



Darwin Initiative Main Project Annual Report

To be completed with reference to the “Writing a Darwin Report” guidance: (<http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms>). It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)

Submission Deadline: 30th April 2018

Darwin Project Information

Project reference	3270
Project title	Alleviating rural poverty through conflict mitigation and improved crop yields
Host country/ies	Zimbabwe & Botswana
Contract holder institution	University of Oxford, Wildlife Conservation Research Unit
Partner institution(s)	Victoria Falls Wildlife Trust
Darwin grant value	£318 827
Start/end dates of project	Start date: 1 April 2016 / End date: 31 March 2019
Reporting period (e.g., Apr 2016 – Mar 2017) and number (e.g., Annual Report 1, 2, 3)	April 2017 – March 2018 Annual Report 2
Project Leader name	Andrew Loveridge & David Macdonald
Project website/blog/Twitter	www.wildcru.org
Report author(s) and date	Andrew Loveridge, Roger Parry, Kristina Kesch; April 2018

1. Project rationale

Western Zimbabwe and north-eastern Botswana are agriculturally marginal, with poor soils and rainfall (see “Map of project sites in accompanying material”). However, livelihoods in rural communities rely precariously on subsistence agriculture, especially crop growing and livestock ownership. Traditionally women bear the burden of land clearance and cultivation with limited access to inputs such as fertiliser or mechanisation. Crop failure in poor years often results in chronic malnutrition, particularly affecting households with no alternative incomes; frequently those headed by women. Poverty increases reliance on natural resources, leading to unsustainable, illegal or commercial utilisation of resources such as wood, wildlife products and bush-meat. Simple improvements to cropping methods greatly improve yields and food security, and reduce land and labour requirements and environmental damage.

Around protected areas, livestock predation by large predators, particularly lions, leads to significant loss for already impoverished people. The loss of draught animals further impacts the ability to prepare fields and livestock depredation routinely results in retaliatory killing of globally threatened predators causing population declines and measureable impacts to biodiversity and ecosystem function in protected areas. Aside from intrinsic value to natural systems, large predators are economically valuable and attract significant revenue to host countries through tourism, which is frequently the largest and most viable local revenue generator.

At a national and international scale the project trials and showcases the effectiveness of novel livestock protection techniques to mitigate impacts of biodiversity and reduce the need of lethal control of globally threatened predators. At the same time, it highlights the economic and ecological value of viable predator populations, builds capacity and improves food security for local communities.

2. Project partnerships

Darwin Initiative projects are required to be collaborative.

Describe the partnership between the lead institution and partner(s) and how this has developed over the last year of the project. For projects that have no formal partnerships, discuss what relationships there are with institutions that supported the delivery of this work.

- Are partnerships based on demand stemming from the host country/ies and to what extent are all partners involved in project planning, monitoring and evaluation and decision making?
- Have there been particular achievements, lessons, strengths or challenges with the partnership(s), and how have the latter been met?
- Please substantiate comments with evidence and use indicators.

While the Principal Investigator (PI) is ultimately responsible for the implementation of this project, a diverse management structure has been developed to maximise effectiveness and enable the project to be adaptable to locally different circumstances. The management of the project has been divided between three Project Managers, each managing 1-2 project sites (Hwange Manager: Mabale & Tsholotsho sites; Victoria Falls Manager: Victoria Falls; Botswana Manager: Chobe Enclave & Boteti sites; see “Map of project sites”). Project Managers facilitate project activities on the ground and manage Community/Lion Guardians. Where project sites are situated far from each other, Project Managers are assisted by local Community Officers, who provide support with project logistics and implementation, and promote community liaison (see Section 9). Project Managers, in close collaboration with their respective target communities and wildlife managers, are responsible to adapt the general concept of the project to locally different conditions to maximise its effectiveness on the ground. Project Managers regularly report to the PI and key decisions are discussed with and approved by the PI.

For this project, the University of Oxford has formed a formal partnership with the Victoria Falls Wildlife Trust (VFWT) in Zimbabwe. VFWT is managing partner funds and allocates these to field teams in Zimbabwe and Botswana (via WildCAT and Trans-Kalahari Predator Programme (formerly Botswana Lion Corridor Project)). During the second year, VFWT has continued to organise, co-ordinate and implement field work, provided training, organised workshops and disseminated information about DI and the project in their area (see Section 3; www.vicfallswildlifetrust.org, section “Human Wildlife Conflict”, “VFWT homepage screenshot”). The VFWT provides material for project reporting and is assisting in the preparation of reports. The VFWT continues to independently manage a remarkable team of Community Guardians (CGs) and field managers, and nurtures a close relationship with volunteer village communities, local administrators and traditional leadership. The project’s progress is being discussed with the Principal Investigator (PI) on a regular basis either in person (2-3 times a year) or by email. The VFWT staff’s local expertise is being considered carefully when key decisions are made by the PI.

Both WildCRU and VFWT have a long standing relationship with the Government of Zimbabwe’s Parks and Wildlife Management Authority (PWMA) and work closely with PWMA research officers and managers on predator management issues surrounding Hwange National Park and in the Victoria Falls area. PWMA are very supportive of the project and have renewed all necessary permissions (see “HLR Research permit 2018”). The project works closely with both PWMA regional field staff and national staff at the headquarters in Harare and PWMA have provided valuable ground support for the project. Furthermore, a Memorandum of Understanding has been signed between the Victoria Falls Wildlife Trust, Jafuta Foundation and the Hwange

Rural District Council to coordinate responses to human-wildlife conflict reports within the operational area (see “VFWT_HRDC_Memorandum of Understanding 2017”).

The Government of Botswana’s Department of Wildlife and National Parks (DWNP) has been very enthusiastic and supportive about this project and have specifically requested our help in mitigating human-predator conflict. Even though the process of issuance of research permits is currently still under revision by the Ministry of Environment, Natural Resources Conservation and Tourism (see “MENT Press Release Jan 2017”), the DWNP added the Botswana Project Manager to the current research permit of the Trans-Kalahari Predator Programme in 2017. After facing delays during year 1, we have thereby been given the necessary permission to fully introduce the programme into Botswana (see “TKPP Research permit 2016-2018”, “Research permit Isden”, “Email Dr. Flyman 12.10.17”). The Botswana Manager reports on progress of the project to the DWNP on a quarterly basis and local DWNP officers are highly involved in the introduction of the concept into the Botswana sites (see “TKPP Annual Report 2017”, “TKPP_HWC_1st Quarterly Report Apr 2018”).

We continue to collaborate with Elephants for Africa and Elephants Without Borders to increase the overall effectiveness of human-wildlife conflict mitigation in the Boteti and Chobe Enclave areas respectively. During the second year, we have coordinated our activities with both NGOs and have started the implementation of joint human-wildlife conflict workshops in order to cover both major conflict species in these areas (see “TKPP_HWC_1st Quarterly Report Apr 2018”).

Due to the ongoing suspension on the issuance of research permits in Botswana, sociologist Prof. Alice Hovorka from Queen’s University, Canada, has still not been able to acquire a research permit. We therefore repeated the Zimbabwe baseline survey on food security and local attitudes towards predators and conservation in Botswana to provide current status information prior to introduction of the programme (see Section 3.1). We have further agreed to co-supervise and sponsor a local MSc student with a strong background in sociological sciences (see “Matsoga Sponsorship Confirmation”), who will study temporal human-lion conflict patterns in northern Botswana and the effectiveness of our conflict mitigation technique.

The Kavango-Zambezi Transfrontier Conservation Area Secretariat (KAZA Secretariat) has enthusiastically endorsed the project and continues to offer valuable support. Our team members lead the Hwange-Chobe-Makgadikgadi working group under the KAZA Carnivore Conservation Coalition (KCCC). As a consequence of the project being selected as a priority project for the KAZA Carnivore Conservation Strategy (see “KAZA Carnivore Conservation Strategy_draft_Dec_2017”), which is currently being developed with assistance of the project leadership, additional funding for the programme has been pledged (see Section 3.1).

Traditional leaders in the target communities continue to be supportive and are especially grateful for being consulted extensively for planning of the project and decision making on its implementation. Additional communities have been approached or voiced their interest in the project to be introduced to their area (see “Request for lion guardian_Emanaleni”, “TKPP_HWC_1st Quarterly Report Apr 2018”).

3. Project progress

3.1 Progress in carrying out project Activities

Activities 1.1-1.6 for Output 1: Showcasing benefits of the project to international development agencies

In October 2017, the annual Long Shields Community and Lion Guardian training workshop was conducted in Tsholotsho and 14 Community Guardians from 3 project sites in Zimbabwe were trained in GPS, radio telemetry, data collection, report writing, mobile boma management concept and first aid (see “2017 Long Shields Guardians Workshop”, “2017 Long Shields Guardians Workshop Agenda”). Boma installation workshops were conducted in each project site in Botswana with the support of the Hwange Project Co-ordinator and a visiting Lion Guardian from Zimbabwe. Associated communities were trained in boma management and provided with detailed insights by experienced Zimbabwe staff (see “Boma workshop poster_Khumaga”, “Boma installation report_Khumaga”, “Boma installation report_Khumaga 2”, “ChE Update Report_Oct17”). Following a series of livestock predation events in Binga near Chizarira National Park in northwestern Zimbabwe (www.herald.co.zw/lions-wreak-havoc-in-binga/), 2 local men were trained as Lion Guardians (see “Binga LGs training workshop report_June 2017”) and the

concept has since been implemented in their area. In Botswana, an additional community in the Chobe Enclave has been approached and Emanaleni village in the Tsholotsho project site in Zimbabwe have voiced interest in the project to be introduced to their area (see “Request for lion guardian_Emanaleni”, “TKPP_HWC_1st Quarterly Report Apr 2018”).

In 2017, two film teams from National Geographic and Victoria Falls Productions (Tom Varley) visited and filmed the programme and its impact on rural livelihoods (see “TKPP Annual Report 2017”) and information on the project continues to be disseminated on YouTube (“WildCRU A personal message from Professor David Macdonald March 2016”, “WildCRU A personal message from Professor David Macdonald”), through the Trans-Kalahari Predator Programme’s Annual Report 2017 (see “TKPP Annual Report 2017”), via the WildCRU homepage (www.wildcru.org/research/tkpp-mitigating-conflict/), the Victoria Falls Wildlife Trust homepage (www.vicfallswildlifetrust.org, see “VFWT homepage screenshot”) and the media (www.pressreader.com/south-africa/sunday-times/20170402/281547995735391). In June 2017, the concept was presented to a team of theme park designers in Zimbabwe to potentially feature the programme in the theme park to increase awareness in the general public (see “Agenda_Santonga Workshop_June 2017”, “Santonga workshop presentation_Kesch”).

After the WWF funding pledge in 2016, a two-year funding agreement has been signed in April 2017 and is ongoing (see “WWF Grant Agreement”). Furthermore, the project continues to be supported by Panthera (see “Grant agreement_Panthera_2017”), African Bush Camps Foundation (see “African Bush Camps_invoice16_17”) and a grant from the Robertson Foundation to WildCRU under a new grant agreement for the period 2017-2021 (see “Robertson funding confirmation_Dr Burnham”). The project has been selected a priority project for the KAZA Carnivore Conservation Strategy (see “KAZA Carnivore Conservation Strategy_draft_Dec_2017”) and additional WWF funding has been approved through the KAZA Carnivore Conservation Coalition (see “KCCC Funding Workshop_Proceedings_Nov2017”, “Email Russell Taylor 04.04.2018”). In 2017, several additional funding applications for the continuation of the programme after completion of Darwin funding were submitted to the IUCN, European Commission, and Biotechnology and Biological Sciences Research Council UK.

The project continues to be refined with governmental and non-governmental institutions and affected communities and meetings were held with representatives from the Department of Wildlife and National Parks, Department of Veterinary Services, Ministry of Agriculture, Chobe Enclave Community Trust, village chiefs, Village Development Committees and tourism operators in Botswana (see “ChE introductory visit_Sep2017”, “ChE Update Report_Oct17”, “Botswana CG project_sociological survey results_Oct 2017”). In collaboration with Great Plains Conservation, we spearheaded a meeting to improve communication and networking between local NGOs to increase efficiency when engaging in community-based monitoring projects such as the Community Guardians, in February 2018 (see “Concept Note_Citizen-led monitoring project”, “Summary_Citizen-led monitoring meeting_Feb2018”). In November 2017 and February 2018, the Lion/Community Guardian and Mobile Boma concept was presented at two workshops headed by the Botswana Department of Veterinary Services to discuss the potential of commodity-based predator-friendly meat trade for future financial self-sustainability of the programme (see “CBT Workshop_Agenda_2017-10-18”, “FebruaryDVSwksp_Agenda”, “Invitation presentation CBT workshop Gaborone”, “Presentation_CBT Workshop_Gaborone_Feb2018”, “Presentation_CBT Workshop_Nov2017”). Information on carnivore conservation, and results of predator surveys and conflict mitigation efforts have further been presented to the Victoria Falls village communities in October 2017 (see “VF Carnivore Conservation Presentation_Parry_26th Oct 2017”, “VF HWC CGs and Mitigation_Dlodlo_Oct 2017”, “VF survey results_Loveridge_Oct 2017”). The Hwange Project Manager presented the concept at the University of Cambridge Student Conference on Conservation Science and was awarded third prize for the best talk (see “SCCS Prog 2018”, “SCCS_3rd_prize_winner”). The project was further showcased to several development agencies visiting the project, including ALERT, African Bush Camp Foundation, Dream Project, CIRAD and WEZ. To increase overall awareness, it was presented to wildlife and tourism authorities of Zimbabwe and Botswana, students and foreign safari tourists (see “TKPP Annual Report 2017”).

Activities 2.1-2.10 for Output 2: Decreasing levels of human-predator conflict

Since the end of year 1, a total of 14 Community/Lion Guardians (including 2 women) have been active in village communities directly adjacent to Hwange National Park (10 in Tsholotsho and Mabale) and in the Victoria Falls area (4) in Zimbabwe (see 1st Annual Report). In preparation of

the programme being fully introduced into Botswana, 2 Community Officers were hired for the Chobe Enclave (Ms Mabuso Kakambi) and Boteti (Mr Charlton Kefenyang) areas respectively (see “Contract 1_Charlton_Sept2017”, “Contract 2_Charlton_Feb2018”, “Contract 1_Mubuso_Oct2017”, “Contract 2_Mubuso_Nov2017”). In May 2018, the project is further planning to recruit 4 CGs (including at least one woman) in the Boteti (2) and Chobe Enclave (2) areas of Botswana, who were previously identified as suitable candidates in close collaboration with the village leadership (see “TKPP_HWC_1st Quarterly Report Apr 2018”).

All Guardians in Zimbabwe participated in the annual training course and are fully trained in GPS, radio telemetry, data collection, report writing, mobile boma management concept and first aid (see “2017 Long Shields Guardians Workshop”, “2017 Long Shields Guardians Workshop Agenda”). In June 2018, a Botswana CGs training workshop is planned to be conducted in collaboration with the already established LG/CG team in Zimbabwe. This approach will provide new CGs with the opportunity to exchange experiences with Guardians in Zimbabwe and learn from the well-established team to avoid replication of initial mistakes.

In year 2, a total of 5 additional bomas have been deployed in our project sites (see “Boma installation report_Khumaga”, “Boma installation report_Khumaga 2”, “ChE Update Report_Oct17”, “Email Lio_Mambanje boma installation and training”), adding to a total of 21 bomas adjacent to Hwange National Park (13), in the Victoria Falls area (4), in the Boteti area (2) and in the Chobe Enclave (2). The current bomas are housing 1,570 cattle of 132 families, of which 11% are female-headed and 12% do not have a working age male (see “Boma installation report_Khumaga”, “Boma installation report_Khumaga 2”, “ChE Update Report_Oct17”, “Survey_Vic Falls_Mar18”, “TKPP Annual Report 2017”). A total of 322 cattle were vaccinated against common diseases, 127 cattle were treated for disease and 1058 cattle were treated for preventive tick control (see “TKPP Annual Report 2017”). A total of 39 households associated with the additional bomas have been trained in boma management and implementation of boma rotation schedules (see “Boma installation report_Khumaga”, “Boma installation report_Khumaga 2”, “ChE Update Report_Oct17”, “Email Lio_Mambanje boma installation and training”).

Monitoring protocols have been continued from previous years to record conflict incidents, retaliatory killing of predators, predator numbers and trends in Zimbabwe. Protocols will be introduced in Botswana during training of newly recruited Community Guardians in June 2018. In 2017, Zimbabwe Guardians tracked a total of 553 km of transect, completed 550 herd sightings and conducted 10 lion deterrence actions (see “TKPP Annual Report 2017”). 201 heads of livestock were killed by lions in our project sites around Hwange National Park (see “TKPP Annual Report 2017”), representing a 58% increase to the previous year, but still a 13% reduction of conflict compared to levels before the pilot project was initiated in 2012.

Variation in levels of human-lion conflict are generally to be expected due to variable environmental conditions however, the significantly increased number of livestock losses around Hwange National Park can mostly be explained by an incident of one lioness being killed as a problem animal after attacking a villager. As a consequence, the 4 dependent cubs killed a significant number of goats, most likely due to a lack of experience with hunting larger and more dangerous natural prey species (see “Email conversation_Hwange goat kills_Feb18”).

Our project site in the Victoria Falls area experienced a marked increase of livestock losses to lions from 72 head of livestock killed in 2016 to 160 head in 2017 (see “Survey_Vic Falls_Mar18”). The majority of livestock however was killed within 3 months, between January and March 2017 (92 head, see “Email Mr. Dlodlo_06.04.2018”), before mobile bomas were installed in the area in April 2017. Since then, the same amount of livestock (92 head) was killed by lions in a time span of 12 months (April 2017 – March 2018) that was killed in the previous 3 months (January-March 2017). Comparing 92 livestock losses between January and March 2017 to 24 head of livestock lost between January and March 2018 suggest a decrease in conflict of around 70% since the concept was fully introduced in the area (see “Email Mr. Dlodlo_06.04.2018”). The results therefore indicate the success of the enclosures in reducing overall conflict levels in the area. Notably, across all sites, no livestock was killed inside mobile bomas, demonstrating the high effectiveness of the enclosures, if correctly used (see “TKPP Annual Report 2017”, “Survey_Vic Falls_Mar18”).

In the process of introducing the programme to the Chobe Enclave and Boteti areas of Botswana, we visited 29 cattle posts associated to the Kavimba community in the Chobe Enclave and 22 cattle posts associated to the Khumaga community in the Boteti area. We assessed kraal structures and locations, kraaling behaviour, documented herd sizes and patterns of lion

depredation and introduced cattle owners and herd boys to the concept (“ChE introductory visit_Sep2017”, “Botswana CG project_sociological survey results_Oct 2017”). In addition to efforts detailed in previous reports, we conducted a sociological baseline survey in Khumaga (46 interviews completed, see “Botswana CG project_sociological survey results_Oct 2017”, “Community questionnaire_Botswana”), providing employment for 2 research assistants (see “Contract Charlton_Sept2017_ Questionnaires”, “Contract Lister_Sept2017_ Questionnaires”) and to be repeated in year 3 to quantify change. Our partner organization Elephants Without Borders recently conducted a comprehensive sociological baseline survey in the Chobe Enclave and baseline information is available for this area. Furthermore, a Mswana MSc student with a strong background in sociological sciences will be co-supervised and sponsored by WildCRU and project scientists (see “Matsoga_Sponsorship Confirmation”) and will investigate temporal human-lion conflict patterns in northern Botswana and the effectiveness of our conflict mitigation technique.

Since 2017, 12 potential conflict lions have been monitored with satellite collars in the Hwange (7) and Victoria Falls (3) areas of Zimbabwe and the Chobe Enclave (1) and Boteti (1) areas of Botswana (see “Darting report_Boteti Apr 2018”, “Survey_Vic Falls_Mar18”, “TKPP_Annual Report 2017”, “TKPP_Darting Permit-lions_Jan 2018”). The number of active satellite collars on potential problem animals varies between years as collar batteries only last for about 1-1.5 years, collared individuals may disperse or get killed in retaliation for livestock predation or hunted as trophies. Additional collaring of potential problem lions in Zimbabwe and Botswana is scheduled for the dry season of 2018. Lion GPS satellite movement data are being collected and monitored continuously and area-specific Whatsapp groups have been established in Zimbabwe for daily conflict management. In 2017, a total of 286 warning alerts were sent (~1400 warning alerts since we started in 2012, see “TKPP Annual Report 2017”), which is comparable to the previous year, showcasing the continued acceptance of the project in the communities. In Botswana, Whatsapp groups for conflict management are planned to be introduced after the Community Guardian training is complete. Preliminary results from lion GPS data from Zimbabwe suggest that individuals seem to adjust their movement behaviour at the large scale with regards to home range location, and at the fine scale with regards to changes in movement behaviour in direct response to Guardian interventions. Furthermore, certain factors such as age, sex, history of depredation and cub presence seem to have a significant influence on individual behaviour and therefore on the probability of interventions occurring (see “Email Mrs. Petracca 19.02.18”). In the second year of the project, 2 peer-reviewed articles were published on the risk of pathogen transmission at the wild/domestic herbivore interface at protected area boundaries (see Annex 3, “Miguel et al 2017. Drivers of FMD in cattle”) and drivers of domestic and wild herbivore habitat selection at the edge of protected areas (see Annex 3, “Valls-Fox et al 2018. Wild prey habitat selection dependence on water and cattle”), adding up to a total of 4 published peer-reviewed articles since year 1.

Activities 3.1-3.5 for Output 3: Decreasing number of predators killed in retaliation for livestock predation

Livestock predation and retaliation killing incidents are being recorded continuously in Zimbabwe and through the DWNP in Botswana. In year two, 2 lions were destroyed as problem animals in our project sites around Hwange National Park, which represents a 71% decrease in retaliation killings from the previous year (see “Hwange lion mortality 2017”, “Email Jane Hunt Apr18”). In Victoria Falls, we further recorded a 100% decrease, with zero lions destroyed since the concept was fully introduced in April 2017 (see “Survey_Vic Falls_Mar18”). In Botswana, data on destruction of predators is continuously being collected by the Department of Wildlife and National Parks (DWNP), which will serve as a baseline to determine effectiveness of mitigation strategies starting in 2018.

Data from baseline surveys conducted in Zambezi Park and Matetsi Safari Area Units 6&7 in 2016 have been analysed and suggest a total population of 90 adult lions in both areas combined (see “Predator survey report_Zambezi_Matetsi6&7”). Existing baseline survey data has been complemented by a comprehensive large carnivore survey encompassing 200 camera traps in Makgadikgadi Pans National Park in Botswana in the dry season of 2017. Between August and November 2017, a camera trap and spoor based survey was conducted in Hwange National Park, encompassing 156 cameras in the Dzivinine and Josavinine areas of the park to monitor population dynamics (see “TKPP Annual Report”). Survey data is currently being analysed and first results will be available in the next reporting period.

Activities 4.1-4.4 for Output 4: Increased crop yields and food security

In preparation of the cropping season 2017/2018, 115 fields have been fertilised with mobile bomas in Hwange and Victoria Falls project sites in Zimbabwe and 95 families (11% female-headed, 12% without a working age male) have been provided with a total of 240 kg of maize seeds. Monitoring protocols to measure increases in crop yields through the use of mobile bomas were implemented on 37 plots throughout the current rainy season (November 2017 - March/April 2018) and results will be available in the next reporting period (see "Survey_Hwange_Mar18", "Survey_Vic Falls_Mar18"). Results from the previous crop growing season suggest a 50% increase in crop yields (44% in stem diameter, 50% in number of cobs, 100% in cob length) in project sites around Hwange National Park through the use of mobile bomas. However, overall crop production is defined as the output of quantified maize cobs (number of cobs/plant) and does not take cob length or grain size into account. Therefore, the actual increase in crop production might be much higher and we are currently discussing more accurate methods to quantify crop yields for future reports (see "Survey_Hwange_Mar18").

In addition to the survey on yield and contribution to household food security in Zimbabwe, a baseline household survey was conducted in Botswana and to be repeated after the introduction of mobile bomas onto fields to quantify change (see "Botswana questionnaire survey"). The first farmers have agreed to trial mobile boma fertilization on their crop fields in 2018 and we are hoping to have results on their impact after the next cropping season (see "TKPP_HWC_1st Quarterly Report Apr 2018").

3.2 Progress towards project Outputs

NOTE: Please see Section 3.1 and Annex 1 for details and evidence for the below:

Indicators 1.1-1.5 for Output 1: Showcasing benefits of the project to international development agencies

Comparable to year 1, the project continues to receive a considerable amount of interest from many different stakeholder groups, before overall benefits will be showcased on its completion. Having been approached by communities and development agencies alike, who are interested to introduce the concept into their areas, showcases the general acceptance and appreciation the concept receives widely. In addition to the project been taken up in two additional areas in Zimbabwe and Namibia in year 1, it has further been taken up in one additional area in Zimbabwe in year 2. As in year 1, the project continues to be successful in securing additional funding and to disseminate information on a national and international level through workshops, presentations, reports, online resources and peer-reviewed literature. Project staff are involved in both governmental and private sector development initiatives, aiming to contribute to the wider benefits of the concept on national human-predator conflict management level. As several indicator measures aimed at year 3 have already been implemented by the end of year 2, we are highly confident the output indicators still hold adequate to measure success of the project and to achieve Output 1 by the end of year 3.

Indicators 2.1-2.4 for Output 2: Decreasing levels of human-predator conflict

By the end of year 2, the project has exceeded year 1's target of 12 CGs and currently encompasses 14 CGs and 21 mobile bomas in Zimbabwe and Botswana. As a result, livestock losses were reduced markedly where bomas were correctly used and no livestock have been lost inside mobile bomas. The introduction of the concept to Victoria Falls in April 2017 led to a significant reduction of previously escalating human-lion conflict levels in the area (~70%). Baseline surveys on local conflict levels and attitudes towards predators and conservation, have been collated and conducted, and a Mswana MSc student has been recruited to investigate the drivers of livestock predation in more detail in our Botswana project sites. Analysis of satellite GPS movement data of lions continues to show that interventions seem to influence individual ranging behaviour. We are therefore confident we will achieve Output 2 by year 3 in Zimbabwe. As the project sites in Botswana are both situated in high conflict areas, we are further confident that the interventions will have a significant positive effect and reduce conflict levels by 70% by year 3, even though CGs interventions will only be introduced in 2018. Experience in Zimbabwe has shown that benefits of interventions can be expected immediately after introduction of the concept. The indicators are therefore still considered adequate to measure success of the project by year 3.

Indicators 3.1-3.2 for Output 3: Decreasing number of predators killed in retaliation for livestock predation

A decrease of lion retaliation killings in Zimbabwe project sites of up to 100% is a very encouraging result after the second year of the project and we are hoping to achieve similar results in Botswana, after the concept has been fully rolled out in 2018. We continue to collect data on predator populations in adjacent protected areas and, due to the marked decrease of retaliation killings in Zimbabwe, are very confident to achieve the project outputs by year 3.

Indicators 4.1-4.3 for Output 4: Increased crop yields and food security

One hundred and thirty-two households (11% female-headed, 12% without a working age male) from 15 village communities in 5 human-lion conflict hotspots across two countries have been introduced to the mobile boma concept, with 21 mobile bomas set up and fertilising 115 fields in year 2. Results from the 2016/2017 cropping season (year 1) suggest a minimum of 50% increase in crop yields in Hwange project sites, exceeding the originally anticipated 30%. We are therefore still confident the output indicators hold adequate to measure success of the project and to achieve Output 4 by the end of year 3.

3.3 Progress towards the project Outcome

In close collaboration with affected village communities, the project is successfully implementing novel livestock and predator protection strategies in Zimbabwe and Botswana. Where these techniques have been fully introduced and used correctly, human-lion conflict incidences have decreased substantially (zero losses inside mobile bomas) and retaliation killings of lions have decreased by 70-100% as a result. Predator populations are being monitored in both countries and mortality rates and population size changes will be analysed by the end of year 3. Currently 132 households participate in the project, of which 11% are female-headed and 12% do not have a working age male. Crop yields have shown to increase by at least 50% due to our introduced livestock protection technique that simultaneously improves field fertility. We therefore believe that all indicators are still highly adequate to measure the outcome of the project and are confident that, after full introduction of the concept in Botswana in 2018, we will reach our goal of self-sufficiency for 90% of “boma” households and zero households on less than 2 meals a day by the end of year 3 (see Sections 3.1, 3.2 and Appendix 1 for details and evidence).

3.4 Monitoring of assumptions

All assumptions have proven to still hold true as a means for success of the project (see Section 3 and Annex 1) with following comments:

Assumption 2.1: Lion guardian programme successfully set up, lion guardians trained and facilitate improved livestock husbandry.

Comments: Due to delays in the permit acquisition process (see Section 2 and 1st Annual Report), followed by extensive consultative work with participating village communities in Botswana, the training of Botswana CGs will only be conducted in June 2018. However, CGs have been identified and the recruitment process is well under way in both Botswana sites. The anticipated number of CGs will therefore be reached within the next reporting period and the assumption will therefore continue to hold true.

3.5 Impact: achievement of positive impact on biodiversity and poverty alleviation

Globally, many large predators are facing endangerment and extinction while being critical keystone components of ecosystem biodiversity and function, and a major local revenue generator for the tourism industry. Recently, African lion population size decreased by 43% in only three lion generations within 21 years and lions are therefore classified as Threatened in their West African range and Vulnerable in East and southern Africa. One of the main reasons for this widespread decline is lethal control of lions in retaliation for livestock losses.

Between the start of the pilot project in 2012 and the end of year 1, livestock losses have been reduced by 45% and retaliatory killings of predators have declined markedly in project sites in Zimbabwe (see 1st Annual Report, Indicator 0.1). During the course of the project since, levels of livestock losses have increased, however, notably no livestock has been lost inside mobile

bomas, showcasing the continued effectiveness of the enclosures. Fluctuations are to be expected and major peaks in conflict levels were mostly caused by specific individual conflict lions (see Section 3.1). Even though the project experienced temporarily increased conflict levels, the significant decreases in retaliation killings of lions in Hwange and Victoria Falls project sites of 71% and 100% respectively are extremely encouraging (see Section 3.1). Project activities therefore seem to increase tolerance of the predators by local communities leading to fewer retaliation killings, contributing to one of the main anticipated benefits of the project (Indicator 0.2). Consequently, we are expecting predator populations in protected areas to be stable or increasing by year 3 (Indicator 0.3), providing essential ecosystem services to biodiversity conservation and representing valuable national assets that attract tourism and generate employment and sustainable income for developing countries.

Zimbabwe falls into the category of a 'low income' country (per capita GDP- \$856, 72% of population below national poverty line; <http://databank.worldbank.org>) and Botswana, while wealthier (per capita GDP \$6935), nevertheless has 19% of population below national poverty line - most in rural villages. In this context, the financial impact of human-wildlife conflict is significant, particularly on vulnerable households. Baseline survey data show that affected households lose, on average, \$473 per annum to livestock predation (i.e. 55% of per capita GDP in Zimbabwe), mostly by lions. By reducing predation incidents inside livestock enclosures to zero (see Section 3.1), the project can achieve a large positive impact on revenue streams within poor rural households. In addition, the project was able to demonstrate an increase of at least 50% in crop yields through the fertilization of fields with the use of mobile bomas in Zimbabwe project sites (see Section 3.1), adding significant benefits to food security and potential revenue streams for participating households (Indicator 0.4). The project further builds capacity by creating employment for rural villagers and currently employs 14 CGs and 2 Community Officers (see Section 3.1).

4. Contribution to the Global Goals for Sustainable Development (SDGs)

As direct benefits, the project aims to alleviate poverty (SDG 1: no poverty) in rural communities of Zimbabwe and Botswana through reduced livestock losses and increased food security (SDG 2: no hunger, SDG 3: good health and well-being), with a particular focus on vulnerable female headed households (SDG 5: gender equality). We aim for 90% of participating households to be self-sustained by the end of year 3 (SDG 11: sustainable cities and communities). In order to achieve these goals, we have engaged an additional 39 households in the mobile boma concept in 2017/2018, adding to a total of 132 households (see Section 3 and Annex 1). Human-predator conflict levels have decreased significantly in the project sites with zero livestock lost inside mobile bomas and a reduction of 70-100% in retaliation killings of lions. Simultaneously, crop production has increased by at least 50% in participating communities through the use of mobile bomas on fields (see Section 3 and Annex 1).

The project will further offer full-time employment and training to a total of 20 local villagers as Community Guardians and Community Officers (SDG 8: decent work and economic growth), to simultaneously reduce livestock losses while protecting globally threatened predator populations (SDG 15: life on land). The project is currently employing 14 fully-trained CGs and 2 Community Officers, including three women (SDG 5: gender equality). Four additional CGs are expected to be employed in Botswana in the next reporting period (see Section 3 and Annex 1), including at least one woman, who has previously been identified as a suitable candidate.

Whilst the number of people benefitting directly from the project is relatively modest in the context of widespread rural poverty in Africa, the real, although indirect, benefit of the project is demonstrate and publicise the tangible benefits of community guardian and conflict mitigation methods to, and build partnerships with, the international donor community and development agencies to spread the concept to benefit significantly more people (SDG 17: partnerships for the goals). In year 2, the project continued to be spread to one additional area through training of development agencies. Furthermore, we were able to secure further funding for the project from international donors (see Section 3 and Annex 1).

5. Project support to the Conventions, Treaties or Agreements

This project primarily supports the host countries to meet their objectives under the Convention on Biological Diversity (CBD). Through **scientific research** (CBD article 12) by experienced UK

scientists in close collaboration with local practitioners, it addresses **in situ conservation** of key elements of biodiversity (CBD article 8) in rural Zimbabwe and Botswana (Indicator 0.3). The project focuses on predators (predominantly lions) which are valuable ecologically and economically (through revenues from tourism) but also causing significant damage to rural livelihoods. First results indicate that the programme seems to be effective in offering **solutions to human-wildlife conflict** (CBD article 7, Indicator 0.1) and alleviating rural poverty (Indicator 0.4) and should be widely implemented. Equally, reduced need to destroy damage causing wildlife (Indicator 0.2) encourages more **sustainable utilisation of biodiversity** (CBD article 10) and potentially more sustainable revenue from tourism. Finally, the project trains local field staff and target communities in implementation of effective conflict mitigation thereby **building capacity** (CBD article 12) and ensuring continuation of activities and legacy of the project (see Section 3 and Annex 1 for details).

The PI is in permanent liaison with the Zimbabwe Parks and Wildlife Management Authority to discuss results, successes and pitfalls of the project. The Department of Wildlife and National Parks is the body responsible for implementation of international conventions in Botswana. Its national and regional staff have continuously been consulted during the past year and have provided valuable support for the introduction process of the programme and its careful adaptation to local requirements (see Section 3 and Annex 1).

6. Project support to poverty alleviation

The project is working to alleviate poverty at different levels. Direct benefits for impoverished rural communities in Zimbabwe and Botswana will be felt by households participating in mitigation methods (e.g. mobile bomas, CGs). We estimate that up to 1000 households (conservatively 5000 people) will benefit from the project by end of year 3, with CG employment, boma materials, training, set-up and maintenance costs covered through the project. The use of mobile bomas is expected to reduce labour inputs (particularly by women) significantly in fertilisation of fields, and has already shown to increase crop yields by at least 50%, contributing significantly to local food security (particularly important in vulnerable households). To date, 132 households are participating in the mobile boma concept, a number we aim to increase to 200 through additional mobile and permanent bomas in 2018 (see Section 9). Furthermore, the employment and training of up to 20 villagers as CGs and Community Officers increases capacity and creates employment in rural communities. Notably, the physical disability of a Botswana Community Officer had led to very limited employment opportunities in his rural community prior to employment through this project. The combination of bomas and CGs aims to reduce livestock predation incidents by up to 70% in the project lifetime, which will have a significant financial impact, particularly for vulnerable households. As a result of the project in year 2, retaliatory killings of globally threatened predators have decreased by 70-100% in Zimbabwe project sites, exceeding an originally anticipated 60% decrease, showcasing the effectiveness of the concept. Stable or increasing predator population sizes are not only a key component for ecosystem health and function but further represent a valuable national asset for the tourism industry, a major contributor to GDP in both project countries. To increase empowerment of rural communities, the project seeks to be community-led, achieved through an inclusive process of planning and decision making.

Besides direct benefits to a limited number of villagers in Zimbabwe and Botswana, the real, although indirect, benefit of the project is to showcase methods of reducing livestock loss and increasing food security to the wider conservation and donor community. In year 2 of the project, we continued to be able to secure further funding for the project from international donors and the concept has been implemented in one additional area in Zimbabwe due to training provided by our project staff. By spreading the concept to additional areas, capacity building and benefits of the programme will be accessible to a much larger number of people through a snowball effect beyond the reach of this project.

7. Project support to gender equality issues

Livelihoods in rural communities in western Zimbabwe and north-eastern Botswana rely precariously on subsistence agriculture, with a focus on subsistence crop growing followed by livestock ownership. The area is agriculturally marginal, with poor soils and rainfall, and traditionally women bear the burden of land clearance and cultivation with limited access to inputs

such as fertiliser or mechanisation. Sociological research has shown that women are often unaware of governmental support programmes or benefits when compared to their male counterparts and crop failure in poor years often results in chronic malnutrition, particularly affecting households with no alternative incomes; frequently those headed by women. A particular focus of this project lies on vulnerable households, especially those headed by women and those without a working age male, contributing greatly to gender equality. Including the additional mobile bomas installed in year 2, 11% of households currently participating in the mobile boma concept are headed by women, whereas 12% do not include a working age male (see Section 3, Appendix 1, Indicators 0.4 & 4.1). The project will continue to particularly focus on vulnerable households, for which simple improvements to cropping methods and livestock protection could greatly improve financial security, yields and food security, and reduce land and labour requirements. Furthermore, employment opportunities as CGs and Community Officers are not limited to men. Currently, 2 out of 14 CGs and one Community Officer are female and one additional woman has been identified as a suitable candidate to be employed as a CG in Botswana in 2018 (see Section 3, Appendix 1, Indicators 0.4 & 4.1).

8. Monitoring and evaluation

Discuss systems and processes employed internally to monitor and evaluate the project this year. Comment on the suitability of this approach, and whether you have identified any areas for improvement.

When writing this section, consider the following:

- How can you demonstrate that the Outputs and Activities of the project actually contribute to the project Outcome?
- What are the indicators of achievements (both qualitative and quantitative) and how are you measuring these?
- Have there been any changes made to the M&E plan over the reporting period?

Key areas of monitoring and evaluation hinge on demonstrating a reduction in conflict and associated reduction in financial loss, increases in crop production and both a reduction in the need to destroy predators and stable or increasing predator populations. During the course of the project, we continuously monitor its impact through data collected by field staff and reported on to the Project Managers on a monthly basis. Project Managers monitor progress of the project and conduct first analysis of the data, information which is provided to the PI on a quarterly basis. Through these structures, the PI monitors the project's progress and its impact on provision of training, building capacity and disseminating information. Monitoring and evaluation of these key project components are undertaken in different categories: 1) Implementation of solutions to mitigate conflict, 2) Monitoring of crop yields and 3) Verification that methods of reducing HWC have biodiversity benefits. Comprehensive data analysis of the above mentioned evaluation points will be finalized by project scientists at the end of year 3 to determine the overall impact of the introduced human-lion conflict mitigation techniques.

Due to the expansion of the programme to new project sites in Botswana and Victoria Falls and the expansion of the project to five field sites in two countries required greater co-ordination. Therefore, in June 2017, we held a meeting in Victoria Falls including representatives from Botswana, the Victoria Falls and the Hwange project sites to discuss the reporting structure of the project. It was agreed to introduce a mandatory quarterly reporting scheme from all Project Managers to the PI to improve regularity of project reporting across sites (as described in the paragraph above). Since then, field staff continue collecting data in both countries and regularity of reports submitted to the project leadership has improved considerably.

Capacity building and training of local community members as Lion/Community Guardians is one the key objectives of this project. During annual Guardian training workshops they received training in GPS, radio telemetry, data collection, report writing, mobile boma concept and first aid. Through a competitive approach, workshop participants were grouped into teams and experienced Project Managers evaluated their performance (quality of work, motivation, team play and efficiency) in the framework of a points system. The team with the highest score of points won the competition, whereby this approach led to a high level of motivation for workshop participants.

9. Lessons learnt

Due to the significant expansion of the project, its reporting structure had to be reviewed to improve the regularity of reporting by introducing mandatory quarterly reporting from Project Managers to the PI. Due to the immense distance between project sites in Botswana (>600 km), we further employed local Community Officers in each village community to support the Botswana Project Manager on the ground, which has been a very successful approach.

Our partner communities continue to be very appreciative to be included in the planning and decision making process when introducing the project to new sites. While the extensive inclusion of local stakeholders is very time-consuming and therefore might lead to delays of the project, it supports acceptance of the concept to a great extent and the project will continue to follow this approach. Furthermore, the involvement of senior Zimbabwe project staff in the introduction of the concept in Botswana has proven to be highly successful and their expertise has been very valuable to communities and project managers alike.

Farmers in Botswana have been reluctant to pool cattle herds into communal bomas and average herd sizes in Botswana appear to be bigger when compared to Zimbabwe. Therefore, Botswana bomas each encompass cattle of only one household at the current stage and we therefore reduced our anticipated number of participating households on completion of the project from 250 to 200. We were facing similar reluctance to pool cattle when originally introducing the pilot project in Zimbabwe in 2012. However, this was overcome when benefits of larger herds became apparent to local villagers and we are anticipating a similar mind shift in Botswana over time.

While mobile bomas have proven to be predator-proof and no livestock has been lost inside such enclosures to this day, herding practises vary with seasons and availability of fodder in grazing areas. At the end of the dry season, fodder might become very sparse in certain regions and farmers are not able to protect their livestock in enclosures every night due to the long distances necessary to travel for sufficient fodder. In some areas, efficiency of livestock protection is generally or seasonally lacking and cattle is left to graze unattended. In such circumstances, people do not seem to pay sufficient attention to lock their livestock into protective enclosures at all times. Therefore, livestock losses continue to occur when bomas are not correctly used and cattle are left outside protective enclosures overnight. We are currently developing a training protocol with several local partners, which is anticipated to include a range land management aspect to improve the efficiency of grazing area, if funding can be secured. With this approach distances to be covered by cattle in search of fodder could potentially be reduced significantly, which would allow for night time protection of livestock.

In the Chobe Enclave region of Botswana, crop fields are mostly located on river flood plains (locally called molapo farming), which are very nutrient rich. Therefore, farmers in this area have expressed no interest in using mobile bomas on their fields as increasing field fertility is not necessary in this region. Nevertheless, human-lion conflict levels are very high and we have therefore decided to locally replace mobile bomas with permanent predator-proof structures in 2018. Adopting a boma design from the Kwando Carnivore Programme in Namibia has led to a very fruitful reciprocal exchange of expertise, as they received training from us in the Mobile Boma and Community Guardian concept during year 1 of the project.

10. Actions taken in response to previous reviews (if applicable)

All project partners highly appreciate the recommendations received through the review of the 1st Annual Report. As a consequence, we have included more details on the management of the project and the training of CGs in this report. We are further providing more details on progress to achieve the project outputs.

11. Other comments on progress not covered elsewhere

n/a

12. Sustainability and legacy

The project is based on long term research collaboratively undertaken by VFWT and WildCRU in ecosystems and community areas in the two countries and we anticipate that this collaboration will be ongoing beyond the end of the Darwin Project. Sustainability of the project comes through core findings being implemented beyond the end of the project period by local stakeholders and communities and for communities to take ownership of the initiatives. This will be achieved through including local people in a stakeholder driven, consultative process since the start of the project. This process incorporates needs and priorities of local people into the mitigatory solutions tested to ensure relevance and uptake of the recommended solutions and training.

In Botswana, project staff are further highly involved in several regional development initiatives. We initiated and chaired a meeting to improve communication and networking between local NGOs to increase efficiency when engaging in community-based monitoring projects. Together with several partners, we are further discussing the potential of commodity-based wildlife-friendly meat trade for future financial self-sustainability of the programme (see Section 3.1).

Through workshops, newsletters, online resources, reports and peer-reviewed literature information about the project continues to be disseminated and handover of know-how and technology to both local stakeholders and the wider public is achieved. We have been successful in showcasing our approach to mitigation of human-lion conflict to international donors and the project has raised considerable interest from several international and national development agencies and government institutions. Training has been provided to institutions from Namibia and Zimbabwe, where parts of the programme have been implemented in three areas since. Furthermore, we were able to secure further funding for the project from international donors and the project has been selected a priority project within the KAZA Carnivore Conservation Strategy (see Section 3 and Annex 1).

13. Darwin identity

The logo of the Darwin Initiative and a link to the DI homepage is being displayed on the WildCRU and Victoria Falls Wildlife Trust homepages (see <https://www.wildcru.org/sponsors/>, “WildCRU sponsors homepage screenshot”, www.vicfallswildlifetrust.org/Wildlife%20Research%20Human%20Wildlife%20Conflict.html, “VFWT homepage screenshot”). The DI has further been acknowledged and the logo has been displayed in presentations, newsletters, reports, on project vehicles, workshop invitations and peer-reviewed publications (see e.g. “Botswana project vehicle_Darwin”, “ChE invitation community meeting Jan18”, “ChE invitation community meeting Mar18”, “ChE invitation community meeting lion_ele May18”, “Certificate Mobile Kraal Construction Workshop”, “CV and Job Application Workshop”, “Invitation lion collaring workshop”, “Miguel et al 2017. Drivers of FMD in cattle”, “Presentation_CBT_Workshop_Gaborone_Feb2018”, “Presentation_CBT workshop_Nov2017”, “Presentation Understanding Lions”, “TKPP Annual Report 2017”, “Understanding Predators Workshop”, “VF Carnivore Conservation Presentation_Parry_26th Oct 2017”, “VF HWC CGs and Mitigation_Dlodlo_Oct 2017”, “VF survey results_Loveridge_Oct 2017”).

14. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2017 – 31 March 2018)

Project spend (indicative) since last annual report	2017/18 Grant (£)	2017/18 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)			4.4	
Consultancy costs			78	Due to permitting issues the expected consultant could not be employed. This work was undertaken by existing staff and costs are therefore

				reflected in the staff cost budget line
Overhead Costs			0	
Travel and subsistence			26	Regional travel was more costly than originally anticipated, hence an overspend of £631 on this budget line
Operating Costs				
Capital items (see below)				
Monitoring & Evaluation (M&E)			0	
Others (see below)				
TOTAL				

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2017-2018

Project summary	Measurable Indicators	Progress and Achievements April 2017 - March 2018	Actions required/planned for next period
<p>Impact</p> <p>Introduction of novel conflict mitigation measures demonstrates to donor community ways to reduce poverty and protect biodiversity by reducing livestock losses, improving food security and reducing necessity to kill predators</p>		<p>Human-wildlife conflict has been reduced and food security improved substantially through novel conflict mitigation measures. These measures continue to be showcased to international and national donors and the concept has been adopted in one additional area in Zimbabwe while additional funding has been secured from international donors.</p>	
<p>Outcome</p> <p>Trial and showcase novel livestock protection strategies that reduce livestock loss, improve crop yields, and food security, increase community engagement in conservation and reduce retaliatory killing of large predators</p>	<p>0.1: Conflict incidents with large predators reduced by 70% from a baseline of 200 predation incidents on average per year in each study area (approx 1250 households in each of 4 sites) by year 3 of project</p> <p>0.2: Number of predators killed in retaliation for livestock loss reduced by 60% by project end (baseline annual mortality rates of lions 0.07 (7%) and 0.10 (10%), reduced to mortality rates of 1-3%)</p> <p>0.3: Predator populations are stable or increasing during project lifetime</p> <p>0.4: Approx 250 households participating in boma project increase crop yield by 30% - 50% (increases of 25% in cob sizes, 25 to 30cm, and number of cobs per plant increased from 2-3 to 3-4 on boma treated sites). Number households on fewer than 2 meals a day (currently 48%) reduced by 80% and those on only 1 meal to zero (currently 6%) by year 3, especially in vulnerable female headed households. 90% of 'boma' households self-sufficient by year 3.</p>	<p>The project is successfully implementing in Zimbabwe and Botswana. Where novel livestock and predator protection strategies are correctly used, human-lion conflict incidences (zero losses in mobile bomas) and retaliation killings of lions (up to 100%) have decreased substantially. Predator populations are being monitored in both countries and currently 132 households participate in the project, of which 11% are female-headed and 12% do not have a working age male. Furthermore, crop yields have shown to increase by at least 50% and we therefore believe that all indicators are still highly adequate to measure the outcome of the project and are confident that, after full introduction of the concept in Botswana in 2018, we will reach our goal of self-sufficiency for 90% of "boma" households and zero households on less than 2 meals a day by the end of year 3 (see Section 3.1 and 3.2 for details and evidence).</p>	<p>Encourage use of mobile bomas to treat additional fields, with special attention to vulnerable households in Botswana. Increase livestock protection and food security through increased crop yields for these households.</p> <p>Introduce stationary predator proof livestock enclosures in areas where additional field fertilization is not needed.</p> <p>Recruit and train 4 additional Community Guardians in Boteti area and Chobe Enclave to increase livestock protection for communities in these areas.</p> <p>Continue to offer training to interested stakeholders and showcase success of the project to international funding bodies.</p>
<p>Output 1.</p> <p>The benefits of lion guardian programme and</p>	<p>1.1: Report published highlighting benefits used by 2-3 development agencies to inform their funding allocations to this and similar concepts by year 3</p>	<p>Considering the continued wide-spread interest in the project, requests for training in the concept from development agencies and communities alike, its uptake in several independent sites in Namibia and Zimbabwe, involvement of project staff in both governmental and private sector development initiatives contributing to the wider benefits of the concept, and the continued success of securing additional funding</p>	

<p>mobile bomas showcased to international development agencies to encourage uptake of the concept at a large scale</p>	<p>1.2: Short video showcasing project seen by 2-3 international development donors and influences their policy choices by end of year 3</p> <p>1.3: Contact made and meetings held with 3-4 international development NGOs and governments by year 3</p> <p>1.4: Awareness raised of project results (through local workshop in year 3) and uptake of the project findings by government agricultural departments.</p> <p>1.5: Findings of the project are reflected in National predator management plans in Zimbabwe and Botswana</p>	<p>(see Section 3.1 for details and evidence), we are confident the output indicators still be adequate to measure success of the project and to achieve Output 1 by the end of year 3.</p>
<p>Activity 1.1 Workshops organised yearly in years 1-3</p>	<p>The annual Long Shields Community and Lion Guardian training workshop was conducted in Tsholotsho (see “2017 Long Shields Guardians Workshop”, “2017 Long Shields Guardians Workshop Agenda”).</p> <p>Boma installation workshops were conducted in each project site in Botswana (see “Boma workshop poster_Khumaga”, “Boma installation report_Khumaga”, “Boma installation report_Khumaga 2”, “ChE Update Report_Oct17”).</p> <p>Two local men from Binga were trained as Lion Guardians (see “Binga LGs training workshop report_June 2017”) and the concept has been implemented in their area. An additional community has been approached in the Chobe Enclave and a lion guardian has been requested by Emanaleni village in Zimbabwe (see “Request for lion guardian_Emanaleni”, “TKPP_HWC_1st Quarterly Report Apr 2018”).</p>	
<p>Activity 1.2 Workshop interim reports written in years 1 and 2 and disseminated to stakeholders and via websites</p>	<p>Workshop reports have been written, summarized in the Trans-Kalahari Predator Programme’s Annual Report 2017 and disseminated to the Botswana and Zimbabwe Governments (see “ChE Update Report_Oct17”, “2017 Long Shields Guardians Workshop”, “Binga LGs training workshop report_June 2017”, “Boma workshop poster_Khumaga”, “Boma installation report_Khumaga”, “Boma installation report_Khumaga 2”, “TKPP Annual Report 2017”).</p> <p>Information on the project is available to the public via the WildCRU homepage (www.wildcru.org/research/tkpp-mitigating-conflict/), the Trans-Kalahari Predator Programme’s Annual Report (see “TKPP Annual Report 2017”) and the Victoria Falls Wildlife Trust homepage (www.vicfallswildlifetrust.org, see “VFWT homepage screenshot”).</p>	
<p>Activity 1.3 Final report written end of year 3 and used to solicit further donor support to roll out concept</p>	<p>Final report will be written in year 3 after all workshops have been organised.</p>	
<p>Activity 1.4 Video material collected throughout project and short video made of project to publicise work to future donors</p>	<p>Two film teams filmed the programme and its impact on rural livelihoods.</p>	

	<p>The concept was presented to theme park designers to potentially be featured in the theme park to increase awareness in the general public (see “Agenda_Santonga Workshop_June 2017”, “Santonga workshop presentation_Kesch”).</p> <p>Information on the project continues to be disseminated through video material on YouTube (“WildCRU A personal message from Professor David Macdonald March 2016”, “WildCRU A personal message from Professor David Macdonald”).</p>
<p>Activity 1.5 Meetings requested in year 3 with key conservation and development donor agencies (e.g. FAO, development banks etc) to publicise the work and solicit further funding.</p>	<p>A two-year funding agreement has been signed with WWF (see “WWF Grant Agreement”). The project continues to be supported by Panthera (see “Grant agreement_Panthera_2017”), African Bush Camps Foundation (see “African Bush Camps_invoice16_17”) and a grant from the Robertson Foundation to WildCRU (see “Robertson funding confirmation_Dr Burnham”).</p> <p>As a priority project of the KAZA Carnivore Conservation Strategy (see “KAZA Carnivore Conservation Strategy_draft_Dec_2017”) additional WWF funding has been approved through the KAZA Carnivore Conservation Coalition (see “KCCC Funding Workshop_Proceedings_Nov2017”, “Email Russell Taylor 04.04.2018”).</p> <p>Funding applications were submitted to the IUCN, European Commission and Biotechnology and Biological Sciences Research Council UK to source additional funding.</p>
<p>Activity 1.6 Awareness of project raised in national wildlife management departments and conservation NGOs to engage support and incorporate findings into national policy in year 3 and throughout project where possible</p>	<p>The project continues to be refined with governmental and non-governmental institutions and affected communities (see “ChE introductory visit_Sep2017”, “ChE Update Report_Oct17”, “Botswana CG project_sociological survey results_Oct 2017”).</p> <p>A meeting was organised for NGOs to improve communication and networking when engaging in community-based monitoring projects (see “Concept Note_Citizen-led monitoring project”, “Summary_Citizen-led monitoring meeting_Feb2018”).</p> <p>The concept was presented at two workshops on the potential of commodity-based predator-friendly meat trade headed by the Botswana Department of Veterinary Services (see “CBT Workshop_Agenda_2017-10-18”, “FebruaryDVSwksp_Agenda”, “Invitation presentation CBT workshop Gaborone”, “Presentation_CBT Workshop_Gaborone_Feb2018”, “Presentation_CBT Workshop_Nov2017”).</p> <p>Information on carnivore conservation, predator survey results and the effectiveness of conflict mitigation efforts were presented to the Victoria Falls village communities in October 2017 (see “VF Carnivore Conservation Presentation_Parry_26th Oct 2017”, “VF HWC CGs and Mitigation_Dlodlo_Oct 2017”, “VF survey results_Loveridge_Oct 2017”).</p> <p>The concept was presented at the Cambridge Student Conference on Conservation Science 2018 (see “SCCS Prog 2018”, “SCCS_3rd_prize_winner”).</p> <p>The project was showcased to several development agencies, wildlife and tourism authorities of Zimbabwe and Botswana, students and foreign safari tourists to increase overall awareness (see “TKPP Annual Report 2017”).</p>

<p>Output 2.</p> <p>Decrease in the levels of human-predator conflict in the study areas implemented through lion guardian programme</p>	<p>2.1: 12 LGs recruited, trained and active in community by end of year 1</p> <p>2.2: Conflict levels decline by 50% by end year 1 and 70% by year 3, from a baseline of around 200 per year in each area, through interventions of LGP and use of mobile bomas.</p> <p>2.3: Data show attitudes of men and women in community to predators and conservation improves against existing baseline attitudinal data by year 3.</p> <p>2.4: Analysis of GPS collar data from 15 lions show that potential problem lions avoid agro-pastoral lands due to LG interventions, starting year 1 with final analysis by year 3.</p>	<p>Where bomas are correctly used, 14 CGs and 21 mobile bomas continue to have a positive impact on human-lion conflict levels in Zimbabwe and Botswana. A strong positive effect through the introduction of mobile bomas in Victoria Falls further demonstrates the effectiveness of the concept. Baseline data on local conflict levels and attitudes towards predators and conservation have been collated and changes can be quantified by year 3. Furthermore, lions seem to react to interventions considering their impact on lion movement behaviour. Even though Botswana CGs will only be active in 2018, experience in Zimbabwe has shown that a significant positive effect of interventions can be expected immediately after introduction of the concept (see Section 3.1 for details and evidence). We are therefore confident the output indicators still hold adequate to measure success of the project and to achieve Output 2 by the end of year 3.</p>
<p>Activity 2.1 Recruit men and women as 'lion guardians' in 4 community areas (Zimbabwe: Hwange Communities, Mvuthu Community (Vic Falls), Botswana: Chobe Enclave and Boteti River, year 1</p>	<p>A total of 14 Community/Lion Guardians (including 2 women) are active in Zimbabwe (see 1st Annual Report). In Botswana, 2 Community Officers have been hired to assist the programme introduction (see "Contract 1_Charlton_Sept2017", "Contract 2_Charlton_Feb2018", "Contract 1_Mubuso_Oct2017", "Contract 2_Mubuso_Nov2017"). In May 2018, the project is planning to recruit 4 CGs in Botswana (including 1 woman), previously identified as suitable candidates (see "TKPP_HWC_1st Quarterly Report Apr 2018").</p>	
<p>Activity 2.2 Provide training in data collection , HWC mitigation methods, etc to 'Lion guardians' in year 1</p>	<p>All Guardians in Zimbabwe participated in the annual training course and are fully trained in GPS, radio telemetry, data collection, report writing, mobile boma management concept and first aid (see "2017 Long Shields Guardians Workshop", "2017 Long Shields Guardians Workshop Agenda"). The Botswana CGs are planned to be trained in June 2018, in collaboration with the Zimbabwe team.</p>	
<p>Activity 2.3 Select communities that will receive mobile bomas (paying special attention to inclusion of vulnerable communities and vulnerable households, ensure the female livestock owner are included).</p>	<p>5 additional bomas have been deployed in Hwange and Botswana (see "Email Lio_Mambanje boma installation and training", "ChE Update Report_Oct17", "Boma installation report_Khumaga", "Boma installation report_Khumaga 2"). The total of 21 bomas are housing 1,570 cattle of 132 families, of which 11% are female-headed and 12% do not have a working age male see "TKPP Annual Report 2017", ChE Update Report_Oct17", "Boma installation report_Khumaga", "Boma installation report_Khumaga 2", "Survey_Vic Falls_Mar18"). 322 cattle were vaccinated against common diseases, 127 cattle were treated for disease and 1058 cattle were treated for preventive tick control (see "TKPP Annual Report 2017").</p>	
<p>Activity 2.4 Provide training in boma management and implement boma rotation schedules for movement of bomas between community crop fields in dry season</p>	<p>39 households associated to the additional bomas have been trained in boma management and implementation of boma rotation schedules (see "Email Lio_Mambanje boma installation and training", "ChE Update Report_Oct17", "Boma installation report_Khumaga", "Boma installation report_Khumaga 2").</p>	

<p>Activity 2.5 Set up monitoring protocols to record conflict incidents, retaliatory killing of predators, predator numbers and trends and collate historical data on these, data recorded throughout.</p>	<p>Monitoring protocols have been continued from previous years and will be introduced in Botswana during training of the recruited Community Guardians in June 2018. Zimbabwe Guardians tracked 553 km of transect, completed 550 herd sightings, recovered and conducted 10 lion deterrence actions (see “TKPP Annual Report 2017”). Around Hwange, 201 heads of livestock were killed by lions (see “TKPP Annual Report 2017”), representing a 58% increase to the previous year, but still a 13% reduction of conflict compared to levels before the pilot project was initiated. The significantly increased number of livestock losses can mostly be explained by 4 orphaned and inexperienced cubs, who killed a significant number of goats (see “Email conversation_Hwange goat kills_Feb18”). Victoria Falls experienced an increase of livestock losses between 2016 and 2017 (see “Email Mr. Dlodlo_06.04.2018”, “Survey_Vic Falls_Mar18”). After the programme was fully introduced into the area, a significant decrease in livestock losses was recorded indicating the success of the mobile bomas. No livestock was killed inside mobile bomas, demonstrating the effectiveness of the enclosures, if correctly used (see “TKPP Annual Report 2017”, “Survey_Vic Falls_Mar18”).</p>
<p>Activity 2.6 Sociologist designs and implements survey to quantify baseline attitudes to predators and conservation, year 1, follow up survey in year 3 to quantify change</p>	<p>29 cattle posts associated to the Kavimba community in the Chobe Enclave and 22 cattle posts associated to the Khumaga community in the Boteti area were assessed for kraal structures and locations, kraaling behaviour, documented herd sizes and patterns of lion depredation. Cattle owners and herd boys were introduced to the concept (“ChE introductory visit_Sep2017”, “Botswana CG project sociological survey results_Oct 2017”). A sociological baseline survey was conducted in Khumaga (“Botswana CG project sociological survey results_Oct 2017”, “Community questionnaire_Botswana”), providing employment for 2 research assistants (see “Contract Charlton_Sept2017_Questionnaires”, “Contract Lister_Sept2017_Questionnaires”) and to be repeated in year 3. Furthermore, sociological baseline information for Chobe Enclave is available from Elephants Without Borders. A Mswana MSc student will investigate temporal human-lion conflict patterns and the effectiveness of the concept (see “Matsoga_Sponsorship Confirmation”).</p>
<p>Activity 2.7 Capture and radio collar 15 lions in the study sites</p>	<p>Since 2017, 12 potential conflict lions were monitored with satellite collared in Zimbabwe and Botswana and additional collaring is scheduled for the dry season of 2018 (see “Survey_Vic Falls_Mar18”, “TKPP_Annual Report 2017”, “TKPP_Darting Permit-lions_Jan 2018”, “Darting report_Boteti Apr 2018”).</p>
<p>Activity 2.8 GPS satellite collars monitored by field managers and communities alerted (via mobile phone app- ‘whatsapp’) when lions approach their area (throughout)</p>	<p>Lion GPS satellite movement data are being monitored and Whatsapp groups have been established in Zimbabwe. In 2017, a total of 286 warning alerts were sent (~1400 warning alerts since we started in 2012, see “TKPP Annual Report 2017”). In Botswana, Whatsapp groups are planned to be introduced after the CG training is complete.</p>
<p>Activity 2.9 Collect, collate and analyse lion GPS data to quantify changes in behaviours due to lion guardian activity (years 1-3)</p>	<p>Preliminary results suggest that lions seem to respond to Guardian interventions in terms of movement behaviour. Age, sex, history of depredation and cub presence</p>

		seem to have a significant influence on individual behaviour (see “Email Ms. Petracca 19.02.18”).
Activity 2.10 Prepare report (1) and publications for peer review (1- 2) showcasing reductions in HWC (year 3)		2 peer-reviewed articles were published (see Annex 3, “Miguel et al 2017. Drivers of FMD in cattle”, “Valls-Fox et al 2018. Wild prey habitat selection dependence on water and cattle”), adding up to a total of 4 published articles since year 1.
Output 3. Decrease in the numbers of predators killed in retaliation for livestock predation contributes to goals of Convention on Biodiversity	3.1: The number of predators killed in retaliation for livestock predation declines by 60% by year 3 of project (mortality rates decline from 7-10% to 1-3% of predator population, approx 25-30 lions to 3-10 lions and similar for spotted hyaena. 3.2: Predator population size in protected areas adjacent to study sites stable or increasing, with current population densities of 3.5 lions/ 100km ²)	A decrease of lion retaliation killings in Zimbabwe project sites of up to 100% is a very encouraging result after the second year of the project and we are hoping to achieve similar results in Botswana, after the concept has been fully rolled out in 2018 (see Section 3.1 for details and evidence). We continue to collect data on predator populations in adjacent protected areas and are very confident to achieve the project outputs by year 3.
Activity 3.1 Collate baseline data on predators destroyed as problem animals against which to measure change over the project (year 1)		Baseline data has been recorded by project scientists in Zimbabwe since 2010 and is continuously being collected by the Botswana DWNP.
Activity 3.2 Record problem animal control incidents at each site throughout project and use this to compare to baseline levels of retaliatory killing of predators (by year3)		Incidents are being recorded continuously in Zimbabwe and through the DWNP in Botswana. In year two, retaliation killings decreased by 71% (2 lions destroyed as problem animals) in our Hwange project sites compared to year 1 (see “Hwange lion mortality 2017”, “Email Jane Hunt Apr18”). In Victoria Falls, retaliation killings decreased by 100% with no lions killed since the programme was fully introduced (see “Survey_Vic Falls_Mar18”). In Botswana, available baseline data will be used to determine changes to levels of retaliation killings starting in 2018.
Activity 3.3 Collate existing survey data where possible (from WildCRU, PWMA, DWNP, conservation NGOs) or run baseline surveys to obtain data on predator populations in year 1		Baseline surveys have been analysed and suggest a total of 90 adult lions in Zambezi Park and Matetsi Safari Area Units 6&7 (see “Predator survey report_Zambezi_Matetsi6&7”). A comprehensive large carnivore survey (200 camera traps) was conducted in Makgadikgadi Pans National Park in Botswana (see “TKPP Annual Report”) and first results will be available in the next reporting period.
Activity 3.4 Survey predator populations (using a spoor transect method) in year 2 and 3 to compare to baseline to show trends		A large carnivore survey was conducted (156 camera traps and spoor surveys) in the Dzivinine and Josavinine areas of Hwange National Park to monitor population dynamics (see “TKPP Annual Report 2017”). First results will be available in the next reporting period
Activity 3.5 Analysis of data on trends in problem animal control and predator populations for peer review and publication (quantity 1, year 3).		Data to be analysed in year 3.
Output 4. Increased crop yields and food security through use of mobile bomas to	4.1: Fifteen volunteer village communities (approx 300 households average of 25 households per village, 6.9 people per household, 10% female headed, 15% with no working age male) in four conflict hotspots	By the end of year 2, 15 village communities (132 households; 11% female-headed, 12% without a working age male) from 5 conflict hotspots have been introduced to the mobile boma concept, with 21 mobile bomas set up and 115 fields fertilized. Due to the results from first year’s cropping season (50% increase in crop yields) exceeding the anticipated 30% increase in crop yields already by year 1 (see Section 3.1 for

<p>fertilise fields highlighted</p>	<p>introduced to the mobile communal boma concept and receive bomas and training by end of year 1.</p> <p>4.2: Crop yields in 'boma treated' fields increases by at least 30% in crop seasons from project year 1 to 3.</p> <p>4.3: Food security, particularly in vulnerable households measurably increased in the approximately 300 households participating in boma project, by project end. Increased crop yield by 30% - 50% (see baselines above) and number households on 2 meals or less a day (currently 48% of households) reduced by more than 80% and reduce to zero number of households on only 1 meal a day (currently 6% households) by year 3, especially in vulnerable female headed households. 90% of 'boma' households self-sufficient by year 3.</p>	<p>details and evidence), we are confident the output indicators hold adequate to measure success of the project and to achieve Output 4 by the end of year 3.</p>
<p>Activity 4.1 Monitoring protocols put in place for crop growing season to measure increases in crop yields through use of mobile bomas to fertilise fields. Randomised, case controlled experiments using standardised seed to compare treated (fertilised via boma) and untreated field sites (wet season of yr 1- 3)</p>	<p>Protocols in place in Zimbabwe. Protocols will be implemented in Botswana as soon as trial bomas have been deployed on crop fields and crops will be planted in the cropping season 2018.</p>	
<p>Activity 4.2 Throughout growing season of yr 1 – yr 3 crops monitored and growth and yields measured (according to above protocol).</p>	<p>115 fields have been fertilised with mobile bomas in Zimbabwe. Associated 95 families have been provided with 240 kg of maize seeds. Crop growth has been monitored throughout the 2017/2018 crop growing season and results will be available in the next reporting period (see "Survey_Hwange_Mar18", "Survey_Vic Falls_Mar18"). Results from the previous crop growing season suggest a 50% increase in crop yields in our Hwange project sites see "Survey_Hwange_Mar18"). In Botswana, protocols will be implemented as soon as first bomas are deployed on fields in 2018.</p>	
<p>Activity 4.3 Survey of households by sociologist to determine change in food security in households in participating village communities at outset and yearly to show increases in food security (with particular attention paid to female headed and vulnerable households).</p>	<p>Surveys in Zimbabwe have been complemented with Botswana surveys (see "Botswana questionnaire survey", "TKPP_HWC_1st Quarterly Report Apr 2018").</p>	
<p>Activity 4.4 Analysis of data on crop yields and improved food security and report written (1) to high these changes for donor community and for peer reviewed publications (1) in year 3.</p>	<p>Data to be analysed and report and publication to be written in year 3.</p>	

Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: (Max 30 words) Introduction of novel conflict mitigation measures demonstrates to donor community ways to reduce poverty and protect biodiversity by reducing livestock losses, improving food security and reducing necessity to kill predators			
Outcome: (Max 30 words) Trial and showcase novel livestock protection strategies that reduce livestock loss, improve crop yields, and food security, increase community engagement in conservation and reduce retaliatory killing of large predators	0.1: Conflict incidents with large predators reduced by 70% from a baseline of 200 predation incidents on average per year in each study area (approx 1250 households in each of 4 sites) by year 3 of project 0.2: Number of predators killed in retaliation for livestock loss reduced by 60% by project end (baseline annual mortality rates of lions 0.07 (7%) and 0.10 (10%), reduced to mortality rates of 1-3%) 0.3: Predator populations are stable or increasing during project lifetime 0.4: Approx 250 households participating in boma project increase crop yield by 30% - 50% (increases of 25% in cob sizes, 25 to 30cm, and number of cobs per plant increased from 2-3 to 3-4 on boma treated sites). Number households on fewer than 2 meals a day (currently 48%) reduced by 80% and those on only 1 meal to zero (currently 6%) by year 3, especially in vulnerable female headed households. 90% of 'boma' households self sufficient by year 3.	0.1: Project conflict incident reports collected over project duration, official predation reports database, analysis of livestock survivorship data published in peer reviewed paper and reports. Perception surveys of men and women in community 0.2: Project and management authority records on retaliatory killing (historical and current). 0.3: Project surveys of predators show an increase against baseline data on populations 0.4: experimental data collected on crop yields published in peer reviewed papers and reports. Comparative photographs in reports to illustrate yield difference. Household surveys of female and male headed households.	Communities are willing to participate in novel livestock husbandry techniques and herd livestock communally. Bomas and field rotation schemes are used correctly. Baseline data on predator populations are available for use. Baseline data on food security made available by local government or can be collated by project.
Outputs: 1. The benefits of lion guardian programme and mobile bomas showcased to international	1.1: Report published highlighting benefits used by 2-3 development agencies to inform their funding allocations to this and similar concepts by year 3	1.1: Published report and information available on WildCRU project website, number downloads logged and analysed by country as part of ME.	The project leaders are able to develop contacts in international development and donor agencies in order to effectively present the concept.

<p>development agencies to encourage uptake of the concept at a large scale</p>	<p>1.2: Short video showcasing project seen by 2-3 international development donors and influences their policy choices by end of year 3</p> <p>1.3: Contact made and meetings held with 3-4 international development NGOs and governments by year 3</p> <p>1.4: Awareness raised of project results (through local workshop in year 3) and uptake of the project findings by government agricultural departments.</p> <p>1.5: Findings of the project are reflected in National predator management plans in Zimbabwe and Botswana</p>	<p>1.2: Project highlighted in local and international press (2 articles per year)</p> <p>1.3: Video available online and sent to donors (downloads logged and analysed as part of ME)</p> <p>1.4: Records of discussions, meetings and contact with donor agencies</p> <p>1.5: Donor agencies approached adopt or fund this and similar concepts</p> <p>1.6: Workshop report and attendance list.</p> <p>1.7: National Predator Management plans and strategies.</p>	
<p>2. Decrease in the levels of human-predator conflict in the study areas implemented through lion guardian programme</p>	<p>2.1: 12 LGs recruited, trained and active in community by end of year 1</p> <p>2.2: Conflict levels decline by 50% by end year 1 and 70% by year 3, from a baseline of around 200 per year in each area, through interventions of LGP and use of mobile bomas.</p> <p>2.3: Data show attitudes of men and women in community to predators and conservation improves against existing baseline attitudinal data by year 3.</p> <p>2.4: Analysis of GPS collar data from 15 lions show that potential problem lions avoid agro-pastoral lands due to LG interventions, starting year 1 with final analysis by year 3.</p>	<p>2.1: Reports on recruitment, Records of training sessions attended by LGs in mitigation techniques.</p> <p>2.2: Conflict incident records database, Wildlife management agency records, monthly lion guardian field reports</p> <p>2.3: questionnaire surveys, project reports and publications.</p> <p>2.4: 'Problem' lions collared and records of interventions kept</p> <p>GPS database on lions analysed to verify avoidance behaviour at short and long term time scales.</p>	<p>Lion guardian programme successfully set up, lion guardians trained and facilitate improved livestock husbandry.</p> <p>Permissions remain in place to collar lions in host countries, ethics committees approve animal handling protocols.</p>
<p>3. Decrease in the numbers of predators killed in retaliation for livestock predation contributes to goals of Convention on Biodiversity</p>	<p>3.1: The number of predators killed in retaliation for livestock predation declines by 60% by year 3 of project (mortality rates decline from 7-10% to 1-3% of predator population, approx</p>	<p>3.1: Project and wildlife management records of legal and illegal retaliatory killing.</p>	<p>Project continues to have access to data on predator populations to add to existing data on historical trends and surveys continue to be undertaken.</p>

	<p>25-30 lions to 3-10 lions and similar for spotted hyaena.</p> <p>3.2: Predator population size in protected areas adjacent to study sites stable or increasing, with current population densities of 3.5 lions/100km²)</p>	<p>3.2: Project reports to management agencies and publications</p> <p>3.3: Ongoing predator population surveys by linked NGOs and WildCRU projects</p> <p>3.4: Analysis and publication by project scientists of predator population trends using existing baseline data</p>	
<p>4. Increased crop yields and food security through use of mobile bomas to fertilise fields highlighted</p>	<p>4.1: Fifteen volunteer village communities (approx 300 households average of 25 households per village, 6.9 people per household, 10% female headed, 15% with no working age male) in four conflict hotspots introduced to the mobile communal boma concept and receive bomas and training by end of year 1.</p> <p>4.2: Crop yields in 'boma treated' fields increases by at least 30% in crop seasons from project year 1 to 3.</p> <p>4.3: Food security, particularly in vulnerable households measurably increased in the approximately 300 households participating in boma project, by project end. Increased crop yield by 30% - 50% (see baselines above) and number households on 2 meals or less a day (currently 48% of households) reduced by more than 80% and reduce to zero number of households on only 1 meal a day (currently 6% households) by year 3, especially in vulnerable female headed households. 90% of 'boma' households self sufficient by year 3.</p>	<p>4.1: Reports of training sessions, logs of community training and meetings kept. LG monthly reports</p> <p>4.2: Crop monitoring data in database for analysis. Data on crop yield experiment (standardised seed and planting in randomised treated and untreated plots) published in reports and peer reviewed literature.</p> <p>4.3: Community survey data quantify savings in time and labour input and benefits in food security felt by households headed by men and women in boma project villages. A particular focus of the survey to be benefits to women in their traditional role in crop husbandry.</p>	<p>Village communities are willing to function as a collective and take part in the mobile boma trial and use the boma correctly and consistently.</p> <p>Care is taken to ensure inclusion of vulnerable households (e.g. female headed households) in village communal boma collective so uptake of scheme is not just by community elites.</p> <p>Crop growing is not adversely affected by external factors (drought, disease etc).</p>

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

- 1.1 Workshops organised yearly in years 1-3
- 1.2 Workshop interim reports written in years 1 and 2 and disseminated to stakeholders and via websites
- 1.3 Final report written end of year 3 and used to solicit further donor support to roll out concept
- 1.4 Video material collected throughout project and short video made of project to publicise work to future donors
- 1.5 Meetings requested in year 3 with key conservation and development donor agencies (e.g. FAO, development banks etc) to publicise the work and solicit further funding.
- 1.6 Awareness of project raised in national wildlife management departments and conservation NGOs to engage support and incorporate findings into national policy in year 3 and throughout project where possible

- 2.1 Recruit men and women as 'lion guardians' in 4 community areas (Zimbabwe: Hwange Communities, Mvuthu Community (Vic Falls), Botswana: Chobe Enclave and Boteti River, year 1
- 2.2 Provide training in data collection, HWC mitigation methods, etc to 'Lion guardians' in year 1
- 2.3 Select communities that will receive mobile bomas (paying special attention to inclusion of vulnerable communities and vulnerable households, ensure the female livestock owner are included).
- 2.4 Provide training in boma management and implement boma rotation schedules for movement of bomas between community crop fields in dry season
- 2.5 Set up monitoring protocols to record conflict incidents, retaliatory killing of predators, predator numbers and trends and collate historical data on these, data recorded throughout.
- 2.6 Sociologist designs and implements survey to quantify baseline attitudes to predators and conservation, year 1, follow up survey in year 3 to quantify change
- 2.7 Capture and radio collar 15 lions in the study sites
- 2.8 GPS satellite collars monitored by field managers and communities alerted (via mobile phone app- 'whatsapp') when lions approach their area (throughout)
- 2.9 Collect, collate and analyse lion GPS data to quantify changes in behaviours due to lion guardian activity (years 1-3)
- 2.10 Prepare report (1) and publications for peer review (1- 2) showcasing reductions in HWC (year 3)

- 3.1 Collate baseline data on predators destroyed as problem animals against which to measure change over the project (year 1)
- 3.2 Record problem animal control incidents at each site throughout project and use this to compare to baseline levels of retaliatory killing of predators (by year 3)
- 3.3 Collate existing survey data where possible (from WildCRU, PWMA, DWNP, conservation NGOs) or run baseline surveys to obtain data on predator populations in year 1
- 3.4 Survey predator populations (using a spoor transect method) in year 2 and 3 to compare to baseline to show trends
- 3.5 Analysis of data on trends in problem animal control and predator populations for peer review and publication (quantity 1, year 3).

- 4.1 Monitoring protocols put in place for crop growing season to measure increases in crop yields through use of mobile bomas to fertilise fields. Randomised, case controlled experiments using standardised seed to compare treated (fertilised via boma) and untreated field sites (wet season of yr 1- 3)
- 4.2 Throughout growing season of yr 1 – yr 3 crops monitored and growth and yields measured (according to above protocol).
- 4.3 Survey of households by sociologist to determine change in food security in households in participating village communities at outset and yearly to show increases in food security (with particular attention paid to female headed and vulnerable households).
- 4.4 Analysis of data on crop yields and improved food security and report written (1) to high these changes for donor community and for peer reviewed publications (1) in year 3.

Annex 3: Standard Measures

Table 1 Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Y2	Y3	Total to date	Total planned during the project
1A	No. people to submit thesis for PhD qualification	1 male, 1 female	1 Zimbabwean, 1 Canadian	0	1		1	2
1B	No. people to attain PhD qualification	1 female, 1 male	1 Zimbabwean, 1 Canadian	0	0		0	2
2	Number of people to attain Masters qualification (MSc, MPhil etc.)	1 female	1 Batswana	0	1		1	1, number expandable if suitable students apply
4C	Postgraduate Diploma in International Wildlife Conservation Practice	1 male	1 Zimbabwean	1	0		1	1, number expandable if students apply
4D	No. training weeks			35			35	35, number expandable if students apply
6A	Community Guardian training	14 male, 2 female	16 Zimbabwean	14	16		16	50
6B	No. training weeks			2	2		4	6
6A	Field-coordinator	1 male	1 Zimbabwean	1	1		2	2
6B	No. training weeks			2	2		4	6
6A	Interviewer training in social science surveys	5 male, 1 female	Zimbabwean	6	0		6	6
6B	No. training weeks			9	0		9	9
6A	Children educational programme		2000 Zimbabwean	1000	1000		2000	3000

	on human-wildlife conflict and conservation							
6B	No. training weeks			6	6		12	18
7	No. training materials			3 comic books			3	3
11A	No. papers published			2	2		4	7
11B	No. papers submitted			1	0		1	
14A	Cecil Summit			1 talk			1 talk	
14A	NGO communication/networking				1 talk		1 talk	
14A	Victoria Falls community presentation				3 talks		3 talks	
14B	State of KAZA Symposium			2 posters			2 posters	
14B	CBT workshops				2 talks		2 talks	
20	No. of bomas to be handed over to host country	16		16 (24,000£)	5 (7,500 £)		21 (31,500 £)	21 (31,500 £)
22	No. permanent field plots and sites to be established and continued			16	5		21	21
23	WWF funding, ABCF funding			50,000 € (WWF), 14,218 USD (ABCF)	210,000 USD (WWF), 2,760 USD (ABCF), 20,000 USD (Panthera)		50,000 €, 246,978 USD	

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)
Drivers of Foot and Mouth Disease in cattle at wild/domestic interface: insights from farmers, buffalo and lions*	Peer-reviewed journal	Miguel, E., Grosbois, V., Fritz, H., Caron, A., De Garine-Wichatitsky, M., Nicod, F., Loveridge, A.J., Stapelkamp, B., Macdonald, D., Valeix, M. (2017)	female	French	Diversity and Distributions	https://www.researchgate.net/publication/315750900_Drivers_of_Foot_and_Mouth_Disease_in_cattle_at_wild_domestic_interface_insights_from_farmers_buffalo_and_lions
Water and cattle shape habitat selection by wild herbivores at the edge of a protected area*	Peer-reviewed journal	Valls-Fox, H., Chamaille-Jammes, S., de Garine-Wichatitsky, M., Perrotton, A., Courbin, N., Miguel, E., Guerbois, C., Caron, A., Loveridge, A., Stapelkamp, B., Muzamba, M., Fritz, H. (2018)	male	French	Animal Conservation	https://www.researchgate.net/publication/322499095_Water_and_cattle_shape_habitat_selection_by_wild_herbivores_at_the_edge_of_a_protected_area

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	Yes
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	No
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	Yes
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	No
Have you involved your partners in preparation of the report and named the main contributors	Yes
Have you completed the Project Expenditure table fully?	Yes
Do not include claim forms or other communications with this report.	