 1962; AMNH 68917, 3 Jun. 1962; CAS 180604, 7 Nov. 1990. **Kihungye River**: CAS 180607, 23 Nov. 1990. **Kitahurira**: AMNH 68778, AMNH 68884, 3 Jun. 1962. **Mubwindi Swamp**: CAS 180572-80, 27 Oct. 1990; CAS 180581-83, 28 Oct. 1990; CAS 180584-89, 6 Dec. 1990; CAS 180590, 7 Dec. 1990; CAS 180591-92, 8 Dec. 1990; CAS 180593-98, 9 Dec. 1990; MVZ (JVV 1255-56), 6 Dec. 1990. **Munyaga River**: CAS 180603, 5 Nov. 1990. **Ngoto Swamp**: CAS 180605, 9 Nov. 1990. **Omubiyanja Swamp**: CAS 177202, CAS 180600, 24 Nov. 1990; CAS 180599, 3 Nov. 1990; CAS 180601, 25 Nov. 1990; MVZ (JVV 792), 3 Nov. 1990. **Ruhizha**: CAS 180564-70, 31 Oct. 1990; CAS 180602, 30 Oct. 1990; CAS 180608-11, 3 Dec. 1990. **Wolfram Mine**: CAS 180563, CAS 180571, 26 Oct. 1990.

Phrynobatrachus parvulus Boulenger, 1905

Remarks. - The three AMNH specimens are assigned to *P. parvulus* with hesitation as they exhibit some characteristics of the very similar *P. cryptotis*. Only one specimen has the "silvery infratympanic streak" diagnostic of the former. Moreover, the locality data indicate "Ishasha River, 3,500 feet" which may be extralimital to the forest proper.

Material Examined. - **Ishasha River** AMNH 68774-76, 28 Jun 1962.

Phrynobatrachus versicolor Ahl, 1924

Remarks. - This species is particularly numerous at Mubwindi Swamp. De Witte (1941) calls attention to the variability in texture of dorsal skin. Our

Mubwindi material has smoother dorsal skin than individuals sampled at the Wolfram Mine; nonetheless, both series fit the description of *P. versicolor*.

Material Examined . - Buhoma Road : CAS 180631-34, 4 Nov. 1990; CAS 180649-52, 22 Nov. 1990; CAS 180653-55, 23 Nov. 1990; CAS 180660, 26 Nov. 1990; CAS 180656, 27 Nov. 1990; CAS 180658, 29 Nov. 1990; CAS 180659, 30 Nov. 1990; MVZ (JVV 1173-74), 28 Nov. 1990; MVZ (JVV 1177), 29 Nov. 1990. **Impenetrable Forest** : LACM 35215, Mar. 1967; LACM 35216, LACM 35248-69, LACM 35271-73, LACM 35275-81, 8 Mar. 1967; LACM 36217, 9 Mar. 1967; LACM 60661-65, 60673-77, Jul. 1969. **Itama Mine** : LACM 35247, 24 Mar. 1967. **Kayonza Forest** : FMNH 12160, FMNH 75407-10, no date. **Kihungye River** : CAS 180657, 23 Nov. 1990. **Mubwindi Swamp** : CAS 180635-39, 27 Oct. 1990; CAS 180640, 28 Oct. 1990; CAS 180641-45, 6 Dec. 1990; CAS 180646-48, 9 Dec. 1990; LACM 35228, 35230-33, 35235-41, 35243-46, 20 Mar. 1967; MVZ (JVV 1301), 7 Dec. 1990; MVZ (JVV 1321), 8 Dec. 1990; MVZ (JVV 1338), 9 Dec. 1990. **Munyaga River** : CAS 180628, 1 Nov. 1990; CAS 180629-30, 2 Nov. 1990. **Ruhizha** : LACM 39219-21, LACM 36223-26, 9 Mar. 1967. **Wolfram Mine** : CAS 180612-27, 26 Oct. 1990.

Genus *Petropedetes* Reichenow, 1874

Petropedetes sp.

Remarks. - The inclusion of this West African species in the Impenetrable Forest fauna is based on three series of tadpoles with the tooth formula : 5,4+4/1+1,7 (Fig. 6a,b) The tadpoles were identified by Dr. R. Altig, and are consistent with descriptions by Lamotte *et al.* (1959), Lamotte & Zuber-Vogeli (1954, *P. palmipes*) and Lamotte & Lescure (1981, *P. natator*). If correctly identified, this constitutes the first record for the genus east of Cameroon with the

exception of *P. obscurus* (= *P. camerounensis*) described in error as coming from Kenya by Ernst Ahl (Perret, 1984). We are aware that the larvae may be undescribed tadpoles of one of the other species listed here but we feel it unlikely. However, if the larvae are tadpoles of *P. dendrobates*, a species which shares some characteristics with members of the genus *Petropedetes* such as expanded digital finger and toetips, then relationships within *Petropedetes* are in need of clarification. However, adults of *Phrynobatrachus dendrobates* were not collected at the tadpole localities below.

Material Examined. - Ishasha River: CAS 103656 (3 tadpoles), collected by L. W. Swan, 29 Jun. 1966. **Mubwindi Swamp** : CAS 180673 (11 tadpoles), 6 Dec. 1990; CAS 180674 (5 tadpoles), 9 Dec. 1990.

Genus *Rana* Linnaeus, 1758

Rana angolensis Bocage, 1866

Remarks. - We follow Poynton's (1968) analysis of the *Rana fuscigula/R. angolensis* problem and recognize that there are probably a number of undescribed cryptic species contained within the enormous range of this taxon as presently recognized. We have been unable to reconcile our material with the descriptions of either *R. desaegeri* or *R. ruwenzorica* described by Laurent (1972) from nearby Zaire. Tadpole tooth formula : 1,3+3/3.

Material examined. - Buhoma Road CAS 177170-71, 1 Nov. 1990; CAS 177200, 22 Nov. 1990; MVZ (HWG 2126, HWG 2130), 5 Nov. 1990. **8 km S of Buhoma** : CAS 177192, 30 Nov. 1990. **Impenetrable Forest** : LACM 35191-99, 8 Mar. 1967; LACM 35205, 9 Mar. 1967; LACM 60682-84, Jul 1969. **Ishasha Gorge** : CAS 177145-46, 6 Nov. 1990; CAS 177147-51, CAS 177194, CAS 180662, 7 Nov. 1990. **Itama Mine** : LACM 35211, 24 Mar. 1967; LACM 35212-14, 5

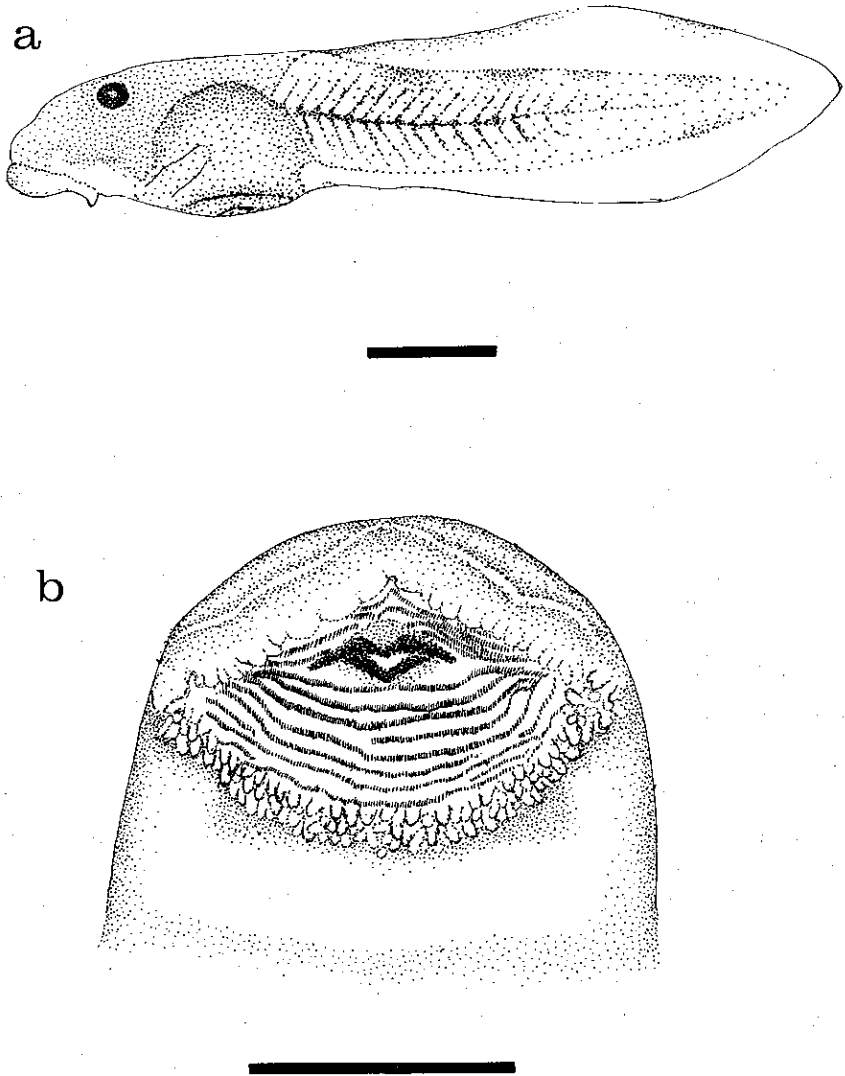


Fig. 6. - *Petropedetes* sp. - (a) Left lateral view (CAS 180673), from series of 11, stage 25 larvae; NW end Mubwindi Swamp, 6 Dec. 1990. Bar = 5 mm. - (b) Ventral view (CAS 103656), from series of three larvae, stages 26, 31 and 41; Ishasha River, 29 June 1966, collected by L. W. Swan. Oral disc partially closed, thus some tooth rows not visible. Bar = 5 mm.

Apr 1967. **Kitahurira** : AMNH 68839, 5 Jun 1962. **Mubwindi Swamp** : CAS 177193, 29 Oct. 1990; CAS 178289, 6 Dec. 1990; CAS 177204-05, 7 Dec. 1990; CAS 177206, CAS 178290, 8 Dec. 1990; LACM 35206-10, 20 Mar. 1967. **Munyaga River**: CAS 177172-82, 2 Nov. 1990; CAS 177183-85, 3 Nov. 1990; CAS 177186-90, 22 Nov. 1990; CAS 177191, 28 Nov. 1990;

MVZ (JV 1159), 28 Nov. 1990. **Ngoto Swamp** : CAS 177195-98, 9 Nov. 1990. **Omubiyanja Swamp** : CAS 177201, 24 Nov. 1990; CAS 177203, 25 Nov. 1990. **Ruhizha** : CAS 177169, 31 Oct. 1990; CAS 177199, 16 Nov. 1990; LACM 35200-04, 9 Mar. 1967. **Wolfram Mine** : CAS 177152-68, CAS 180661, 26 Oct. 1990; MVZ (RCD 11312-13), 26 Oct. 1990.

Genus *Ptychadena* Boulenger, 1917

Ptychadena chrysogaster Laurent, 1954

Remarks. - *P. chrysogaster* is a new but not unexpected record for Uganda. All CAS material was collected along roads indicating that perhaps this species is not a true forest dweller. According to Laurent (1954) the species is common at higher elevations in the Kivu area of Zaire. Schmidt & Inger (1959) characterize *P. c. guibei* as an inhabitant of open country.

Material examined. - **Ishasha River:**

AMNH : 68718, AMNH 103110-12, 26 Jun. 1962. **Ishasha Gorge** : CAS 176983, 7 Nov. 1990. **Ruhizha** : CAS 176979, 30 Oct. 1990; CAS 176978, 31 Oct. 1990; CAS 176980, 3 Dec. 1990; MVZ (JVV 1240), 4 Dec. 1990. **South Entrance** : CAS 176981-82, 13 Dec. 1990.

Genus *Hylarana* Tschudi, 1838

Hylarana albolabris (Hallowell, 1856)

Remarks. - African workers tend to recognize the genus *Hylarana* as distinct; some Asian workers do not. *Hylarana* is retained here as treated by Perret (1977) pending a revision of the group that includes examination of the Asian type material. The tadpole tooth formula in our material agrees with that given in Lamotte *et al.*, (1959) : 1,4+4/1+1,2. Our specimens were frequently found perched on small branches just off the surface of the water in swampy situations.

Material examined. - **Buhoma Road:**

CAS 180668, 27 Nov. 1990. **Ishasha River** : AMNH 68681-82, 27 Jun 1962. **Ishasha Gorge** : CAS 177143-44, 6 Nov. 1990. **Munyaga River** : CAS 180669, 29 Nov. 1990. **Ngoto Swamp** : CAS 177136-42, 9 Nov. 1990; MVZ (HWG 2136), 8 Nov. 1990.

Family Hyperoliidae

Genus *Leptopelis* Gunther, 1859

Leptopelis kivuensis Abl, 1929

Remarks. - The advertisement call is a loud "clack;" bright green juveniles were particularly common on the ends of sedges in the middle of Mubwindi Swamp. A very similar species, *L. karisimbensis* apparently inhabits montane meadows of nearby volcanoes in Rwanda (Schiøtz, 1975). It is distinguished from *L. kivuensis* by presence a bright blue vocal sac; *L. kivuensis* has a white vocal sac.

Material examined. - **Buhoma Road**

CAS 177113, 5 Nov. 1990; CAS 177114-15, 23 Nov. 1990; MVZ (HWG 2125), 5 Nov. 1990. **Kitahurira** : AMNH 68552-53, 6 Jun 1962. **Mubwindi Swamp** : CAS 174858-61, CAS 174862, 14 Feb. 1990; CAS 177036-86, 27 Oct. 1990; CAS 177087-93, 6 Dec. 1990; CAS 177094-99, 7 Dec. 1990; CAS 177102-04, 8 Dec. 1990; CAS 177100, CAS 177105-10, 9 Dec. 1990; CAS 177101, 10 Dec. 1990; MVZ (JVV 1259-61), 6 Dec. 1990; MVZ (JVV 1361, 1364-65), 9 Dec. 1990. **Munyaga River** : CAS 177111, 2 Nov. 1990; CAS 177112, 5 Nov. 1990. **Omubiyanja Swamp** : CAS 177116, 24 Nov. 1990; CAS 177117, 25 Nov. 1990; CAS 177118-21, 26 Nov. 1990. **Ruhizha** : CAS 180665, 30 Oct. 1990; CAS 177122, 12 Nov. 1990; CAS 177123, 14 Nov. 1990; CAS 177124-25, CAS 177135, 15 Nov. 1990; CAS 177126, 2 Dec. 1990; CAS 177127-34, 3 Dec. 1990; MVZ (JVV 1234), 3 Dec. 1990. **Wolfram Mine** : CAS 177035, 26 Oct. 1990. **Ihizhu River** : LACM 60655, LACM 60657, Jul. 1969. **Ishasha River** : AMNH 73310, 28 Jun 1962.

Leptopelis christyi (Boulenger, 1912)

Remarks. - The single specimen below is the only one we have seen from the Impenetrable Forest which is referable to *L. christyi*. Several LACM specimens originally identified as such

from Itama Mine, Ihihizu River and Kalinzu Forest are *L. kivuensis*. All of the LACM material from Bwamba, Bugoma and Sango Bay are *L. christyi* and lack the white spot beneath the eye.

Material Examined . - **Kitahurira** : AMNH 68887, 5 Jun 1962.

Genus *Phlyctimantis* Laurent & Combaz, 1950

Phlyctimantis verrucosus (Boulenger, 1912)

Remarks. - In addition to the localities below, this species was heard calling from a disturbed area at Ishasha Gorge, and from the forest remnant at Ngoto Swamp. Males call from offshore but not floating, as frequently the case in *Kassina maculata*; *P. verrucosus* males support themselves on submerged vegetation. Laurent (1979) has said they frequently take refuge by day among leaf litter on the forest floor in association with the dwarf chameleon, *Rhombopholeon spectrum*. According to field notes, one LACM specimen was collected in undergrowth "nowhere near water" and was "covered with a clear latex-type liquid which has a rather noxious smell."

Material examined . - **8 km S Buhoma** : CAS 178231-35 (6 tadpoles), 30 Nov. 1990. **Impenetrable Forest** : LACM 60656, Jul. 1969. **Itama Mine** : LACM 35183, 26 Mar. 1967. **Kayonza Forest** : CM 38118, 6 Aug. 1960. **Omubiyanja Swamp** : CAS 176946-50, 3 Nov. 1990; CAS 176951-73, CAS 178229 (eggs), 24 Nov. 1990; CAS 176974-75, CAS 178230 (43 tadpoles), 25 Nov. 1990; CAS 176976-77, 26 Nov. 1990; MVZ (HWG 2115), 3 Nov. 1990; MVZ (JV 1018, 1026), 24 Nov. 1990.

Genus *Afrixalus* Laurent, 1944

Afrixalus laevis (Abl, 1930)

Remarks. - A new but not unexpected record for Uganda. Reported from Albert National Park by Laurent (1950), Schiøtz (1974) has noted strong similarities in habitat preference, voice and general appearance between *A. laevis*, *A. uluguruensis*, an endemic to the Eastern Arc Mountains of Tanzania, and *A. sylvaticus* of coastal Kenya.

Material examined . - **Buhoma Road**: CAS 178170-71, 5 Nov. 1990. **Kihungye River** : CAS 178172, 23 Nov. 1990.

Afrixalus orophilus (Laurent, 1947)

Remarks. - Reported by Laurent (1950) from Albert National Park, these specimens confirm the prediction in Frost (1985) that this species occurs in Uganda.

Material examined . - **Omubiyanja Swamp**: CAS 178167, 24 Nov. 1990; CAS 178168, 25 Nov. 1990; CAS 178169, 26 Nov. 1990; CAS 180086, 3 Nov. 1990.

Afrixalus osorioi (Ferreira, 1906)

Remarks. - The specimens in hand agree with Schiøtz' concept of *A. osorioi conigicus* (1974, 1975) except our material is somewhat darker in coloration.

Material Examined. - **Omubiyanja Swamp**: CAS 178162, 3 Nov. 1990; CAS 178163-65, 24 Nov. 1990; CAS 178166, 25 Nov. 1990.

Genus *Hyperolius* Rapp, 1842

Hyperolius castaneus Abl, 1931

Remarks. - This was the most numerous treefrog at Mubwindi swamp; see Laurent (1950, Plate II) for pattern variation.

Material examined. - **Impenetrable Forest** : LACM 35186, LACM 35189, 8

Mar. 1967; LACM 35188, LACM 35190, 9 Mar. 1967. **Ishasha River** : ANMH 68915, 28 Jun. 1962. **Mubwindi Swamp**: CAS 180490-542, 27 Oct. 1990; CAS 180543, 28 Oct. 1990; CAS 180546-60, 6 Dec. 1990; CAS 180561, 7 Dec. 1990; CAS 180562, 9 Dec. 1990; LACM 35187, 20 Mar. 1967. MVZ (HWG 2105), 28 Oct. 1990; MVZ (JVV 1273-74), 6 Dec. 1990. **Omubiyanja Swamp**: CAS 180130, CAS 180489, CAS 180545, 3 Nov. 1990. **Ruhizha** : CAS 180544, 30 Oct. 1990. **Wolfram Mine** : CAS 180096-107, 26 Oct. 1990.

Hyperolius lateralis Laurent, 1940

Material examined. - **Ishasha Gorge**: CAS 180434-48, 7 Nov. 1990. **Ngoto Swamp** : MVZ (HWG 2137), 9 Nov. 1990. **Omubiyanja Swamp** : CAS 180091-162, 3 Nov. 1990; CAS 180163-70, 24 Nov. 1990; CAS 180171-74, 25 Nov. 1990; CAS 180175-76, 26 Nov. 1990

Hyperolius platyceps (Boulenger, 1900)

Remarks. - Our material is in agreement with Laurent's material of *H. platyceps langi* from the Virungas (1972, Plate 8, figs 3-6), but is somewhat larger (males to 24 mm.) than the Schiøtz material from Entebbe and Budongo Forest (16-18 mm.).

Material examined. - **Ishasha Gorge** MVZ (JVV 859), 7 Nov. 1990. **Omubiyanja Swamp**: CAS 180682-94, 3 Nov. 1990; CAS 180695-709, 24 Nov. 1990; CAS 180710-12, 25 Nov. 1990; MVZ (HWG 2117), MVZ (JVV 804, 807), 3 Nov. 1990.

Hyperolius cinnamomeoventris Bocage, 1866

Material examined. - **Ishasha River**: AMNH 68921, 28 Jun. 1962. **Mubwindi Swamp** : CAS 180131, 27 Oct. 1990. **Munyaga River** : CAS 180713, 22 Nov. 1990. **Ngoto Swamp** : CAS 180132-35, 9 Nov. 1990. **Omubiyanja Swamp** : CAS

180136-38, CAS 180714-19, 24 Nov. 1990; CAS 180139-40, CAS 180720-21, 25 Nov. 1990; CAS 180141, 26 Nov. 1990.

Hyperolius frontalis Laurent, 1950

Remarks. - This species is similar in size, call and possession of green vocal sac with *H. alticola* (see below). Our material was collected while calling from dense secondary growth overhanging a small brook. Our *H. alticola* specimens were found calling from along the Munyaga River, only a few hundred meters away. Calls of both species are described by Schiøtz (1976) as a "hard buzzing."

Material examined. - **Buhoma Road**: CAS 180121, 4 Nov. 1990; CAS 180122-26, 5 Nov. 1990; CAS 180127, 21 Nov. 1990; MVZ (HWG 2114), 2 Nov. 1990; MVZ (JVV 809-10), 4 Nov. 1990. **Kitahurira** : AMNH 68885, AMNH 69925, 5 Jun. 1962. **Munyaga River**: CAS 180108-15, 1 Nov. 1990; CAS 180116-20, 2 Nov. 1990; CAS 180128-29, 28 Nov. 1990.

Hyperolius alticola Abl, 1931

Material examined. - **Buhoma Road** MVZ (HWG 2127, 2131, 2133), 5 Nov. 1990; MVZ (JVV 1200-01), 26 Nov. 1990. **Mubwindi Swamp** : CAS 174863-72, 14 Feb. 1990. **Munyaga River** : CAS 180449, 1 Nov. 1990; CAS 180450-66, 2 Nov. 1990; CAS 180467-72, 3 Nov. 1990; CAS 180473-81, 5 Nov. 1990; CAS 180482-86, 22 Nov. 1990; CAS 180488, 26 Nov. 1990; CAS 180487, 28 Nov. 1990.

Hyperolius kivuensis Abl, 1931

Remarks. - Our material was collected in disturbed areas only, indicating that this is not a true forest species.

Material Examined. - **Ishasha Gorge**: CAS 180090, 7 Nov. 1990. **Ngoto Swamp** : CAS 180087-9, 9 Nov. 1990.

Hyperolius viridiflavus pitmani *Laurent, 1951*

Remarks. - Very numerous during the second visit to Omubiyanja Swamp, apparently replacing *H. lateralis* as the dominant species present during the first visit. Schiøtz (1976) found his specimens "sitting very inaccessibly on vegetation over very deep water." Our material was calling from reeds in 0.5 - 1 m deep water. CAS 179101 is a juvenile, and referred to this taxon with some doubt.

Material examined. - **Ruhizha**: CAS 179101, 26 Oct. 1990; CAS 180092, 12 Dec. 1990. **Omubiyanja Swamp**: CAS 178173-80, CAS 180093-94, 3 Nov. 1990; CAS 178181-202, CAS 180095, 24 Nov. 1990; CAS 178203-22, 25 Nov. 1990, CAS 178223, 26 Nov. 1990; MVZ (HWG 2116), (JVJ 771, 777), 3 Nov. 1990; MVZ (JVJ 1035-36), 24 Nov. 1990. **Wolfram Mine**: CAS 179102, 26 Oct. 1990.

Hyperolius viridiflavus bayoni (*Boulenger, 1911*)

Remarks. - This is probably not an Impenetrable Forest species but present in disturbed areas of its periphery.

Material Examined. - **Ishasha River** AMNH 68624, 25 Jun 1962.

ACKNOWLEDGEMENTS

This survey was conducted under the auspices of the Development Through Conservation project (CARE) under the direction of Dr. Jan Kalina. Logistical support was provided by Dr. Thomas Butynski of the Impenetrable Forest Conservation Project, Ruhizha, Uganda.

Our thanks to the Uganda Forest Department and Mr. Moses Okua, Chief Game Warden of the Uganda Game Department for their cooperation, and to Dr. Jonathan Baranga, Deputy Director of IFCP, Ruhizha for his

Dr. Harry Greene of the University of California, Berkeley, and Michael MacRae of Ashland, Oregon joined us in the field; Mr. Anthony Katende, Curator of the Makerere Herbarium rendered botanical assistance and Mr. John Miskell of CARE was of great assistance in Kampala.

Our efforts in the forest were aided by Game Biologists Dennis Babaasa and Edgar Buhanga; the following Game Guards were our constant companions in the field and of great service: Mr. Benjamin Bayenda, Mr. Stephen Tibigarukamu, Mr. Francis Nkabyemera, Mr. Erineriko "Posho" Safari, Mr. David Turebwomwe, Mr. Geoffrey Kakoma, Mr. Babu Milton, Mr. Vincent Banshekura and Mr. Didas Rutemba.

Photographs were printed by E. Roy Eisenhardt of the California Academy of Sciences (CAS); Alan E. Leviton prepared the map. Figures 6a & b were drawn by Francine H. Kalbfeld (CAS). We have examined much of the material mentioned above (CM = Carnegie Museum; LACM = Los Angeles County Museum of Natural History; AMNH = American Museum of Natural History; FMNH = Field Museum of Natural History) except for that in the British Museum and in Copenhagen. The following allowed us to examine specimens in their care: C. J. McCoy, E. Sensky, J. W. Wright, C. Webber and D. R. Frost. Unfortunately, we were unable to query relevant European collections for additional records as these institutions do not maintain geographic files. All material collected in November and December, 1990 is housed in the California Academy of Sciences (CAS), except for a representative series at the University of California (MVZ) and several specimens at the Museum of Natural History, London (BMNH).

We have leaned heavily on literature produced by the various surveys of National Parks by the Belgian govern-

ment in present-day Zaire. These and other references used are cited in the bibliography.

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(Manuscript received 28 January 1993, accepted 29 July 1993)