

Conservation Leadership Programme

Final Report

CLP project ID: 0134010

Project Title: Last Chance to Save? Averting amphibian conservation crisis in Bale, Ethiopia.

Host Country: Ethiopia.

Site Location: Harrena Forest, Bale Mountains National Park (BMNP); 39°- 40°E and 6°-7° N

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List of abbreviations

AAU	Addis Ababa University
AAWG	African Amphibians Working Group
BM	Bale Mountains
BMNH	The Natural History Museum, London
BMNP	Bale Mountains National Park
CLP	Conservation Leadership Program
CR	Critically Endangered
EN	Endangered
EWCA	Ethiopian Wildlife Conservation Authority
FGD	Focused Group Discussion
FZS	Frankfurt Zoological Society
IUCN	International Union for Conservation of Nature
NMA	National Meteorological Agency
USFWS	US Fish and Wildlife Services
VU	Vulnerable

Acknowledgements

We would like to thank Conservation Leadership Program (CLP) for funding the project and the Ethiopia Wildlife Conservation Authority for issuing research and export permits and providing a vehicle for the dry season field trip. The British Natural History Museum also supported the team by providing the team with materials (including swabbing kits). Colleagues at the Imperial College (London) assisted the team in the analysis of samples to identify the presence of pathogenic diseases on Bale Mountains National Park (BMNP) amphibians. Frankfurt Zoological Society and the BMNP have also provided logistical support for the team during its stay in Dinsho and Rira. Our work would not have been possible without the help of our parataxonomists (Hussien and Hussien) and our field cook (Mohammed). Michele Menegon, Malcom Lagen, Mike Hoffman and Stephen Spawls contributed by giving permission for the use of their photo(s) for the booklet and handbook.

Section 1

Summary

The remarkable amphibians of Haremma have declined in numbers since their first description in the late 1980s and are possibly headed to extinction if no intervention is made. This project aimed to get a better understanding of their conservation biology. This was done via surveying amphibians, assessing the impacts of habitat quality, testing for pathogenic diseases and also by communicating with the local people through Focused Group Discussions (FGDs), workshops and meetings. Consistent with previous works, the Bale Mountains (BM) amphibians were found to be declining in number and their habitat is deteriorating mainly due to the growing number of humans and livestock. To increase the local awareness, the team published a leaflet in Oromiffa (the local language) and also organized a poem/essay contest in local schools on topics about Haremma Forest. To further communicate the threats and teach locals and tourists about the biology and threats of the BM amphibians the team prepared a booklet in Oromiffa and English, which will be published with the second instalment from CLP. This project also reviewed the IUCN assessments and proposed changes, which were adopted at the 2012 African Amphibians Working Group meeting in Italy. Results from the team's work have also been incorporated in one scientific publication and another article is under preparation.

Introduction

A rich and varied number of animal and plant species occur in Ethiopia, many of which are endemic (Kingdon, 1997). Ethiopia has a large number of vertebrate species, including 63 species of amphibians, out of which a remarkable 25 species (40% of the total) are endemics (Largen, 2001; Mengistu, 2012). These species occur across ecologically diverse areas of the lowland and highlands of Ethiopia (Yalden, 1983) but are most rich in highland areas.

The Bale Mountains National Park (BMNP) is the most important conservation area in the Ethiopian Highlands and is of international significance. It is one of the 34 International Biodiversity Hotspots and also qualifies for World Heritage Site and Biosphere Reserve Listing (BMNP management plan 2007). Its importance is due to the number of Ethiopian endemics within its borders, many of which are threatened. Examples of endemic amphibians species include monotypic genera *Altiphrynoides*, *Spinophrynoides*, *Balebreviceps* and *Ericabatrachus* (Largen, 2001; Largen and Drewes, 1989; Largen 1991). Besides *Spinophrynoides*, these genera are restricted to the Bale Mountains.

The Hareenna Forest (the study site) is found extending between 39°-40° E and 6°-7° N. It is one of the largest stands of moist tropical forest remaining in Ethiopia. Approximately half of the BMNP falls in this forest, which ranges from 1500-3500 m a.s.l, inside the park boundary. This forest is home to high levels of biodiversity and endemism but is relatively poorly known scientifically.

Bale Mountains were only first briefly surveyed in 1986 for amphibians in two localities close to a road (at 3200m and 2200m). From this relatively restricted survey, endemic genera and species were described (Largen, 1991, 1995, 2001; Largen and Drewes, 1989; Largen and Sprawls, 2006) and an unprecedented diversity was revealed for Africa. Since then, little additional knowledge about the natural history of these frogs has been gained – except for the fact that they now seem to be less abundant than they were in the 1980s. The lack of knowledge is of particular concern given the gross environmental degradation

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that is currently occurring in Ethiopia (Tadesse, 2001), and particularly in Bale (Fetene, *et al.*, 2006). This suggests the longevity of these remarkable endemic amphibian species is questionable (Loader *et al.*, 2009). These species therefore require urgent conservation action and our team created a collaboration to increase knowledge and promote amphibian conservation in this region.

Our team was comprised of five Ethiopian and one international researcher. The objectives of the research were to better understand the conservation biology, learn how to manage the current crisis and to promote the conservation of the threatened amphibian species. Our other target was to make better estimates of IUCN-based conservation assessments.

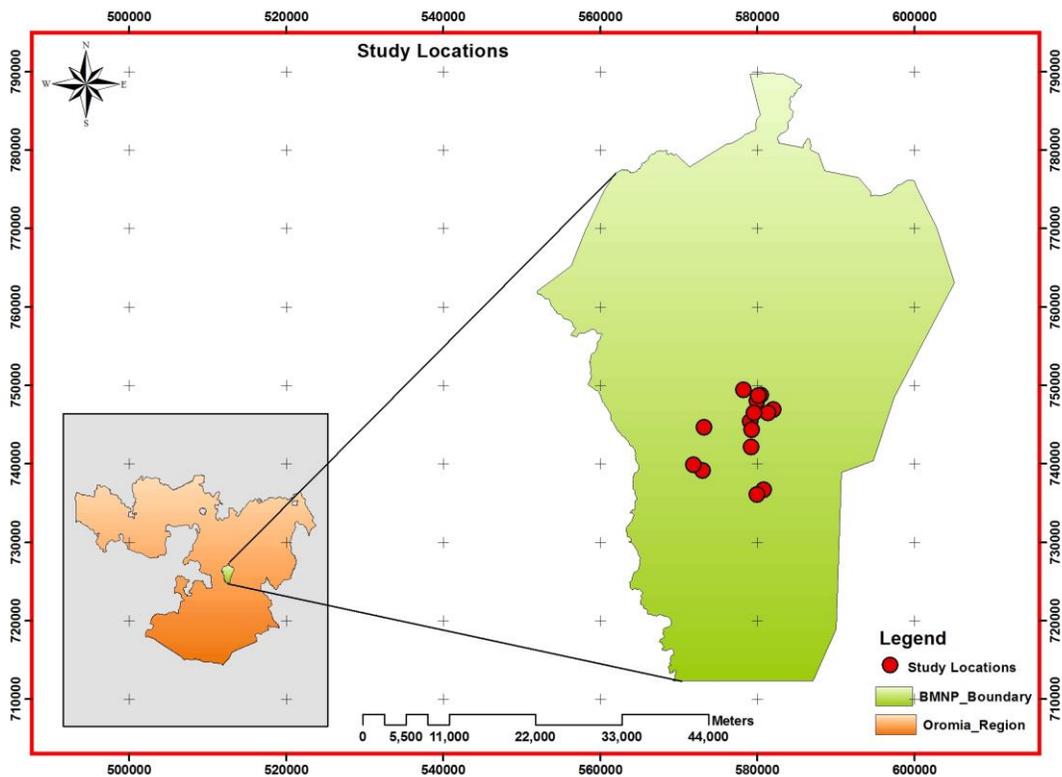


Fig 1. Location Map of the study area. Inset map is regional political boundaries of Oromia region in Ethiopia, with enlarged area of the Bale Mountains National Park.

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Key partners of the project

Ethiopian Wildlife Conservation Authority (EWCA): is the federal authority in Ethiopia working on wildlife conservation. EWCA gave permission to conduct research on the BMNP and provided other logistical support (e.g. office and internet service).

Frankfurt Zoological Society (FZS): is a non-governmental organization working in the BMNP. FZS lent some camping gears and also provided a building to stay at when team members are in the BMNP, but not in the field.

The Natural History Museum, London (BMNH): is a UK-government funded institution. The BMNH collaborated by providing materials for the chytrid fungus data collection and for the data analysis. An expert from the Museum has taken part in the fieldwork which helped build the capacity of the team as well as increased the quality of the work.

Institute of Biogeography, University of Basel, Switzerland: collaborated on the project with Dr. Simon Loader. He provided necessary consultation from previous works.

Project members

Fikirte Gebresenbet

Qualifications: BSc in Biology and Msc in Dryland Biodiversity and a Post Graduate Diploma in International Wildlife Conservation practices. Currently, she is a PhD candidate in the Department of Zoology, at Oklahoma State University (USA) and works on the conservation of large carnivores in Ethiopia.

Capacity: Fikirte was the team leader and she played the major roles in organizing field works, preparing the community education leaflet and booklet texts and also writing the reports.

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Roman Kassahun Aberra

Qualifications: BSc in Biology and MSc in Environmental Science.

Capacity: R. Aberra, completed her MSc at University of Addis Ababa, co-supervised by Dr S. Loader on the **Investigation of environmental change on the distribution, abundance and diversity of amphibians in Haremma Forest**. She is the only biologist in Ethiopia who did postgraduate research on BM frogs. Roman participated in training the parataxonomists about the different methods of data collection and specimen identification. She also played a key role in processing research permits, organizing the field work, identifying the specimens, data analysis and writing up of the project report.

David Gower

Qualifications: BSc in Zoology (University of Reading), PhD in Geology and DSc in Science from University of Bristol.

Capacity: D. Gower conducted scientific research on Bale amphibians in 2006 and 2009. In the current research, he gave trainings to the team members and parataxonomists on different survey techniques and species identification. He trained the team in chytrid fungus survey sample collection. Additionally, he contributed in preparing and editing texts for the poster and booklet.

Wondmagegne Daniel

Qualifications: BSc in Biology (Haramaya University, Ethiopia) and Msc in Systematic Zoology (Addis Ababa University)

Capacity: As a team member Wondmagegne participated in amphibian surveying in the field. He plans to prepare a brief article for contribution at a local newsletter. Currently, he is on PhD study at Texas Tech University (USA) on African civets.

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Fana Gebresenbet

Qualifications: BSc in Plant Science (Haramaya Univerisy, Ethiopia) and Msc in Physical Land Resources (Ghent University, Belgium)

Capacity: As a team member Fana helped in writing the report. Currently, Fana is pursuing his PhD on the issue of large-scale agricultural land acquisitions (often called “land grabbing”). He is following a joint PhD programme offered by the Addis Ababa University and University of Leipzig, Germany.

Kidest Negussie Abnet

Qualifications: BA in Geography and Environmental studies.

Currently she is working for FZS Ethiopia, as a volunteer in one of their project sites, Guassa Community Conservation Area. She is actively participating in the activities of community-based conservation, ecological monitoring, species inventory activities mainly focusing on the study of the herpetofauna of the area. As a team member she participated actively in the field surveys conducted during the dry and wet seasons, and in feeding GPS coordinates and other ecological data into excel sheet.

Dr. Simon Loader

Qualifications: BSc in Zoology (2i) (University of Leeds), MSc in Advanced methods in Taxonomy and Biodiversity (Imperial College) PhD in Molecular Genetics from University of Glasgow.

Capacity: At present he is a faculty at the Institute of Biogeography, Basel University, Switzerland. He has conducted scientific research on Bale amphibians since 2006 and has supervised two Ethiopian students on their MSc and PhD studies on Ethiopian amphibians. In the current research, he contributed in giving some technical advises and in editing texts for the poster, booklet and the final report too. He also played a key role in the IUCN status and criteria evaluation of the Bale amphibians in the recent AAWG meeting.

Section 2

2.1. Aim and objectives

➤ **Overall Goal:**

- Conservation biology of the BMNP amphibians is better understood and their threats and potential solutions are identified.

➤ **Objectives:**

- Improve the accuracy of IUCN assessments and basic biological data of BMNP amphibians.
- Determine the impacts of climate change, habitat quality and degradation on Bale amphibians.
- Investigate the presence and threat of pathogenic diseases on BMNP amphibians.
- Develop public awareness on amphibians and biodiversity conservation in general.
- Recommend better management strategies to ensure the long-term conservation of BMNP amphibians.

The above stated are the original goal and objectives. However, part of the second objective could not be met because the National Meteorological Agency (NMA) of Ethiopia does not have the required historical climate data. The available data from the NMA was patchy and was only that of rainfall, not of temperature which is the most important element to assess the impact. Additionally, the meteorological stations were operational starting from the mid-1990s only (no rainfall data for the years of the first amphibian survey, 1986) and there are gaps in the recorded data. These made it impossible to conduct statistical analysis and reach to a conclusion whether climate has affected the BM amphibians or not.

2.2. Methodology

2.2.1. Amphibian Surveying to improve IUCN assessments

Randomly selected representative sites in the forest were surveyed using:

1. Pitfall trapping: pitfall lines were constructed by sinking buckets into the ground at a 1m interval with their tips leveled with the surface. Drift fences were constructed with plastic sheets along the sides of the pitfalls. Traps were checked every 24 hours, for the presence of frogs, for six days in both seasons.
2. Transect Sampling: transects were laid in randomly selected sampling sites. One and half person hours was spent for searching amphibians in each site.
3. Visual encounter survey: amphibians were searched on the surface and underneath¹ of rocks, logs and other debris. Total person hours were recorded in each survey (from the time spent and the number of people who were in the field). Night searches were also conducted and amphibians were identified using their calls too.
3. Opportunistic captures: took place during walks throughout the BMs.
4. Dip netting: in rivers and streams, for searching aquatic frogs and frog larvae.
5. Timed digging: done in soft soils and at the base of large trees to look for caecilians and possibly sheltering frogs.

When encountered, species were identified to the species or at least to the genus level, using Largen (2001) and released. For taxonomically problematic species, a representative sample of 1 or 2 specimens was collected. Important notes were taken, labels were attached and specimens were anesthetized in MS222 solutions to take tissue samples for further molecular analysis. Specimens were preserved in 70% alcohol and kept in the Natural History Museum at Addis Ababa University. Tissue samples and skin swabs were exported to BMNH for analysis.

2.2.2. Determining impacts of habitat quality and degradation on Bale amphibians

Changes in forest cover and habitat from the original descriptions have been noted. Causes of habitat degradation have been identified through FGDs and observations. Levels of grazing and disturbance were estimated using categories: low, medium and high (against non-grazed areas).

¹ All cover objects turned over to search amphibians were returned to their original positions.

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2.2.3. Testing the presence of pathogenic diseases on amphibians

Swabs were taken from the skin (limbs, under thighs and fingers) of 107 of the encountered adult frogs. Biopsies were also taken from the mouth parts of 40 tadpoles and placed in an agar media. The samples were exported to the UK for lab analysis. As is typical for this type of sample, many of the agar plate samples had to be discarded because of infection and most of the remaining samples were chytrid (*Batrachochytrium dendrobatidis*) free. However, four samples worked in that they allowed BMNP chytrid to be cultured and subjected to DNA characterization². The skin swabs were also analyzed (at Imperial College), DNA was extracted and quantitative PCR assays were run.

2.2.4. Developing public awareness on amphibians and biodiversity conservation in general

A one-day workshop was conducted in Rira with local people, students, and local administration. A brochure about biodiversity conservation, the BMNP and the BM amphibians was prepared in Oromiffa (the local language) and distributed. An educational presentation on conservation and with specific details on amphibians was delivered. A poem/essay contest was prepared for local students on issues relating to conservation and the BM.

A descriptive and educational booklet about the BM amphibians has been prepared in both Oromiffa and English (for local people, conservationists, the general public and tourists) and is ready for publishing.

2.2.5. Recommendations for better management strategies

To understand the underlying problems and recommend better management strategies, FGDs were conducted with different groups of people living in Hareenna (elders, local decision makers, school director, BMNP staff and women). Questions were open-ended, designed to encourage a full answer using the subject's own knowledge and/or feelings.

² This work has been completed by Imperial College (London) colleagues, and they will include the DNA data in a broad analysis of chytrid strains – hopefully this will inform us whether the Ethiopian strain matches with the more or less pathogenic strains globally.

2.3. Outputs and Results

2.3.1. Amphibian survey to improve IUCN assessment

The following is a list of amphibians recorded in the field trips.

Table 1: Number and species of amphibians encountered during both field trips.

No	Species	Dry season	Wet season	Total
1	<i>Leptopelis gramineus</i> *	45	10	55
2	<i>Ptychadena</i> spp	53	numerous	>53
3	<i>Balebreviceps hillmani</i> **	6	11	17
4	<i>Phrynobatrachus minutus</i>	11	numerous	>11
5	<i>Altiphrynoides malcolmi</i> *	2	2	4
6	<i>Xenopus clivii</i>	5	0	5
7	<i>Paracassina kounhiensis</i> *	7	calls	7
8	<i>Hyperolius nasutus</i>	1	calls	1
9	<i>Afrixalus enseticola</i> *	4	0	4
10	<i>Leptopelis ragazzii</i> *	13	20	33
11	<i>Ericabatrachus baleensis</i> **	0	0	0
12	<i>Spinophrynoides osgoodi</i> *	0	0	0
Total		147	>43	>190

** : Bale endemic genera and * : Endemic species of Ethiopia.

We could not normalize the collected data (against surveys conducted in 1986 and 2008/09) to conduct a statistical comparison. To assess the change in number of amphibian species, we divided the number of individual amphibians found in each survey year by the observation days (observation days= number of days*personnel) (Table 2). The ratio shows the effort needed to find a specific species, and by extrapolation, how abundance changed through the years. The effort needed to find all the focus species increased dramatically in the later years than in 1986. Additionally, *Spinophrynoides osgoodi* was encountered only in 1986 survey and *Erichabatrachus baleensis* could not be found in the present survey. See also Gower *et al.* (2012) for further details on changing abundance of amphibian species in Bale Mountains.

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Table 2: Effort made to encounter frogs in different surveying years

Species	Effort		
	1986	2008/09	2010/11
<i>Altiphrynoides malcolmi</i> **	2.25	0.13	0.02
<i>Balebreviceps hillmani</i> **	1.88	0.2	0.09
<i>Ericabatrachus baleensis</i> **	2.88	0.01	0
<i>Spinophrynoides osgoodi</i> *	1.88	0	0

** : Bale endemic genera and * : Endemic species of Ethiopia.

2.3.2. Impacts of habitat quality and degradation on Bale amphibians

Increase in number of people and livestock negatively impacts presence of amphibians, through decline in forest cover and deterioration of the habitat quality by, for example, trampling of streams. For example, the team could not find the typical habitat for *Ericabatrachus baleensis*, streams with a moderate flow of water in pristine forests.

2.3.3. Testing the presence of pathogenic diseases on amphibians

Prevalence of chytrid in the 107 samples was extremely high (ca.75%), confirming previous preliminary results and underlying the threat that this pathogen might represent. However, at this stage, we could not conclusively confirm that this fungus contributes to the killing of amphibians *en masse*.³

2.3.4. Awareness raising on amphibians and biodiversity conservation

A total of 13 local women and 35 local men participated in the one-day workshop, which succeeded to transfer knowledge about amphibians and conservation of the forest as a whole. Overall 250 copies of [leaflet](#) were distributed. The winners of the poem/essay contest (top three) read their work and were given prizes. The reception of local people towards the awareness creation program (both for the role of amphibians in the ecosystem and for the conservation of the forest as a whole) was generally good. The people have started to plant and use bamboo trees for fuel instead of using other forest trees (especially *Erica*), in Hareenna. However, since they are living inside the forest and have no alternative means to sustain their life, deforestation for farming and settlements

³ See [Gower et al. \(2012\)](#) for more information, which is partially a product of CLP project.

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might continue. Therefore, designing and implementing environment friendly projects, that can provide alternative source of income and energy to the people living inside the Hareenna Forest is urgently required.

2.3.5. Recommendations for better management strategies

From the FGDs, the team learnt that honey production, vegetable gardening and small-scale farming are the main livelihood sources. Unseasonal and erratic rains are destroying crops and reducing productivity, while the high population growth rate in the area (due both to high birth rate (six children per mother) and immigration) are reducing the access to resources of each individual. Thus, what we see in the area is an increase in demand, while supply is dwindling, which essentially leads to more pervasive and severe poverty. The forest cover is decreasing due to encroachment for fuel, settlements and farmlands. The amount of water in rivers, streams and ponds is also decreasing gradually. As a result this reduction in size and quality of habitat, the number of amphibians has likely decreased in the forest compared to the last 20-30 years (Gower *et al.*, 2013).

A local myth appears to contribute to limiting of direct killing of amphibians by local people: “if one touches a frog, he/she will fall ill” thus, people in Hareenna avoid touching or killing amphibians.

2.4. Achievements and Impacts

The results revealed that the endemic focus species of the project *Altiphrynoides malcolmi*, *Erichabatrachus baleensis*, *Balebreviceps hillmani* and *Spinophrynoides osgoodi* have decreased in number since their initial survey in 1986. From 1986 to 2011 survey, the habitat of these species has been under severe human pressure. These findings were considered during the most recent meeting of the African Amphibians Working Group (AAWG) meeting in Italy in 2012, and led to the revision of the IUCN Red List status (and or criteria⁴) of the focus species.

Altiphrynoides malcolmi: maintains its EN⁵ status but its criteria changed to B1ab(iii)

Spiniphrynoides osgoodi: changed from VU⁶ B1ab(iii)+2ab(iii) to CR⁷ B1ab(i,iii,v)

Erichabatrachus baleensis: changed from EN B1ab(iii) to CR B1ab(ii,iii,v)+2ab(ii,iii,v)

Balebreviceps hillmani: changed from EN B1ab(iii) to CR B1ab(iii,v) [revised to EN B1ab(iii,v)]

These revised assessments have been approved and will be published later in 2013. Additionally, part of the team's result has been published (with previous works). Three members of the team co-authored and CLP was duly acknowledged ([Gower et al., 2012](#)).

The team had meetings with FZS and BMNP representatives to communicate its findings and to stress over the problems that BM amphibians are facing and the potential solutions ([Gower et al., 2012, 2013](#)). As a result, the outpost in Rira (the village in Hareenna) is now being strengthened by assigning more rangers, a vehicle and horses are also allocated in Rira, to strengthen the patrolling efforts and, to stop further encroachments. On top of that regular meetings and discussions are being held between the BMNP and local decision makers. Thus, the participation of the local people in the conservation of the forest is now increasing. Furthermore, one of our team members (Roman Kassahun) works in EWCA and this creates further opportunity to remind officials that the BM amphibians need due attention.

⁴ More information on IUCN criteria can be found at http://www.iucnredlist.org/documents/reg_guidelines_en.pdf

⁵ EN = Endangered

⁶ VU = Vulnerable

⁷ CR = Critically Endangered

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The team has also prepared a [booklet](#) with the basic descriptions of the BM amphibians and their photos, which will be published when CLP releases the second instalment. The booklet will be useful to inform and educate both the local people and tourists and also to assist in the search and identification of ‘the most wanted’ (those that have not been seen for many years) amphibians. Life is getting very difficult for those living in Hareenna Forest. This also has its own impact on the population of amphibians. The people are destroying most habitat types and streams in which amphibians used to inhabit.

Section 3

3.1. Conclusion

A total of 10 amphibian species consisting of eight endemics were encountered in the Harennna Forest, during the both (dry and wet season) field periods. A comparison of the 1986, 2008/09 and 2010/2011 amphibian survey in the study area revealed a dramatic decline in the presence of the four monotypic genera and other endemic species of Harennna. The results of this study played a major role in revising the IUCN Red List Status of four amphibians of the BM and publication of scientific results (Gower *et al.*, 2013). Additional publications focussing on results of the surveys and disease assays conducted under the CLP project will hopefully be published in the near future.

The suitable habitats of the endemic species are currently under severe human pressure, such as logging for the expansion of farmlands, settlements and for fire wood.

Discussions conducted with different groups of people living in Harennna Forest revealed that the major threats of the forest to be:

- ✓ change from pastoralist way of life to agricultural production,
- ✓ increase in human and cattle population in the area,
- ✓ cutting of forest woods for fuel and for building houses,
- ✓ uncontrolled fire,
- ✓ the conversion of wetlands and forest areas to farm lands and settlements,

These seem to have eventually led to decrease in the forest cover, and further decline in habitat quality and increase in habitat fragmentation, contributing to the serious dwindling of the amphibians in Harennna.

Urgent action is needed and this has been communicated to the BMNP, FZS and EWCA.

3.2. Problems encountered and lessons learnt

Problems encountered:

- Due to the lack of complete climatic data, it was not possible to correlate change in amphibian diversity and abundance to climate change.
- Due to the increase in fuel cost and inflation in general, the team faced problems in allocating the money according to the planned activities.
- EWCA's legislative (1000 USD for expatriate researchers) was not clear enough in communicating whether team advisors should pay a research fee or not and we had to pay after discussions with the Authority that took several days. Recommendations have been given to make the directive clear for future use.
- On the back of previous work and the achievements of the CLP project, Gower, Loader and Aberra successfully applied for a grant of \$30,000 from the US Fish and Wildlife Service to carry out conservation management work on the threatened Bale amphibians. However, the award was never realized because EWCA insisted that Ethiopian government rules required EWCA staff to be appointed as project manager and/or paid assistants but the USFWS cannot make salary payments to individuals already employed by non-USA governments.

Lessons learnt:

The lessons that we learnt whilst working on this study were that we need to:

1. Incorporate young researchers in our team to inculcate the value and skills of conservation to the coming generation;
2. Work with local people hand in hand if change is to come instead of a top-down approach;
3. Recognize that local people do understand the problems regarding their environment but they cannot do anything about it because 'to conserve or not to' is a matter of survival for them;
4. Understand local dynamics and social problems (in our case poverty, lack of fuel alternative, high local population growth, change of life style from pastoralist to a more sedentary way), in addition to ecological and environmental ones, if one aims to develop a successful conservation measure.

3.3. In the future

The following is a list of recommendations for respective bodies mentioned (*) and things that our team members will be doing (†)

1. Write proposals that help to mitigate the already identified problems. Encourage EWCA, FZS, BMNP and other concerned bodies to collaborate with social scientists to address the underlying social problems; (*, †)
2. Write short essays and articles for national newspapers and magazines to inform the general public; (†)
3. Encourage/Lobby policy makers to give higher priority to protecting some sections of good Erica Forest (especially streams); (*, †)
4. Encourage people to leave dead wood on the Haremma escarpment for frog microhabitats; (*, †)
5. Set up provision and distribution of indigenous tree seedlings in the Haremma; (*)
6. The BMNP and FZS should strengthen local school environmental clubs to communicate the message of conservation to the youth; (*)
7. A handbook of the BM frogs is under preparation by David J. Gower, Fikirte Gebresenbet, Simon Loader and Roman Kassahun which is hoped to be published in 2014; the aim is to provide all the necessary information for other people to carry out amphibian research and conservation management in the Bale Mountains. (†)
8. A photograph database website about the Biodiversity of Ethiopia is under preparation by the team leader in collaboration with other colleagues (<http://www.ethiobiodiversity.com/>). The page will have photos and descriptions of the BM amphibians, and due acknowledgement will be given to CLP and other organizations that have contributed for their conservation. (†)

Section 4

4.1. Appendices

Appendix I: Summary of the 1986, 2008/09 and 2010/2011 amphibian surveys in the study area

Species	1986 survey (8 days 1 person)		2008 – 2009 Survey (23 days 3 people)		2010-2011 survey (30 days 6 people)	
	Number of individuals	Effort	Number of individuals	Effort	Number of individuals	Effort
<i>Afrivalus enseticola</i> *	5	0.63	0	0.00	4	0.02
<i>Altiphrynooides malcolmi</i> **	18	2.25	9	0.13	4	0.02
<i>Balebreviceps hillmani</i> **	15	1.88	14	0.20	17	0.09
<i>Ericabatrachus baleensis</i> **	23	2.88	1	0.01	0	0
<i>Leptopelis gramineus</i> *	3	0.38	51	0.74	55	0.31
<i>Leptopelis ragazzi</i> *	20	2.50	29	0.42	33	0.18
<i>Paracassina kounhiensis</i> *	8	1.00	0	0.00	7	0.04
<i>Ptychadena erlangeri</i> *	5	0.63	0	0.00	-	-
<i>Ptychadena neumanni</i> *	21	2.63	51	0.74	-	-
<i>Ptychadena spp</i>	-	-	-	-	>53	>0.29
<i>Spinophrynooides osgoodi</i> *	15	1.88	0	0.00	0	0
<i>Phrynobatrachus minutus</i>	-	-	-	-	>11	>0.06
<i>Xenopus clivii</i>	-	-	-	-	5	0.03
<i>Hyperolius nasutus</i>	-	-	-	-	1	0.01
Total	133		159		>190	

** : Bale endemic genera and * : Endemic species of Ethiopia.

(Sources: Largen(2001) & Aberra (2009))

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Appendix II: Rain fall Records from Goba and Rira (respectively).

Year/month	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	1	121	4	15.9	0	42.2	0	40.7		24.6	0	10.7	
2	0	19.1	4.7	0	5.9	0	0	14		93.1	15.5		
3	73.6	43.1	109.6	14.5	146.5	104.2	55.6	22.2	29.2	114	57.4		
4	147.2	79.8	59.3	140.1	147.7	102.3	105.6	142.8		194.3	145.6	180.1	
5	115.8	115.8	106.8	117.7	118.6	47.6	80.7	19.7		72.1	136.3	96.6	
6	55.4	122.2	35.5	39.5	93.5	36.1	62.8	66.7		140.1	111.3	34.2	33.4
7	115.1	120.3	91.3	120	104.7	85.7	175.9	162		142.6	129	106.7	32.4
8	85.2	156	134.9	188.9	209.1	117	175.3	249.3		211.4	188.3	123.2	
9	177.4	171.8	151.4	119.4	186	61.4	91.6	176.3			139.1	151	100.4
10	280.1	222.1	103.7	119.7	152.8	105	43.5	69.2			116	106.6	42.9
11	159.5	43.9	42.3	31.6	55.4	6.7	45.9	23.4			80.1	66.6	
12	23.6	0	16.2	30.7	10.4	93.3	84.4	68.5	2.5		0	2.4	
SUM	1233.9	1215	859.7	938	1230.6	801.5	921.3	1054.8	31.7	992.2	1118.6	878.1	209.1
	1997	1998	1999	2000	2001	2002	2003	2004					

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Year/month	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	1.4	83.3	51	115.5	14.4	12.2		55.2	49.9	57.5				
2	38.9	49.9		46.3	1.8	0		18.7	6.2	0			29.9	0.3
3	138.4	101	87.5		80.2	12.3		111.8	79.5	40.4			49.8	0
4	205.8	140.2	97.3	65.8	58.1	74.7		73	100	171				
5		151.8	24.6	132.8	33.4	116.1		36.8	6.7	4			108.4	69.2
6	13.7	145.9	43.7	36.7	21.3	20.8	18.9	18.1	6.1	13			22.7	
7	185.7	147.5	59.6	84.6	23.3	35.4	75.9	47.1	85.9	33.1		38.1		129.9
8	52.2	68.9	73.1	69.6	45.1	49.5	155.3	35.9	105.9	40.2				
9	5.3	36.3	53.9	104.3	43.7	38.5	87.6	49.7	75.9	29.4				55.4
10	64.6	46.2	267.5	173.9	156	75.2	78.2	24.5	86.7	65.7		175.3		122.5
11	4.7	63.3	164.1	34.1	3.8	26.2	15.8	30.8	39.5	34.5				51.6
12	38.4	17.8	15.3	1.1	1.4	20.1	22.7	64.2	40.7	45.6	0		0	
SUM	749.1	1052	937.6	864.7	482.5	481	454.4	565.8	683	534.4	0	213.4	210.8	428.9
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004				

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Appendix III: Summary of the project's financial report

Itemized expenses	Total CLP requested (USD)	Total CLP used (USD)
PHASE I - PROJECT PREPARATION		
Administration		
Communications (telephone/internet/postage)		91.15
Books and printing journal articles/materials	300.00	50.00
Insurance		0.00
Visas and permits	1,500.00	1,022.40
Team training (Please detail: meals and horse rent - 7 people for five days)	500.00	244.54
Other (Driver, parataxonomists and the local guide were paid perdiems)	50.00	510.42
Reconnaissance	1000	
Medical supplies/first aid	0.00	96.41
Equipment		
Scientific/field equipment and supplies (Please detail: maglite, audio recorder, stationaries, chemicals, batteries, hard disk and its case, headtorches, meteorology data, sack)	950.00	750.47
Photographic equipment (Please detail: Camera, batteries, SDHC card, Integral USB SC reader)	1,000.00	869.36
Camping equipment (Please detail main items: tents, cooking utensils, sleeping bags)	600.00	141.52
Field guides		0.00
Maps		24.30
Boat/engine/truck		0.00
Fuel		0.00
Other (Please detail:)		0.00
PHASE II - IMPLEMENTATION EXPENSES		
Administration		
Insurance		0.00
Transportation		
Fuel	800.00	897.86
Field vehicle maintenance		26.12
Accommodation for team members and local guides	100.00	43.04
(Please detail: During transportation (\$50 per day for 4 people * 8 days in the cities) 400.00 In the field (\$210 per week for 6 people * 12 weeks) 2520.0)		

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Food for team members and local guides (Please detail: Food in field (\$210 per week for 6 people * 12 weeks) 2520.00)	960.00	1,149.68
Transportation	985.00	3,465.90
Customs and port duties		0.00
Workshops	1960	
Outreach/education activities and materials (brochures, posters, video, t-shirts, etc.) (Please detail: local workshops, FGDs, contest prizes)	350.00	486.76
posters (150 items) 150		145.33
PHASE III - POST-PROJECT EXPENSES		
Administration	1,000.00	
Report production and results dissemination	420.00	
Other (Please detail:)		
Total	12,475.00	10,015.26

4.2. Bibliography

- Aberra RK (2009) An Investigation of Amphibian Diversity and Abundance, in Relation to Environmental Change in Haremma Forest, Bale Mountain National Park, Ethiopia. Msc thesis, Addis Ababa University.
- Bale Mountains National Park General Management Plan 2007-2017 (2007) Compiled and edited by Frankfurt Zoological Society.
- Fetene M, Assefa Y, Gashaw M, Woldu Z & Beck E (2006) Diversity of Afroalpine vegetation and ecology of treeline species in the Bale Mountains, Ethiopia and the influence of fire in Land use change and mountain biodiversity [edited by Spehn E, Liberman M and Körner C].
- Gower DJ, Aberra RK, Schwaller S, Largen MJ, Collen B, Spawls S, Menegon M, Zimkus BM, de Sá, Rafael, Mengistu AA, Gebresenbet F, Moore RD, Saber SA and Loader SP (2013) Long-term data for endemic frog genera reveal potential conservation crisis in the Bale Mountains, Ethiopia. *Oryx*, 47(1): 59–69.
- Gower DJ, Doherty-Bone TM, Aberra RK, Mengistu AA, Schwaller S, Menegon M, de Sá Rafael, Saber SA, Cunningham AA and Loader SP (2013). High prevalence of the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) across multiple taxa and localities in the highlands of Ethiopia. *Herpetological Journal*, 22:225–233.
- Kingdon J (1997) *The kingdom field guide to African mammals*. Academic Press, London and New York.
- Largen MJ (1991) A new genus and species of petropedatine frog (Amphibia Anura Ranidae) from high altitude in the mountains of Ethiopia. *Tropical Zoology*, 4: 139–152.
- Largen MJ (1995) A new species of chameleon (Reptilia Sauria Chamaeleonidae) from montane forest in Ethiopia. *Tropical Zoology*, 8: 333–339.
- Largen MJ (2001) Catalogue of the amphibians of Ethiopia, including a key for their identification. *Tropical Zoology*, 14: 307–402.
- Largen MJ and Drewes RC (1989) A new genus and species of brevipitine frog (Amphibia Anura Microhylidae) from high altitude in the mountains of Ethiopia. *Tropical Zoology*, 2: 13–30.
- Largen MJ and Spawls S (2006) Lizards of Ethiopia (Reptilia Sauria): an annotated checklist, bibliography, gazetteer and identification key. *Tropical Zoology*, 19: 21–109.
- Loader SP, Mengistu A, Schwaller S, Gower D, Nagel PN, Getahun A, Saber SA, and Aberra R (2009) Are Ethiopian highlands changing? Amphibians as ecosystem indicators. *Mountain Forum Bulletin*, 9: 5–6.

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- Mengistu AA (2012) *Amphibian diversity, distribution and conservation in the Ethiopian highlands. Morphology, molecular and biogeographic investigation on Leptopelis and Ptychadena (anura)*. PhD thesis, University of Basel, Switzerland.
- Tadesse G (2001) Land Degradation: A Challenge to Ethiopia. *Environmental Management*, 27: 815–824.
- Yalden DW (1983) The extent of high ground in Ethiopia compared to the rest of Africa. *Sinet: Ethiopian Journal of Science*, 6: 35–39.

4.3. Distribution list

Addis Ababa University (AAU)

Bale Mountains National Park (BMNP)

Conservation Leadership Program (CLP)

Ethiopian Wildlife and Natural History Society (EWNHS)

Ethiopian Wildlife Conservation Authority (EWCA)

Frankfurt Zoological Society (FZS)

Medda Wellabu University, Ethiopia

Mekelle University, Ethiopia (MU)

The Natural History Museum, London (BMNH)

University of Basel, Switzerland (Uni Basel)