Progress Report I: March 2017

Scaling up Activities for the Protection of Ghana's Iconic Giant Squeaker Frog (*Arthroleptis krokosua*) and Co-occurring Endangered Species

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Project Summary

Ghana's critically endangered Giant Squeaker Frog (*Arthroleptis krokosua*) is facing imminent extinction; less than 30 individuals are known to be surviving on earth at Sui River Forest Reserve. Whereas previous attempts were made to address threats of invasive weeds, farming and logging, that of mining had been overlooked. The goal of our Rufford Small Grants second-booster project was therefore, to: investigate the impacts of mine pits on the survival of Giant Squeaker Frog and other resident endangered frogs, and reclaim pits that pose as threats. We identified forty-three (43) open mine pits, within which 10 frogs were trapped. We also recorded the Giant Squeaker Frog and six other endangered frogs, which were also potentially threatened by mining activities. We closed mine pits identified to be ecological death-traps and revegetated with 2,000 native trees. We also trained 30 students in amphibian research and sponsored an undergraduate student who collected data for his dissertation. We educated an estimated 1million people through the launch of interactive programmes such as the Ghana Online Amphibian Literacy (GOAL) Project, and media campaigns including a DW-TV Documentary. For the impressive accomplishments on the RSG-funded projects and others (notably Whitley Fund for Nature), the local Chiefs and people honoured the project leader (Gilbert Adum) and his collaborator Dr. Kerry Kriger of US-based SAVE THE FROGS! with Chieftaincy titles. This is the first in the history of biodiversity conservation in Ghana and perhaps the whole of Africa.

The Conservation Problem

Ghana's critically endangered Giant Squeaker Frog (*Arthroleptis krokosua*) is facing imminent extinction as less than 30 individuals are known to be surviving on earth at the Sui River Forest Reserve (Sui Forest). Unfortunately, this 333.90km^2 reserve is under constant threat from activities that are preventing the survival of the Giant Squeaker Frog and other endangered species including the Ivory Coast Frog (*Amnirana occidentalis*). On our past Rufford-funded projects, we initiated conservation programmes including the restoration of 5-ha of the Giant Squeaker Frog's critical habitat with +10,000 native trees. Subsequently, we also identified abandoned illegal mine pits, which we suspected could be posing as serious death traps to particularly leaf-litter and terrestrial frogs (Owusu-Gyamfi and Adum, 2014).

Figure 1. One of the several mine pits recorded in the home of the Giant Squeaker Frog.

The goal of our RSG second-booster project therefore, was to investigate the impacts of these pits on the survival of the Giant Squeaker Frog and other resident endangered frogs and, to reclaim pits that pose as threats.

Project Outputs and Discussion

Mine Pits and Amphibian Species Distribution Surveys

With information provided by hunters and forest rangers, we located a Hill Sanctuary (Fig. 3) where illegal mining activities seemed to be concentrated. Worryingly, these areas including inselbergs are also the preferred habitats for the Giant Squeaker Frog (Ernst et al., 2008; Adum et al., 2011), the endangered Ringed River Frog, *Prynobatrachus annulatus* (Rödel and Schiøtz, 2004) and most other resident terrestrial species (Adum et al., 2013). We established two 2-ha plots in these areas and another two 2-ha plots in un-mined sites as control. We recorded a total of 43 mine pits, along with their specific site characteristics and geographic coordinates.

We conducted parallel amphibian surveys and recorded 57 and 41 individual frogs in un-mined and mined-out areas respectively (Fig. 2). Frogs that dominated mined-out areas were mostly species that prefer living in stagnant waters or permanent ponds (e.g. *Xenopus tropicalis*) and those that are strong jumpers (e.g. *Ptychadena longirostris*) (Fig.2 and Appendix 4). We believe these species, which rarely occur in intact forest, only invaded the areas following mining activities. The only primary forest species we found to be thriving in these areas were stream-loving frogs: Ivory Coast Frog, *Amnirana occidentalis*, and the two 'new' *Conraua* and *Phrynobrachys* spp. The riverine habitat of these species seems to still be intact as mining activities were only within the reach of 20-50m. Conversely, terrestrial frogs, particularly leaf-litter dependent species were either completely missing (e.g. Giant Squeaker Frog) or their numbers much reduced vis a vis un-mined areas (e.g. other squeaker frogs, *Arthroleptis spp*). The (endangered) Ringed River Frog, usually found in the leaf-litter on such inselbergs (Adum et al., 2013) was also missing.

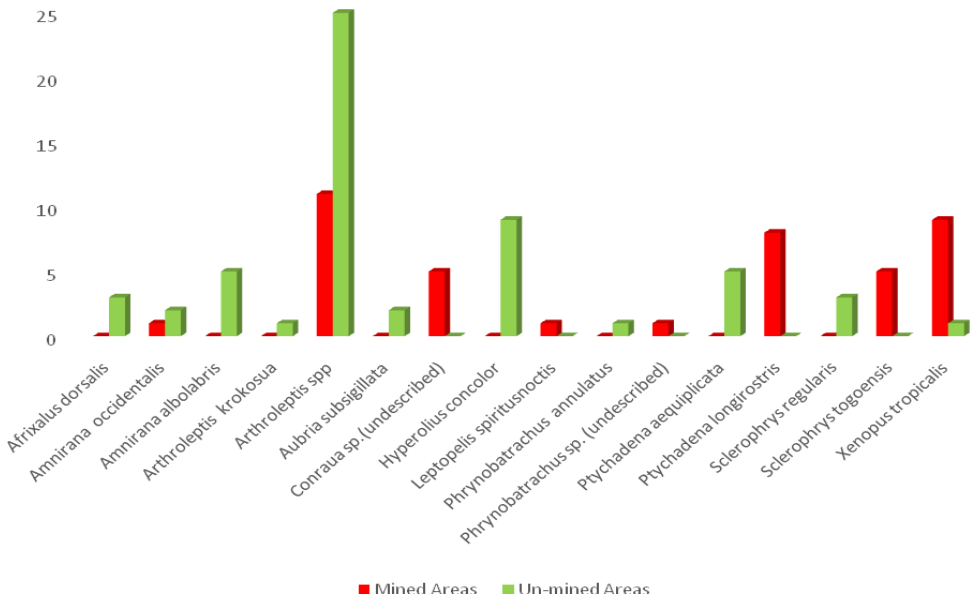

Figure 2. Amphibian species distribution in mined vrs un-mined areas at Sui River Forest Reserve

We identified two causative factors for the drastic impacts of mining on leaf-litter dependent frogs. Mining activities have reduced their habitat, both in size and quality. The leaf-litter depth has been reduced by nearly two-thirds, average of 94.0mm in control versus 37.7mm in mined-out areas (Appendix 3). The depletion of leaf-litter means loss of habitat for breeding, predator escape and protection from desiccation for associated frogs.

The second causative factor is the nature of mine pits, majority were both extremely wide and deep, making it challenging for frogs when they get trapped. The widest pits (12%) were 301-400cm and the deepest (3%) 400-500cm (Figs 3 and 4). In addition, majority (83%) of pits were 201-300cm wide and half of them 101-200cm deep. We found one White-lipped frog (*Amnirana albolabris*) and 9 Western Clawed frogs (*Xenopus tropicalis*) trapped in two pits (Appendix 4). We successfully rescued the White-lipped frog but failed to rescue the Western Clawed frogs, which were in an inundated pit 200cm deep. All other pits up to or deeper than 200cm collected water all year round, which we suspect posed greater danger of trapping and "drowning" to leaf-litter frogs such as the Giant Squeaker Frog.

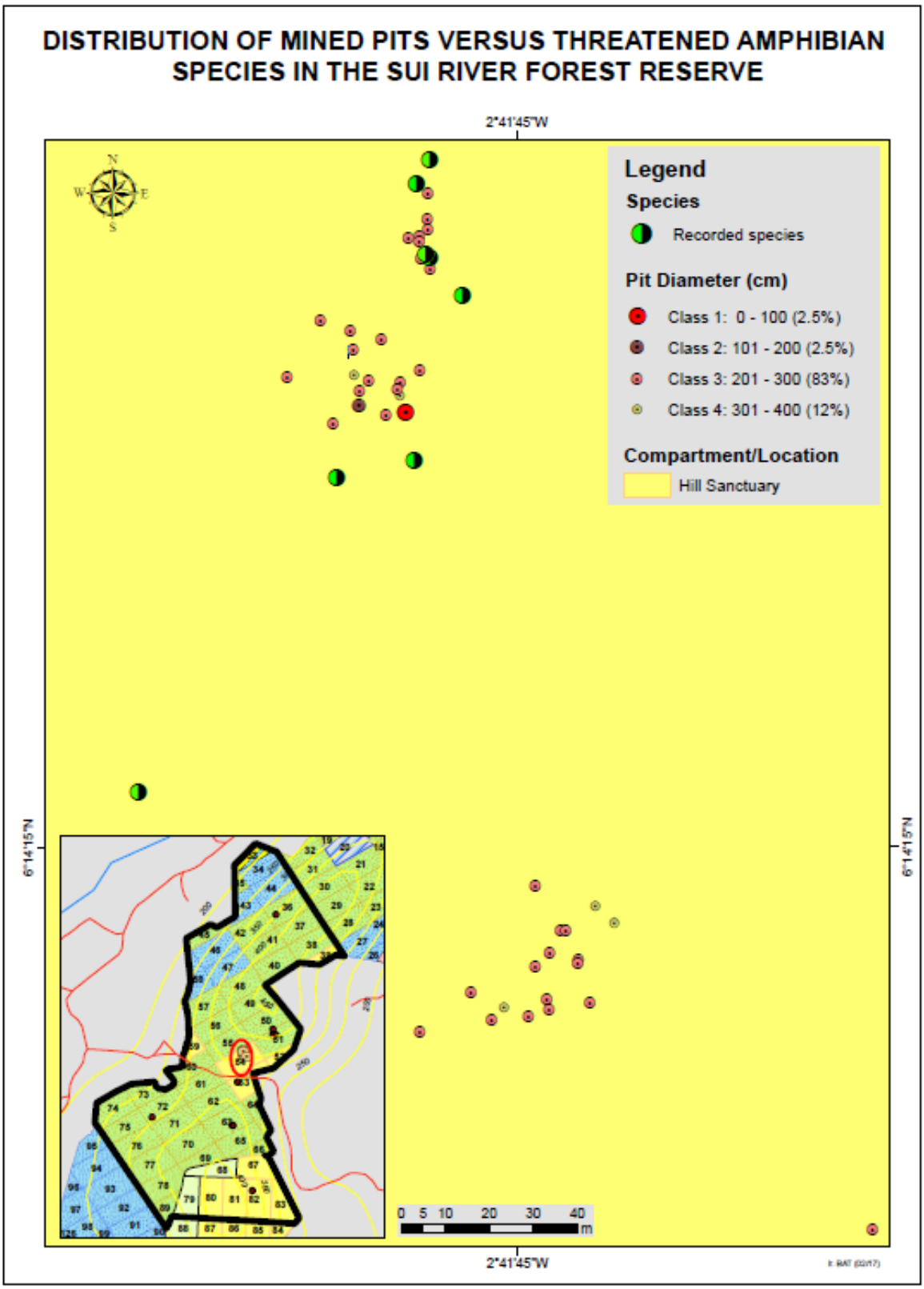

Figure 3. Percentage representation of the number of pits classified by their width (diameter) versus distribution of amphibian species at Sui Forest. N = 43 pits.

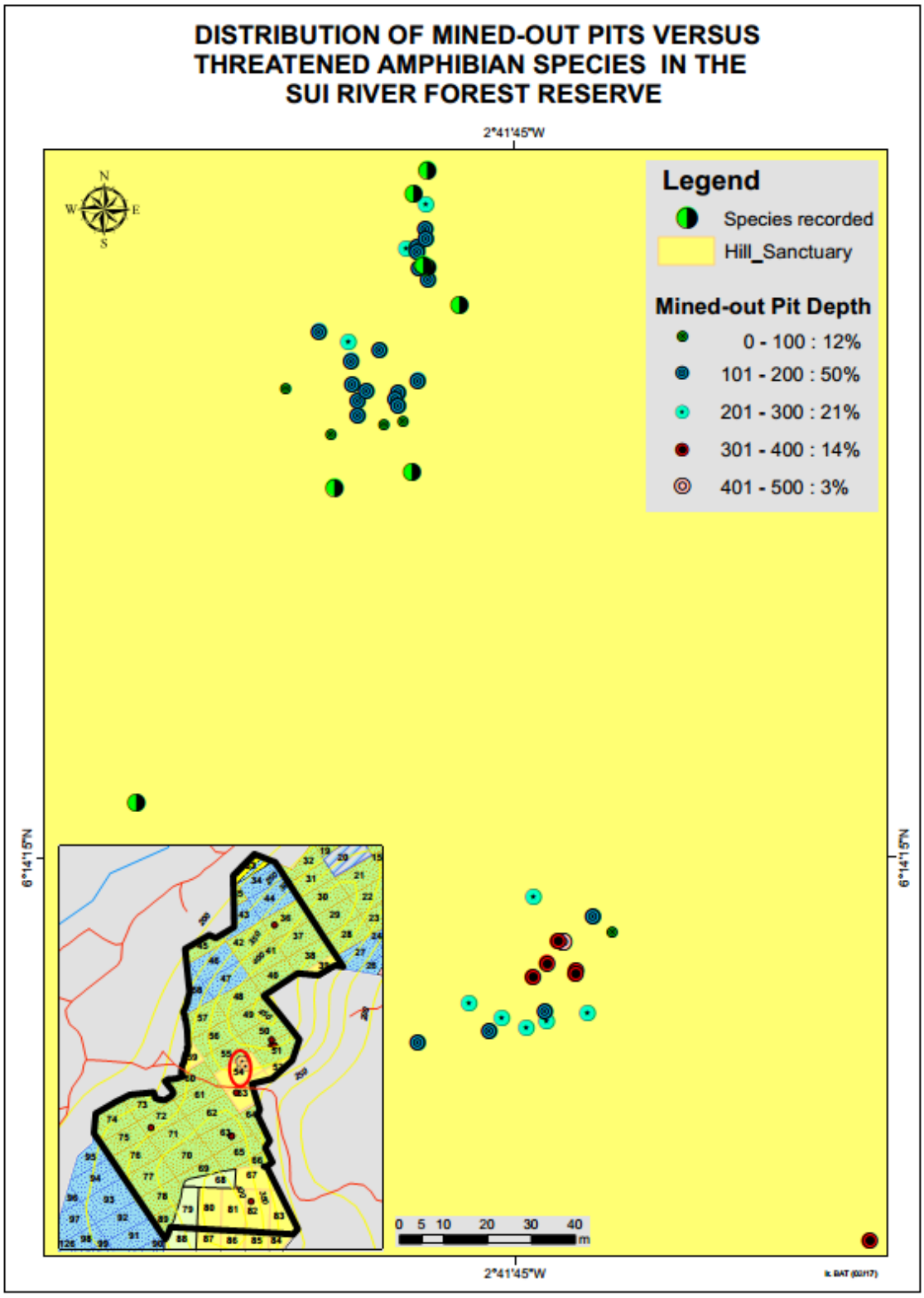

Figure 4. Percentage representation of the number of pits classified by their depth versus distribution of amphibian species at Sui Forest. N = 43pits.

General Amphibian Surveys

In addition to pit mines and associated amphibian surveys, we also conducted day and night opportunistic surveys. In general, we recorded a total of 23 amphibian species belonging to 11 genera and nine families. This increases the total amphibian checklist for Sui Forest to 28 species, from a previous record of 23. This update includes two 'new' frog species and first time records of the West African Brown Frog (*Aubria subsigillata*), Hallowell's Sedge Frog (*Hyperolius concolor*), and Striped Spiny Reed Frog (*Afrixalus dorsalis*). For the second consecutive year, we also made another record of the Giant Squeaker Frog (Fig. 5), an adult male. This brings the total recorded individuals to 33 since its original discovery in 2002. This also means 29 individuals are now thought to be surviving, with the remaining four formerly preserved by scientists as voucher specimens.

Figure 5. The newly recorded adult male of the Giant Squeaker Frog.

These voucher specimens also include the only individual from Mount Nimba, Guinea, for which the Giant Squeaker Frog was 'erroneously' down-listed from Endangered to Near-Threatened. According to IUCN Red List categories, the checklist consists of nearly 35% of globally threatened amphibian species (Appendix 1). Specifically, the two newly discovered species (Fig. 7) believed to be critically endangered; the endangered Ivory Coast Frog and Ringed River Frog; the vulnerable Yapo River Frog (*Phrynobatrachus villiersi*); and three Near-Threatened frogs (Appendix 1).

Figure 6. The endangered Ivory Coast Frog (*Amnirana occidentalis*) in its typical habitat at Sui Forest.

Figure 7. One of the 'new' slippery frog species recorded at Sui Forest.

Geographically, a significant 74% of the recorded species are restricted to the West African Guinean Rainforest (Appendix 1). Confirmation of the two un-described species as new to science will accordingly make Sui Forest their only known locality.

Community Tree Nursery Training

We organised refresher courses for three (3) nursery attendants on the use of waste drinking sachets and organic matter to raise seedlings. With their help, we have raised +2,000 seedlings of Limba (*Terminalia superba*), African mahogany (*Khaya anthotheca*) and Kapok (*Ceiba pentandra*).

Land Reclamation

With the help of landscaping experts, local people and students, we conducted site characterisation of the mined-out areas. Specifically, we studied the geology of the place and the surrounding natural environment. Using residual top soil from logged areas with similar geological features, we filled the pits to elevations of surrounding areas. We then replanted these areas with native tree seedlings from our community nurseries.

Figure 8. Land reclamation activities with volunteers at Sui Forest.

We also planted seedlings to connect other degraded habitats of the Giant Squeaker Frog to previously restored areas.

Figure 9. Habitat restoration activities within Sui Forest to connect Giant Squeaker Frog fragmented areas. Project leader on the top right planting a seedling.

Capacity Building of Students

Workshops

We organised the first ever amphibian world summit at Ghana's premiere science university, the Kwame Nkrumah University of Science and Technology (KNUST) under the theme, 'Empowering Ghanaians to Protect Amphibian Populations.' A host of local and international speakers including the project leader, Gilbert Adum and the

founder of SAVE THE FROGS! Dr. Kerry Kriger gave presentations to about 200 live attendees.

Figure 10. The world amphibian summit banner.

Presentations covered topics bordering on how to conduct amphibian research and conservation activities either as a professional or a volunteer, to help end the global amphibian extinction crisis. A similar workshop was also held at Ghana's premier university, the University of Ghana, for an estimated 250 students under the theme, "Working to Sustain the Ecosystem: Saving the Frogs."

Figure 11. Some attendees of the Amphibian World Summit at KNUST. Field Training

To give students practical experience in amphibian research, we also organised a 10-day field training course at the Sui and Bobiri Forest Reserves. Participants were taken through standardised protocols for the survey of amphibians including where to look for frogs; how to capture and handle frogs; what data to collect; and what to do with this data. One of these students, Master Prince Adu-Tutu, received a scholarship, specifically sponsored by our RSG funds to carry out his undergraduate thesis project. His project has also contributed important data on the impacts of mining on endangered amphibians.

Figure 12. Prince Adu-Tutu (right) and another team member (Francis Boafo Asamoah) during data collection.

Figure 13. Student participants surveying riparian habitats for frogs. Awareness Creation and Community Engagement

'GOAL' Project

We launched an online educational project dubbed, the Ghana Online Amphibian Literacy (GOAL) Project. The GOAL Project is to promote amphibian knowledge, inspire interest in amphibian conservation and increase interactions on social media especially amongst the youth and internet users. Once a month, an article on a selected frog's ecology, biology, threats and conservation needs is blogged online and on SAVE THE FROGS! Ghana's various social media pages. Links to questions related to the blog are provided to allow public participation and a chance to win branded souvenirs including t-shirts. Past features include the Giant Squeaker Frog (www.savethefrogs2.com/countries/ghana/amphibians-of-ghana/goal-squeakers), and the Night Spirit Frog (www.savethefrogs2.com/countries/ghana/amphibians-of-ghana/spirit-night-frog).

Figure 14. GOAL featured articles on Ghana's frogs and the number of people reached.

In each of these features, we highlighted species' distinctive biological uniqueness, habitat requirements, threats to their survival and recommendations to ensure their protection. Within three months of inception, we have increased following to over 8,000 people (Fig. 14) and awarded six (6) quiz participants with customised t-shirts (Fig. 15) and airtime.

Another +40,000 global supporters received regular related newsletter articles from our USA partner, SAVE THE FROGS!

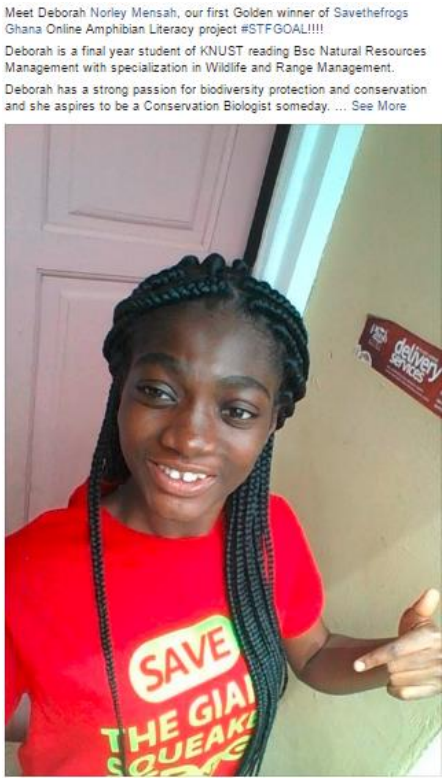

Figure 15. Miss Deborah Norley Mensah, maiden GOAL Project winner in her Giant Squeaker Frog branded t-shirt.

Radio Broadcasts

Together with students from our KNUST Chapter, and conservation scientists from the USA, we gave live broadcasts on KNUST Focus FM (Fig. 16) and reached out to at least 1,000 people within the campus and its environs. We educated the public on the plight of endangered amphibians especially the Giant Squeaker Frog and how to save them.

Figure 16. Some project team members during a live broadcast at KNUST's Focus FM.

Schools Engagement

We also initiated junior high and lower primary outreaches to engage and mentor the younger generation. Altogether, four schools were visited and an estimated 500 students between the ages of 10-15 years (Fig. 17) were educated on amphibian biology and conservation. We are mentoring these kids to serve as environmental stewards within their local communities.

Figure 17. Team members on an outreach programme in a local school.

Impacts of the Project

Discoveries and Re-discoveries

With joint funding from the Whitley Fund for Nature and US-based SAVE THE FROGS!, we have discovered two 'new' frog species, further confirming Sui Forest as one of West Africa's priority conservation areas for amphibians. Within five years running, we have also been able to make successive rediscoveries of the Giant Squeaker Frog and doubled the numbers known to be surviving. The work funded by donors especially The Rufford Foundation is undeniably offering better protection for the Giant Squeaker Frog, which has indeed become Ghana's iconic frog.

Ghana's First Traditional Chief for Frogs and Environment

For his impressive accomplishments in protecting Sui Forest, and improving local livelihoods, the traditional rulers within the project site honoured the project leader, Gilbert Adum and his collaborator, Dr. Kerry Kriger of US-based SAVE THE FROGS! with chieftaincy titles and roles (Fig. 18). This historical honour, the first of its kind in biodiversity conservation perhaps across Africa, implies that Gilbert now rules

together with the custodians of the reserve, the traditional council of Sefwiman. Working under the stool name, Nana Kwabena Bosompem I, Gilbert now represents the community on matters concerning frogs, and the environment. This event, which also coincided with the 2nd Anniversary of Save the Giant Squeaker Frog Day (Appendix 5), was covered and aired to an estimated 1 million audience by Germany's biggest broadcasting house, DW-TV (www.youtube.com/watch?v=JCAYM4vWv0A&t=32s).

Figure 18. Project leader swearing oath of allegiance as the new chief for frogs and environment.

Upcoming Activities

Our immediate task is to conduct further scientific studies in collaboration with the German based institute, Museum Für Naturkunde to confirm the two species as new to science. We will further survey the Sui Forest to monitor the Giant Squeaker and other frogs to further assist in the drafting of the final MoU between us and relevant institutions.

Acknowledgement

The Rufford Foundation has in no small way contributed to all the achievements this project has made in the protection of the Giant Squeaker Frog and other wildlife at Sui Forest. The entire team working on saving the Giant Squeaker Frog is eternally grateful. We also appreciate the Whitley Fund for Nature for co-funding this project. Our sincere gratitude also goes to Ms Mabel Gundlach and Deutsche Welle TV for the documentary 'Frog researcher Gilbert Adum Global 3000.' Also, to the Forestry Commission of Ghana and its staff especially Mr. Raphael Yeboah, Mr. Hugh Brown, Dr. Kwakye Ameyaw, and Mr. Benjamin Torgbor for their support. Finally, to all the 27

local communities surrounding the Sui Forest especially the natives and Paramount Chief of Yawkrom Traditional Area, Nana Agyeman Bosompem I.

Links to Project Articles and Publications

Press Releases and Articles

Gyamfi K. A. (2016) Ghanaian wins grant to save endangered frogs. Available at pulse.com.gh/innovation/illegal-mining-ghanaian-wins-grant-to-save-endangered-frogs-id5175580.html. Accessed on 03/04/17.
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Nhyira A. (2016) Ghanaian wins grant to save endangered frogs. Available at rakghana.com/ghanaian-wins-grant-save-endangered-frogs. Accessed on 03/04/17.
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Owusu-Gyamfi S. (2016) Gilbert Adum of STF! Ghana Wins $14,700 Award to Tackle Illegal Mining. Available at www.savethefrogs2.com/countries/ghana/atewa-hills/gilbert-adum-award-illegal-mining. Accessed on 03/04/2017.
Owusu-Gyamfi S. (2016) Ghanaian wins UK grant award to tackle illegal mining. Available at www.amphibians.org/news/ghana-illegal-mining. Accessed on 03/04/17.
Xlive M. (2016) Ghanaian wins grant to save endangered frogs. Available at xliveafrica.com/2016/11/03/ghanaian-wins-grant-to-save-endangered-frogs
Accessed on 03/04/17.

GOAL Project Articles

Asamoah Boafo F. and Antwi-Baffour E. (2017) Meet Ghana's Beloved "Lady": The Night Spirit Frog. Available at www.savethefrogs2.com/countries/ghana/amphibians-of-ghana/spirit-night-frog Accessed on 03/04/17.
Owusu-Gyamfi S. (2016) Why the Giant Squeaker Frog is "Giant." Available at www.savethefrogs2.com/countries/ghana/amphibians-of-ghana/goal-squeakers.
Accessed on 03/04/17.
SAVE THE FROGS! Ghana Publicity team (2016) Ghana Online Amphibian Literacy Project-GOAL Project. Available at www.amphibians.org/news/goal-project. Accessed on 03/04/17.

Social Media Posts

We regularly put and updated information on our social media webpages:

Facebook: www.facebook.com/SAVETHEFROGS.Gh/
Twitter: @GhanaFrogs

Cited Literature

Adum, G. B., Eichhorn, M. P., Oduro, W., Ofori-Boateng, C. and, Rödel, M.-O. (2013). Two-Stage Recovery of Amphibian Assemblages Following Selective Logging of Tropical Forests. Conservation Biology 27(2): 354-63.

Adum, G. B., Ofori-Boateng, C., Oduro, W., Rödel, M.-O. (2011). Re-discovery of the Giant West African Squeaker, *Arthroleptis krokosua* Ernst, Agyei & Rödel, 2008 (Amphibia: Anura: Arthroleptidae) in two forests of south-western Ghana with observations on the species' variability and habitat preferences. Zootaxa 2744: 34–38.

Ernst, R., Agyei A. C., and Rödel, M.-O. (2008). A new giant species of Arthroleptis (Amphibia: Anura: Arthroleptidae) from the Krokosua Hills Forest Reserve, south western Ghana. Zootaxa 1697:58–68.

Rödel, M-O., Schiøtz, A (2004). *Phrynobatrachus annulatus*. The IUCN Red List of Threatened Species 2004:e.T58092A11718798.

Owusu-Gyamfi, S. and Adum, G. B. (2014). Holding on by a Thread: The Plight of the Giant West African Squeaker Frog, *Arthroleptis krokosua*. FrogLog 22 (3) p.59 and 60.

APPENDICES

Appendix 1: Recorded anuran amphibian species at Sui River Forest Reserve and current conservation status

Family	Species	Geo. Dist.	IUCN Red List Category
Arthroleptidae	*Arthroleptis krokosua*	WAR	NT
Arthroleptidae	*Arthroleptis spp.*	WAR	LC
Arthroleptidae	*Leptopelis spiritusnoctis*	WAR	LC
Bufonidae	*Sclerophrys regularis*	A	LC
Bufonidae	*Sclerophrys togoensis*	WAR	NT
Conrauidae	*Conraua* sp. (Undescribed)	WAR	CR*
Hyperoliidae	*Hyperolius concolor*	WAR	LC
Hyperoliidae	*Afrixalus dorsalis*	WAR	LC
Phrynobatrachidae	*Phrynobatrachus alleni*	WAR	NT
Phrynobatrachidae	*Phrynobatrachus annulatus*	A	EN
Phrynobatrachidae	*Phrynobatrachus calcaratus*	WAR	LC
Phrynobatrachidae	*Phrynobatrachus latifrons*	WAR	LC
Phrynobatrachidae	*Phrynobatrachus plicatus*	WAR	LC
Phrynobatrachidae	*Phrynobatrachus tokba*	WAR	LC
Phrynobatrachidae	*Phrynobactrachus* sp. (Undescribed)	WAR	CR*
Phrynobatrachidae	*Phrynobatrachus villiersi*	WAR	VU
Pipidae	*Xenopus tropicalis*	WAR	LC
Ptychadenidae	*Ptychadena aequiplicata*	A	LC
Ptychadenidae	*Ptychadena bibroni*	A	LC
Ptychadenidae	*Ptychadena longirostris*	WAR	LC
Pyxicephalidae	*Aubria subsigillata*	WAR	LC
Ranidae	*Amnirana occidentalis*	A	EN
Ranidae	*Amnirana albolabris*	A	LC

Key

Geographic Distribution: A = distributed also outside West Africa; WAR = West African Guinean Forest.

Red list: EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; CR* = could be potentially critically endangered.

Appendix 2: Records of Abandoned Mine Pits at Sui River Forest Reserve

Pit ID#	Depth(cm)	Diameter(cm)	Amphibian Number	WL (cm)
1	214	100	0	0
2	262	120	0	0
3	186	121	0	0
4	300	110	0	0
5	270	111	0	0
6	379	133	0	0
7	313	116	0	0
8	420	120	0	0
9	336	126	0	0
10	334	116	0	0
11	248	190	0	0
12	304	162	0	0
13	100	74	0	0
14	127	97	0	0
15	177	109	0	0
16	291	118	0	0
17	104	107	0	0
18	198	155	0	0
19	161	127	0	0
20	174	123	0	0
21	237	107	0	27
22	113	125	0	0
23	179	113	0	0
24	279	109	1	21
25	311	107	0	55
26	173	102	0	0
27	143	117	0	0
28	159	123	0	0
29	178	125	0	0
30	166	117	0	0
31	126	117	0	0
32	152	112	0	0
33	151	96	0	0
34	125	97	0	3.5
35	124	337	0	0
36	73	175	0	0
37	91	434	0	0

38	97	135	0	0
39	125	121	0	0
40	62	113	0	0
41	132	109	0	0
42	238	113	0	0
43	315	164	9	42

Key

Amphibian present = 1; Amphibian absent = 0; Water present = 1; Water absent = 0; WL = Water Level

Appendix 3: Comparative Study of Leaf-Litter Depth for Mined and Un-mined Area

Site	**Plot**	**Leaf-Litter (mm)**
Mined	1	52
Mined	1	20
Mined	1	34
Mined	1	96
Mined	1	10
Mined	1	44
Mined	1	84
Mined	1	40
Mined	1	50
Mined	1	56
Mined	2	26
Mined	2	02
Mined	2	8
Mined	2	4
Mined	2	6
Mined	2	36
Mined	2	54
Mined	2	30
Mined	2	58
Mined	2	44
Un-mined	3	94
Un-mined	3	103
Un-mined	3	110
Un-mined	3	86
Un-mined	3	78
Un-mined	3	82
Un-mined	3	74

Un-mined	3	96
Un-mined	3	101
Un-mined	3	113
Un-mined	4	78
Un-mined	4	88
Un-mined	4	94
Un-mined	4	104
Un-mined	4	100
Un-mined	4	104
Un-mined	4	112
Un-mined	4	78
Un-mined	4	98
Un-mined	4	86

Appendix 4: Comparative Study of Species Distribution between Mined and Un-mined Areas at Sui River Forest Reserve

Species	**No. individuals in Mined Areas**	**No. individuals in Un-mined Areas**
Afrixalus dorsalis	0	3
Amnirana occidentalis	1	2
Amnirana albolabris	0	5
Arthroleptis krokosua	0	1
Arthroleptis spp	11	25
Aubria subsigillata	0	2
Conraua sp.(undescribed)	5	0
Hyperolius concolor	0	9
Leptopelis spiritusnoctis	1	0
Phrynobatrachus annulatus	0	1
Phrynobatrachus sp. (undescribed)	1	0
Ptychadena aequiplicata	0	5
Ptychadena longirostris	8	0
Sclerophrys regularis	0	3
Sclerophrys togoensis	5	0
Xenopus tropicalis	9	1

Appendix 5: Shots from the celebration of the 2nd Giant Squeaker Frog Day