Darwin Initiative: Final 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)*

Darwin Project Information

Project reference	23-018
Project title	Alleviating rural poverty through conflict mitigation and improved crop yields
Host country(ies)	Zimbabwe, Botswana
Contract holder institution	WildCRU, University of Oxford
Partner institution(s)	Victoria Falls Wildlife Trust, Zimbabwe
Darwin grant value	GBP 318,827
Start/end dates of project	01.04.2016 – 31.03.2019
Project leader's name	Andrew Loveridge
Project website/blog/Twitter	www.wildcru.org, www.twitter.com/wildcru_ox
Report author(s) and date	Andrew Loveridge, Kristina Kesch, June 2019

1 Project Rationale

Western Zimbabwe and north-eastern Botswana are agriculturally marginal, with poor soils and rainfall (see map of project sites below). However, livelihoods in rural communities rely precariously on subsistence agriculture, especially crop growing and livestock ownership with median household owning 6-10 cattle and 6-10 sheep or goats (data collected through sociological survey during Darwin Initiative project, Research Ethics Committee Reference No. R53944/RE001). 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.

Map of study sites.
1) Tsholotsho
2) Mabale
3) Victoria Falls, Mvuthu/ Shana area
4) Chobe Enclave
5) Khumaga, Makgadikgadi

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 this project trialled and showcased the effectiveness of novel livestock protection techniques to mitigate impacts of biodiversity and reduce the need of lethal control of globally threatened predators. Specifically we rolled out a lion or community guardian programme in affected communities to alleviate livestock depredation and tested a novel communal mobile boma (livestock enclosure) method to better protect livestock, and when rotated between fallow crop fields, fertilised fields to increase crop yields and improve food security. The project highlights the economic and ecological value of viable predator populations, builds capacity and improves food security for local communities.

2   Project Partnerships

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. 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 course of this project, VFWT has organised, co-ordinated and implemented field work, provided training, organised workshops and disseminated information about DI and the project in their area. The VFWT provides material for project reporting and is assisting in the preparation of reports. The VFWT independently manages 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 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 was considered carefully when key decisions were made by the PI. The relationship between WildCRU and VFWT has been strengthened throughout this project and we will continue working together for this and other projects.

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 2019"). The project works closely with both PWMA regional field staff and national staff at the headquarters in Harare and PWMA continue to provide 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"). We will continue to work very closely with PWMA for this and future projects.

The Government of Botswana's Department of Wildlife and National Parks (DWNP) has been very enthusiastic and supportive of this project and have specifically requested our help in mitigating human-predator conflict. Even though the process of issuance of research permits is was under revision for most of the project period by the Ministry of Environment, Natural Resources Conservation and Tourism (see "MENT Press Release Jan 2017"), the DWNP approved the addition of the project to the current research permit of the Trans-Kalahari Predator Programme in 2017 ("Email Dr. Flyman 12.10.17"). After facing delays during year 1, we were thereby given the necessary permission to fully introduce the programme into Botswana (see "TKPP Research permit 2016-2018", "TKPP Research permit extension 2018-2021"). The Botswana Manager reports on progress of the project to the DWNP on a quarterly basis and local DWNP officers have been instrumental for the introduction of the concept into the Botswana sites (see "TKPP Annual Report 2018", "TKPP Coexistence Quarterly Report Apr 2019"). We will continue to work very closely with the DWNP on this and future projects.

During the course of this project, we have coordinated our activities with the Botswana NGOs Elephants for Africa and Elephants Without Borders 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"). We will continue to work together to increase the overall effectiveness of human-wildlife conflict mitigation in the Boteti and Chobe Enclave areas.

Due to the ongoing suspension on the issuance of research permits in Botswana, sociologist Prof. Alice Hovorka from Queen's University, Canada, has 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. We are further co-supervising and sponsoring a local MSc student with a strong background in sociological sciences (see "Matsoga_Sponsorship Confirmation"), who is studying human-lion conflict patterns in northern Botswana.

The Kavango-Zambezi Transfrontier Conservation Area Secretariat (KAZA Secretariat) has enthusiastically endorsed the project and continues to offer valuable support. Our team members are part of 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"), additional funding for the programme has been pledged (see Section 3.1). We will continue to be active members of the KCCC and are grateful for their support.

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. During the course of this project, 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"). We will continue to engage closely with our target communities and are confident to facilitate rolling-out the concept to additional communities in future.

3 Project Achievements

3.1 Outputs

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

One of the core aims of this Darwin Project was to test human wildlife conflict and conservation interventions and showcase these to encourage wider uptake of successful ideas with the Kavango-Zambezi Transfrontier Conservation Area (KAZA). This has been particularly successful. Namely the use of locally recruited 'lion guardians' to safe guard both people and predators and the introduction of communal mobile bomas to communally herd and protect livestock and at the same time fertilise crop fields and increase crop yields in a part of Africa where people regularly face food insecurity. Throughout the course of the project, it has received a considerable amount of interest from communities and development agencies alike, who are interested to introduce the concept into their areas, showcasing the general acceptance and appreciation the concept receives widely. The project has been featured in several film productions and press articles ("WWF Loewenpatenschaftsbericht April 2018", "SADCSuccessStories2017", with film available at www.facebook.com/pg/SADCStories/). The project concept was show cased at SADC (Southern African Development Congress) and

received considerable attention. The guardian and mobile boma concept has been taken up in three additional areas in Zimbabwe (Save Valley in the southeast Lowveld, Mola in the Nyamynyami Area and Sensengwe in the Binga district, since year 1 (see "Mola Guardian Training report"), with further likelihood of uptake in Namibia ("Letter Kwando Carnivore Project_Feb 2017", "HWC workshop for Save Valley officers_Nov 2016", "ABCF bomas and training Hwange_2016"). Additionally, based on the successes shown by this Darwin Project, WildCRU has been identified as an implementing partner by the KAZA secretariat to undertake further human-wildlife co-existence work in the region (see "Phase III Zimbabwe envisaged projects" and email from Godfrey Mtare, KAZA focal person and TFCA co-ordinator, Zimbabwe entitled "decision making tool ICPs". Successful application for funding under this funding stream could see further project activities funded by the German Development Bank (KfW), via KAZA, demonstrating successful showcasing of project activities.

The project was successful in securing additional funding ("WWF Germany presentation", "WWF Grant Agreement", "Grant agreement_Panthera_2017", "African Bush Camps_invoice16_17", "Robertson funding confirmation_Dr Burnham", "KCCC Funding Workshop_Proceedings_Nov2017", "Email Russell Taylor 04.04.2018", "Arkleton award letter") and to disseminate information on a national and international level through workshops, presentations, reports, online resources and peer-reviewed literature (see "Agenda_Santonga Workshop_June 2017", "Santonga workshop presentation_Kesch", "YouTube - WildCRU A personal message from Professor David Macdonald March 2016", "YouTube - WildCRU A personal message from Professor David Macdonald", "Cecil Summit Programme", "YouTube - WildCRU – Cecil Summit Live Public Outreach", "YouTube - WildCRU - Engagement with the Scientific Community", "CBT Workshop_Agenda_2017-10-18", "FebruaryDVSwksp_Agenda", "Invitation presentation CBT workshop Gaborone", "Presentation_CBT Workshop_Gaborone_Feb2018", "Presentation_CBT Workshop_Nov2017", "VF Carnivore Conservation Presentation_Parry_26th Oct 2017", "VF HWC CGs and Mitigation_Dlodlo_Oct 2017", "VF survey results_Loveridge_Oct 2017", "SCCS Prog 2018", "SCCS_3rd_prize_winner", "Presentation HWC - HWC workshop main camp May 2018", "Presentation – HWC Community Guardians Vic Falls August 2018", "Lions and Vic Falls Town 15th May 2018 VF", "HWC working group meeting 14.09._WildCRU_Kristina", "State of KAZA Symposium Programme", "State of KAZA boma poster", "State of KAZA Long Shields poster", "Poster Maun Research Talks_March 2017", "Presentation Maun Research Talks_March 2017").

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 ("Concept Note_Citizen-led monitoring project", "Summary_Citizen-led monitoring meeting_Feb2018", "CBT Workshop_Agenda_2017-10-18", "FebruaryDVSwksp_ Agenda", "Invitation presentation CBT workshop Gaborone", "Presentation_CBT Workshop_ Gaborone_Feb2018", "Presentation_CBT Workshop_Nov2017", "Summary DWNP meeting 14.8.2018", "Email Kotze 27.08. Update on Hainaveld conflict discussion"). In addition, findings and community conservation needs in relation to livestock protection from carnivores has been incorporated into the Zimbabwe lion strategy (Indicator 1.5, see "Proceedings Zimbabwe Lion Workshop").

<u>Indicators 2.1-2.4 for Output 2: Decreasing levels of human-predator conflict</u>

The project has exceeded its target of 12 community guardians (CGs) and currently includes 16 fully trained CGs (indicator 2.1) and 14 mobile bomas in Zimbabwe and Botswana, protecting the livestock of around 80 families in the Mambanje, Chezhou, Chamabanda, Mansuma, Chiguswi and Mabale areas of the Mabale study site, Victoria Falls site, Khumaga and Chobe Enclave ("Training report CGs VF Aug 2016", "VF Predator Conflict 2009 to 2016 & Guardian Placement", "2017 Long Shields Guardians Workshop", "2017 Long Shields Guardians Workshop Agenda", "TKPP – Zimbabwe training Report_June 2018", "Botswana training itinerary_June 2018", "itinerary_vic_falls workshop 2018"). We recorded no livestock losses from mobile bomas in three years whilst depredation occurred in traditional kraals. On two separate occasions, lions visited the Chamabanda and Mansuma mobile bomas but did not attack livestock protected inside possibly due to the deterrent effect of the opaque canvas sheeting. As a result of both the guardian programme and mobile bomas, around Hwange National Park livestock losses were reduced from 122 ± 29 depredation events annually from 2010-2011 to 40 ± 14 events around Hwange National Park (see Petracca et al. 2019_Ecosphere), where bomas were correctly used and no livestock have been lost inside mobile bomas (Indicator 2.2). Further additional analysis of trends in livestock losses is currently taking place at other sites as part of an Oxford doctoral

thesis (Mr Lovemore Sibanda) and is expected to be available by early 2020. In Botswana monitoring data is only available for one year so trends cannot be assessed at this point in the project, however as the project is ongoing this will be implemented.

Attitudes towards predators and conservation have improved since introduction of the project. Two doctoral studies (to be submitted) have examined the attitudes of people to large predators and both have come to preliminary conclusions that both lion guardians and provision of mobile bomas help to improve people's attitudes to lions. These studies by Mr Lovemore Sibanda and Mr Kim Jacobsen, both Oxford University students supervised by Prof. D. Macdonald and Dr A. Loveridge will submit their theses and accompanying peer reviewed publications in early 2020 (Indicator 2.3) A Motswana MSc student has been recruited to investigate the drivers of livestock predation in more detail in our Botswana project sites ("Matsoga_Sponsorship Confirmation") and this work is ongoing. Doctoral student Ms Laura Perry has undertaken sociological surveys in order to understand the psychology of livestock husbandry practices. This study is currently being written up (see "Darwin Report Sociological Surveys LRP". Analysis of satellite GPS movement data of lions showed that lion guardian interventions seem to influence lion behaviour when applied consistently ("Petracca 2016.Update on Hwange Lion Guardians analysis", Petracca et.al. 2019_Ecosphere). This work is currently in final submission stages to Ecosphere (Indicator 2.4). Four peer-reviewed articles were published or are in advanced stages of acceptance since the beginning of the project (see Annex 5, "Loveridge et al 2017. Bells, bomas and beef steak", "Miguel et al 2017. Drivers of FMD in cattle", "Valls-Fox et al 2018. Wild prey habitat selection dependence on water and cattle", Petracca et al. submitted. The effectiveness of hazing African lions as a conflict mitigation tool: Implications for carnivore management. An additional three manuscripts are due to be submitted within the next few months i) Spatial risk of depredation by carnivores: accounting for livestock distribution (authors: Kuiper, Loveridge et al.) ii) Comparing spatial patterns of lion, hyena, and leopard attacks on different livestock species along a protected area boundary (authors: Loveridge, Kuiper et al. iii) Lions resident along a protected area boundary consistently avoid adjacent village land (authors Loveridge, Kuiper et al.).

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

During the course of the project, lion retaliation killings in Zimbabwe project sites have decreased by 100% ("CG data base") with no lions killed in retaliation in 2018 or 2019 (indicator 3.1). Previously as average of of 3.75 lions were killed a year. It is difficult to ascribe this change unequivocally to our project as the reasons for livestock depredation are complex and influenced by season, lion behaviour and both lion and human sociological factors, however our data suggest that fewer communities are resorting to illegal retaliatory killing than have previously been recorded and this is very possibly due to project activities in the area. (see "Hwange lion mortality 2017", "Email Jane Hunt Apr18"). In Botswana, the programme has only been fully rolled out with lion guardians only starting to record retaliatory killing in 2018. Data suggest this is still a significant problem, with potentially up to 13 lions killed in 2018/2019 in the Khumaga area and 3 in the Chobe Enclave..

Predator population sizes in adjacent protected areas are being monitored continuously and latest camera trap survey results suggest that lion populations are reasonably stable and within expected range for thise sites only surveyed once. Data are from camera trap surveys, analysis using mark recapture software SPACECAP, data given as lions/ 100km2 ±SD.Zimbabwe: Hwange National Park: adjacent to Site 1: 2014: 2.5 ±0.4, 2018 2.3 ± 0.4. Site 2: 2015: 0.9±0.2, 2018: 1.3±0.2. Site 3: 2.3±0.5. Botswana: no surveys were undertaken in the Chobe enclave due, site 4. The closest site to Chobe was Matetsi safari area. 2.8±0.4 and was within the expected range for the area. Makgadikgadi, site 5 had the highest density of lions (5.4±0.5) in populations surveyed for this project despite this population experiencing the highest rates of retaliatory killing. These data are in the process of being prepared for publication.

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

19 village communities in 5 human-lion conflict hotspots across two countries have been introduced to the mobile boma concept. Around Hwange NP (sites 1&2), 94 households with a total of 894 cattle (25.53% female-headed, 10.63% without a working age male) have a total of 11 mobile bomas. installed and are each fertilising an average of 40 fields per year, closely monitored by project staff ("boma maize from chezhou village", "Mr Ndlovu shows some of his boma produce", "Email Lio_Mambanje boma installation and training", "ChE Update Report_Oct17", "Boma installation report_Khumaga", "Boma installation report_Khumaga 2", "ABCF bomas and training Hwange_2016", "Boma installation Mansuma 2, Janiza & Mtshayeli

2016", "Report Victoria Falls bomas_April 2017", "Boma installation Khumaga 1_April 2017").In Zimbabwe, in order to monitor increases in crop yields A total of 900 maize plants were measured at mobile boma treated (n=450) and untreated sites (n=450) from December 2014 to March 2015, and from December 2015 to March 2016 cropping seasons respectively. Plant variables measured were height, number of leaves, stem diameter, length and number of cobs per plant for a period of nine weeks. Findings are that number of cobs, cobs size, plant height, stem diameter and number of leaves all increase on mobile boma fertilised plots compared with untreated plots. All these metrics show that crops are healthier and produce more food for people using this system, which is likely to improve food security. See figure 1 below as an example of increases in number of cobs. Results from monitoring crop growth during the past cropping seasons suggest a 50% increase in crop yields across all project sites, exceeding the originally anticipated 30%. A follow-up sociological survey suggests that food security increased significantly by the end of the project. No households were on only 1 meal a day compared to a baseline of 6%. These data have been analysed by Zimbabwe project manager Liomba Mathe and will be published in a peer reviewed journal.
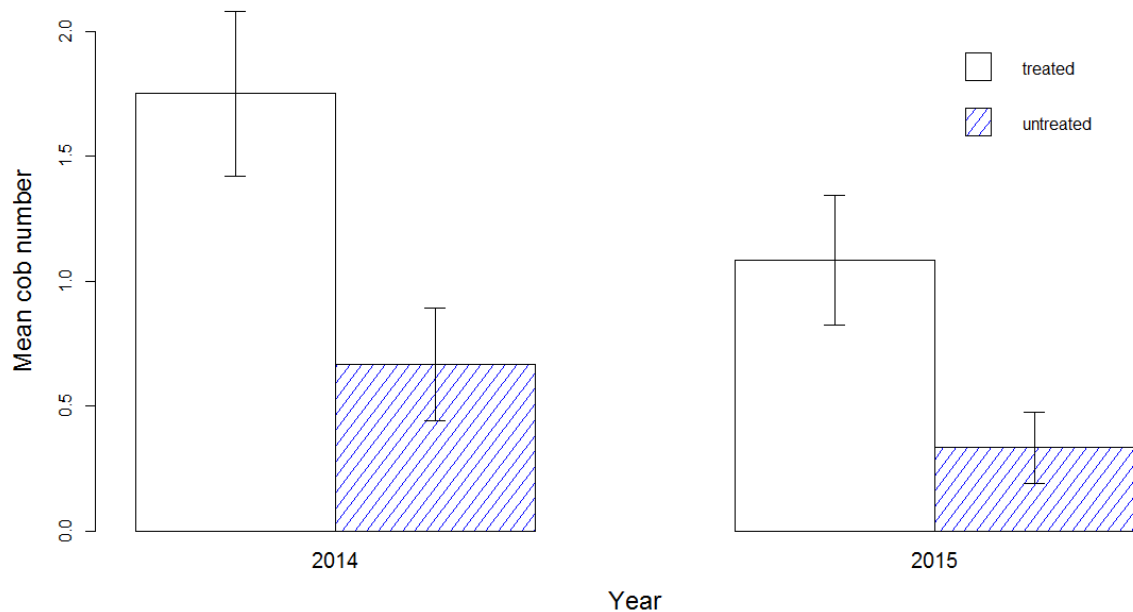

Figure 1: Mean number of cobs (with SE) for 2014 and 2015

Despite initial enthusiasm, this concept has not taken off in Botswana. The four mobile bomas installed have not been rotated to fertilise multiple fields and due to the drought conditions fields have in any case not been ploughed or planted in the wet season cropping period. It seems likely that cultural and sociological factors influence willingness to make use of this kind of novel intervention. In the Khumaga area (site 5) livestock are largely free range and owners do not appear motivated to protect livestock, despite the threat of loss to predators. In the Chobe Enclave 94% of livestock are penned at night and although most bomas were not assessed as being 'strong' livestock losses appear to mostly (61%) be animals left out at night. Lessons learned suggest that in the Chobe area strong permanent bomas would provide the best protection. Mobile bomas were not favoured simply because fields are situated on the Chobe river flood plain and not extra fertilisation is required.

3.2 Outcome

The intended outcome in this project was to 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. This was largely achieved in that the project has successfully showcased the methods of using local 'lion or community guardian programmes (LGPs)' as an interface between communities and conservation authorities and has successfully trialled and showcased the use of communal mobile bomas to both protect livestock and to improve crops yields, both of which were demonstrated to be viable and successful. These aspects of the project have garnered considerable regional interest with uptake of these concepts and ideas in other areas and great interest shown by potential donors and development funds. Where this project has been most effective (in Zimbabwe around Hwange national park, sites 1 and 2), local attitudes to wild

predators are showing signs of improving, though behavioural attitudes are notoriously difficult to change. In this area retaliatory killing of predators has declined (though this often difficult to measure and subject to many ecological and behavioural factors). One possible reason to a high degree of success in these sites is that work was established in this area prior to the project and as such has had a longer period over which to implement change. The project has been less successful in Botswana. Despite support and enthusiasm from the authorities it was initially difficult to gain permissions for the project and this delayed initiation. Sociological, economic and cultural factors differ greatly between Zimbabwe and Botswana. While the community guardian concept has been adopted, locally adapted modes of livestock protection (such as static stockades) may be more appropriate than the mobile bomas, which have been much more readily adopted in Zimbabwe (where people rely more heavily of crop production for food security, as opposed to Botswana where there is an established system of state social security). It clearly difficult to make *a priori* assumptions about uptake of novel concepts across markedly different regional cultures, however it is unsurprising that these differences exist and that willingness to take one new modes of agriculture may differ between communities. This was indeed one of the assumptions identified when originally designing this project.

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

Based on pilot data and experiences elsewhere the introduction of the concept was expected to reduce levels of conflict with predators (particularly lions) by up to 50% in the project lifetime, and potentially by much more in the long term as local people see benefits to adopting more effective and locally appropriate livestock husbandry practices. Consequently we expected that the need for lethal control of large globally threatened predators would decline locally, lessons incorporated into National predator management strategies, attitudes to predators would become less adversarial and recorded levels of retaliatory killing of predators would decline over the project lifetime and long term. Introduction of predator friendly livestock husbandry practices were expected halt decline of predators which are critical and keystone components of ecosystem biodiversity. Viable predator populations in protected areas are valuable national assets that attract tourism and generate valuable sustainable income for developing countries. Given the high impact livestock predation has on communities, particularly vulnerable households, a reduction of 50% in predation incidents through introduction of an LGP represents a significant positive change to direct impacts on livelihoods. Use of mobile communal bomas as novel, labour saving husbandry techniques was expected to encourage more effective livestock protection. We aimed to entirely eliminate livestock loss for households using this technique, with early results suggesting this was feasible if bomas were correctly used. Additionally, fertilisation of fields using livestock in bomas was expected to reduce labour inputs (particularly by women), reduce crop failure and increase crop yields by 30-50% and self-sufficiency for participating families during the project. To ensure long-term and larger scale impacts we aimed to showcase to international development agencies the use of mobile communal bomas for mitigation of livestock predation and improvements to food security.

4   Contribution to Darwin Initiative Programme Objectives

4.1 Contribution to Global Goals for Sustainable Development (SDGs)

As direct benefits, the project aimed 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 aimed 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 a total of around 120 households in the mobile boma concept since 2016 (see Section 3 and Annex 2). Human-predator conflict levels have decreased in sites 1 and 2 with zero livestock lost inside mobile bomas and elimination of in retaliation killings of lions at some sites. Simultaneously, crop production has increased by 50% in participating communities through the use of mobile bomas on fieldsof household experience improved food securityare self-sustained (see Section 3 and Annex 2).

The project further offered full-time employment and training to a total of 16 local villagers as Community Guardians and Community Officers, including 4 women (SDG 5: gender equality, SDG 8: decent work and economic growth), to simultaneously reduce livestock losses while protecting globally threatened predator populations (SDG 15: life on land, see Section 3 and Annex 2).

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 to 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). Through training of development agencies, the project concept has been spread to three additional areas, and we were able to secure further funding for the continuation of the project from international donors (see Section 3 and Annex 2).

4.2 Project support to the Conventions or Treaties (CBD, CITES, Nagoya Protocol, ITPGRFA)

This project primarily supported 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 addressed **in situ conservation** of key elements of biodiversity (CBD article 8) in rural Zimbabwe and Botswana (Indicator 0.3). The project focused on predators (predominantly lions) which are valuable ecologically and economically (through revenues from tourism) but also causing significant damage to rural livelihoods. The programme proved 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 trained 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 2 for details).

The programme's PI was 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 (DWNP) is the body responsible for implementation of international conventions in Botswana. DWNP national and regional staff have continuously been consulted during the past three years and have provided valuable support for the introduction process of the programme and its careful adaptation to local requirements (see Section 3 and Annex 2).

4.3 Project support to poverty alleviation

The project worked to alleviate poverty at different levels. Direct benefits for impoverished rural communities in Zimbabwe and Botswana were felt by households participating in mitigation methods (e.g. mobile bomas, CGs). A total of around 120 households (conservatively 1000 people) benefitted from the project, with CG employment, boma materials, training, set-up and maintenance costs covered through the project. The use of mobile bomas reduced labour inputs (particularly by women) significantly in fertilisation of fields, and increased crop yields by 50%, contributing significantly to local food security (particularly important in vulnerable households). 16 villagers received full time employment and training as CGs and Community Officers increasing capacity and creating employment opportunities 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 aimed to reduce livestock predation incidents by up to 70% in the project lifetime, which would have a significant financial impact, particularly for vulnerable households.

Besides direct benefits to a limited number of villagers in Zimbabwe and Botswana, the real, although indirect, benefit of the project was to showcase methods of reducing livestock loss and increasing food security to the wider conservation and donor community. The project was able to secure further funding from international donors and the concept has been implemented in three additional areas in Zimbabwe. By spreading the concept to additional areas, capacity building and benefits of the programme are accessible to a much larger number of people through a snowball effect beyond the reach of this project.

4.4 Gender equality

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 was on vulnerable households, especially those headed by women and those without a working age male, contributing greatly to gender equality. Across the project, a total of 25.53% % of households participating in the mobile boma concept are headed by women, whereas 10.63% do not include a working age male (see Section 3, Appendix 2, Indicators 0.4 & 4.1). The project particularly focusses on vulnerable households, for which simple improvements to cropping methods and livestock protection 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. The project currently employs 2 female Community Guardians and 1 female Community Officers (see Section 3, Appendix 2, Indicators 0.4 & 4.1).

4.5 Programme indicators

- **Did the project lead to greater representation of local poor people in management structures of biodiversity?**

   The five project sites are each managed by local members of staff, who have been trained through the project. All five staff members will continue to represent their communities and manage their regional Community Guardians and have been invited to present their work on several occasions on national and international conservation management and government level.

- **Were any management plans for biodiversity developed?**

   KAZA Carnivore Conservation Strategy, where this project forms part of a Priority Project and in which WildCRU and our project partners are identified as implementers on funded aspects of the strategy. This ongoing work aligns very closely with this Darwin project's activities which will greatly enhance the legacy of this work.

- **Were these formally accepted?**

   The KAZA carnivore strategy was formally accepted at the end of 2018 and can be access from the KAZA website https://www.kavangozambezi.org/en/publications.

- **Were they participatory in nature or were they 'top-down'? How well represented are the local poor including women, in any proposed management structures?**

  The development of the KAZA Carnivore Conservation Strategy was participatory in so far as that project senior staff are leading a regional working group under the KAZA Carnivore Conservation Coalition and through this contributed significantly to the development of the strategy document. The local communities were represented through the project senior staff.

- **Were there any positive gains in household (HH) income as a result of this project?**

  Income per se is difficult to assess since most households participating in this project rely on subsistence agriculture and are not always part of the formal economy. This project contributed to food security rather than income. Results suggest that improved crop yields in project areas contributed to greatly food security with no households on only one meal a day (project baseline of 6% of households on one meal a day in the project area).

- **How many HHs saw an increase in their HH income?**

  See above.

- **How much did their HH income increase (e.g. x% above baseline, x% above national average)? How was this measured?**

  See above

4.6 Transfer of knowledge

In late 2018, the project leadership, together with project management staff, organized two workshops in Botswana and Zimbabwe, which aimed to inform Government officials from both countries on the outputs of a transboundary landscape scale connectivity model for African lions and its value for conservation planning. The model outputs predict human-lion conflict hotspots in the landscape and prioritize landscape connectivity corridors promoting peaceful coexistence between people and lions through scientifically informed land zonation. During both workshops, the Darwin project was presented to government officials of both countries as an effective human-lion conflict mitigation technique and received much interest. Results of the project have further regularly been featured in various presentations, social media posts, media articles and peer-reviewed scientific publications.

The project has led to several formal qualifications in both developing and developed countries. Two male Zimbabwean site mangers successfully completed the Postgraduate Diploma in International Wildlife Conservation Practice at the University of Oxford. One of the site mangers (Mr Lovemore Sibanda) is in the process of finalising his PhD. In addition, one female American national also successfully finalized her PhD with data generated through the project.

4.7 Capacity building

Throughout the project, local site managers from Zimbabwe and Botswana (3 male, 1 female) have regularly been invited to present the project at various levels, including local park management meetings, District Council meetings, Kavango-Zambezi Transfrontier Conservation Area conservation planning meetings, international lion conservation planning meetings etc. Therefore, their status has increased significantly through this project. Furthermore, due to their training and their efforts to ensure higher safety in their communities, Lion/Community Guardians in both countries (16 male, 3 female) enjoy a higher status in their communities.

5   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 was achieved through employment of local management staff for all projects sites and through the inclusion of 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.

On a transboundary level, the project forms part of a priority project under the KAZA Carnivore Conservation Strategy, which has been developed with considerable participation of project staff.

Project staff are further highly involved in several regional development initiatives in Botswana. We initiated and chaired several meetings 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.

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 and funding has been raised to continue the project after the original Darwin Initiative grant. Training has been provided to projects in other areas. Furthermore, we were able to secure further funding for the project from international donors and the project will continue after Darwin funding comes to an end ensuring that this project continues, including continued employment of project staff.

6 Lessons learned

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 are 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 we highly recommend this approach to any community based projects. 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 120. 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 experienced 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 would like to recommend the development of a training protocol, including a range land management aspect to improve the efficiency of grazing area. 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 expressed limited 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 therefore decided to locally supplement mobile bomas with permanent predator-proof structures. 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.

6.1 Monitoring and evaluation

Key areas of monitoring and evaluation hinged 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 monitored its impact through data collected by field staff and reported on to the Project Managers on a monthly basis. Project Managers monitored progress of the project and conducted first analysis of the data, information which was provided to the PI on a quarterly basis. Through these structures, the PI monitored the project's progress and its impact on provision of training, building capacity and disseminating information. Monitoring and evaluation of these key project components were 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 is ongoing to determine the overall impact of the introduced human-lion conflict mitigation techniques. The evaluation of the overall impact was immensely useful to determine the effectiveness of the concept. Results will be used to continue to improve the concept of this long-term conflict mitigation project.

6.2 Actions taken in response to annual report reviews

All project partners highly appreciate the recommendations received through the review of the 1st Annual Report. As a consequence, we included more details on the management of the project and the training of CGs in the 2nd Annual Report. We further provided more details on progress to achieve the project outputs.

7   Darwin identity

The Darwin Initiative funding for this project formed part of a larger pool of funding from several different donors. However, Darwin funding provided the largest percentage of project funding and the Darwin Initiative has been recognized accordingly. 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", "VFWT homepage screenshot", www.vicfallswildlifetrust.org/Wildlife%20Research%20Human%20Wildlife%20Conflict.html,).
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").

8 Finance and administration

8.1 Project expenditure

Project spend (indicative) since last annual report	Grant (£)	Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Others (see below)				
TOTAL				

Staff employed (Name and position)	Cost (£)
Dr Andrew Loveridge	
Dr Kristina Kesch	
Dr Dominik Bauer	
Dr Jess Isden	
Roger Parry	
Bogani Dlodlo	
Lion Guardians	
TOTAL	

Capital items – description	Capital items – cost (£)
TOTAL	

Other items – description	Other items – cost (£)
Monitoring - Africa Wildlife Tracking services	
TOTAL	

8.1 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
Save Wildlife Conservation Trust	
Panthera	
Robertson Foundation	
Anonymous Donations	
WWF Germany	
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
WWF Germany	
WWF USA	
Lion Recovery Fund	
Anonymous Donations	
TOTAL	

8.2 Value for Money

This project used the allocated Darwin Initiative funds according to expected expenditure in categories anticipated. The project achieved its core objective of showcasing methods of conflict mitigation and at the same time placing livelihoods centrally within the project's aims. Over £ of matched funding was leveraged for this project trebling the investment made by the Darwin Initiative. In addition follow on funding of over £has been raised to continue with project work and will be used to cement the legacy of this project's work. We anticipate that further investment in mitigation techniques and conservation agriculture will be made by major funders in the future, further enhancing legacy and value of the original Darwin Initiative grant.

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Note: Insert your full logframe. If your logframe was changed since your Stage 2 application and was approved by a Change Request the newest approved version should be inserted here, otherwise insert the Stage 2 logframe.

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.

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Outputs:	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.
1. The benefits of lion guardian programme and mobile bomas showcased to international development agencies to encourage uptake of the concept at a large scale	1.2: Short video showcasing project seen by 2-3 international development donors and influences their policy choices by end of year 3	1.2: Project highlighted in local and international press (2 articles per year)	
	1.3: Contact made and meetings held with 3-4 international development NGOs and governments by year 3	1.3: Video available online and sent to donors (downloads logged and analysed as part of ME)	
	1.4: Awareness raised of project results (through local workshop in year 3) and uptake of the project findings by government agricultural departments.	1.4: Records of discussions, meetings and contact with donor agencies	
		1.5: Donor agencies approached adopt or fund this and similar concepts	
		1.6: Workshop report and attendance list.	
	1.5: Findings of the project are reflected in National predator management plans in Zimbabwe and Botswana	1.7: National Predator Management plans and strategies.	
2. Decrease in the levels of human-predator conflict in the study areas implemented through lion guardian programme	2.1: 12 LGs recruited, trained and active in community by end of year 1	2.1: Reports on recruitment, Records of training sessions attended by LGs in mitigation techniques.	Lion guardian programme successfully set up, lion guardians trained and facilitate improved livestock husbandry.
	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.	2.2: Conflict incident records database, Wildlife management agency records, monthly lion guardian field reports	
	2.3: Data show attitudes of men and women in community to predators and conservation improves against existing baseline attitudinal data by year 3.	2.3: questionnaire surveys, project reports and publications.	Permissions remain in place to collar lions in host countries, ethics committees approve animal handling protocols.
		2.4: 'Problem' lions collared and records of interventions kept	
	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.	GPS database on lions analysed to verify avoidance behaviour at short and long term time scales.	

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)	3.1: Project and wildlife management records of legal and illegal retaliatory killing. 3.2: Project reports to management agencies and publications 3.3: Ongoing predator population surveys by linked NGOs and WildCRU projects 3.4: Analysis and publication by project scientists of predator population trends using existing baseline data	Project continues to have access to data on predator populations to add to existing data on historical trends and surveys continue to be undertaken.
4. Increased crop yields and food security through use of mobile bomas to fertilise fields highlighted	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. 4.2: Crop yields in 'boma treated' fields increases by at least 30% in crop seasons from project year 1 to 3. 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.	4.1: Reports of training sessions, logs of community training and meetings kept. LG monthly reports 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. 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.	Village communities are willing to function as a collective and take part in the mobile boma trial and use the boma correctly and consistently. 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. Crop growing is not adversely affected by external factors (drought, disease etc).

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 year s 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 3with 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

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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 year3)

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 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
Impact 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		Human-wildlife conflict has been reduced and food security improved substantially through novel conflict mitigation measures in areas where mobile bomas have been successfully adopted. 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.
Outcome 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.	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 have decreased substantially (by up to 100%) in areas where bomas were adopted successfully by communities. 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 for those households using bomas we we have reached our goal of self-sufficiency for 90% of "boma" households and zero households on less than 1 meals a day 3 (see Section 3.1 and 3.2 for details and evidence).
Output 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	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

development agencies to encourage uptake of the concept at a large scale	1.2: Short video showcasing project seen by 2-3 international development donors and influences their policy choices by end of year 3	funding (see Section 3.1 for details and evidence), we are confident the output indicators were adequate to measure success of the project and to indicate achievement of Output 1.
	1.3: Contact made and meetings held with 3-4 international development NGOs and governments by year 3	
	1.4: Awareness raised of project results (through local workshop in year 3) and uptake of the project findings by government agricultural departments.	
	1.5: Findings of the project are reflected in National predator management plans in Zimbabwe and Botswana	
Activity 1.1 Workshops organised yearly in years 1-3		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").
		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").
		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").
Activity 1.2 Workshop interim reports written in years 1 and 2 and disseminated to stakeholders and via websites		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").
		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").
Activity 1.3 Final report written end of year 3 and used to solicit further donor support to roll out concept		Final report will be written and information disseminated by the project to potential donors.

Activity 1.4 Video material collected throughout project and short video made of project to publicise work to future donors	Two film teams filmed the programme and its impact on rural livelihoods.
	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").
	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").
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.	A follow on one 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").
	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").
	We have raised three years of funding to support Lion Guardians in Zimbabwe from the Lion Recovery Fund (LRF)
	Funding applications were submitted to the IUCNto source additional funding.
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	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").
	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").
	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").
	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").
		The concept was presented at the Cambridge Student Conference on Conservation Science 2018 (see "SCCS Prog 2018", "SCCS_3rd_prize_winner").
		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").
Output 2. Decrease in the levels of human-predator conflict in the study areas implemented through lion guardian programme	2.1: 12 LGs recruited, trained and active in community by end of year 1 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. 2.3: Data show attitudes of men and women in community to predators and conservation improves against existing baseline attitudinal data by year 3. 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.	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. Furthermore, lions can be deterred by hazinginterventions which influences their movement behaviour (See Petracca_et_al. ECOSPHERE). Even though Botswana CGs were only active in 2018 due to delays in gaining permissions, experience in Zimbabwe has shown that a significant positive effect of interventions can be expected (see Section 3.1 for details and evidence). We are therefore confident the output indicators were adequate to measure success of Output 2
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		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 hasrecruited 7 CGs in Botswana (including 1 woman), previously identified as suitable candidates (see "TKPP_HWC_1st Quarterly Report Apr 2018").
Activity 2.2 Provide training in data collection , HWC mitigation methods, etc to 'Lion guardians' in year 1		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 were trained in June 2018, in collaboration with the Zimbabwe team.
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).		Additional bomas have been deployed in Hwange and Botswana bringing the total to 21 (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").
Activity 2.4 Provide training in boma management and implement boma rotation schedules for movement of bomas between community crop fields in dry season	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").
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.	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 in 2017, 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"). To date no livestock have been killed inside the project's mobile bomas.

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"). |
| 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 | 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 herders 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"). Furthermore, sociological baseline information for Chobe Enclave is available from Elephants Without Borders. A Motswana MSc student will investigate temporal human-lion conflict patterns and the effectiveness of the concept (see "Matsoga_Sponsorship Confirmation"). Doctoral student Ms Laura Perry conducted a survey to understand the psychology of livestock |

		protection in the Hwange and Victoria Falls areas (sites 1-3), results of this are pending.
Activity 2.7 Capture and radio collar 15 lions in the study sites		Since 2017, 15 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").
Activity 2.8 GPS satellite collars monitored by field managers and communities alerted (via mobile phone app- 'whatsapp') when lions approach their area (throughout)		Lion GPS satellite movement data are being monitored and Whatsapp groups have been established in Zimbabwe Around 300 warning alerts were sent per year (~1400 warning alerts since we started in 2012, see "TKPP Annual Report 2017"). In Botswana, Whatsapp groups have been established..
Activity 2.9 Collect, collate and analyse lion GPS data to quantify changes in behaviours due to lion guardian activity (years 1-3)		Preliminary results suggest that lions seem to respond to Guardian interventions in terms of movement behaviour. Age, sex, history of depredation and cub presence seem to have a significant influence on individual behaviour (see "Email Ms. Petracca 19.02.18"). Data have been written up and a revised manuscript is awaiting decisions in journal Ecosphere.
Activity 2.10 Prepare report (1) and publications for peer review (1- 2) showcasing reductions in HWC (year 3)		$3 peer-reviewed articles were published (see Annex 3), with additional manuscripts currently being prepared or submitted to journals.
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 (sites 1,2, and 3) of up to 100% is a very encouraging result in 2017 and 2018and we are hoping to achieve similar results in Botswana, after the concept has been fully rolled (see Section 3.1 for details and evidence). Baseline population data has been collected data on predator populations has been collected in adjacent protected areas and analysed.
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 and the project..
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"). No lions were killed in 2018 or 2019 to date. 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 are lacking on retaliation killings of lions, but indications are that significant numbers are killed around Site 5.
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 done in Zambezi Park and Matetsi Safari Area Units 6&7, (site 3/4) Hwange National Park (site 1and 2) and Makgadikgadi pans national park (site 5)been analysed (see section 3, indicators for Output 3 for details of results)
Activity 3.4 Survey predator populations (using a spoor transect method) in year 2 and 3 to compare to baseline to show trends		Predator surveys suggest that population numbers are stable (where trend data are available) or within expected limits for the region.
Activity 3.5 Analysis of data on trends in problem animal control and predator populations for peer review and publication (quantity 1, year 3).		Survey and Problem animal control data have been collected and will be published in peer reviewed journals within the next year
Output 4. Increased crop yields and food security through use of mobile bomas to fertilise fields highlighted	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. 4.2: Crop yields in 'boma treated' fields increases by at least 30% in crop seasons from project year 1 to 3. 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.	By the end of year 2, 19 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. Results from monitoring of crop yields suggests 50% increase in crop yields are possible exceeding the anticipated 30% increase in crop yields already by year 1 (see Section 3.1 for details and evidence), output indicators are adequate to measure progress towards Output 4.
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.		Monitoring have been deployed on crop fields fertilised using mobile bomas to measure yields of and crops planted on these sites compared to controls.

Randomised, case controlled experiments using standardised seed to compare treated (fertilised via boma) and untreated field sites (wet season of yr 1- 3)	
Activity 4.2 Throughout growing season of yr 1 – yr 3 crops monitored and growth and yields measured (according to above protocol).	~40 fields a year have been fertilised with each mobile boma in Zimbabwe. Associated 95 families have been provided with 240 kg of maize seeds. Crop growth has been monitored throughout (see "Survey_Hwange_Mar18", "Survey_Vic Falls_Mar18"). Results suggest a 50% increase in crop yields in our Hwange project sites see "Survey_Hwange_Mar18").
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).	Sociological surveys have been completed in Zimbabwe have been complemented with existing Botswana surveys (see "Botswana questionnaire survey", "TKPP_HWC_1st Quarterly Report Apr 2018").
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.	Data analysed and peer reviewed publication is in preparation (draft can be provided on request).

Annex 3 Standard Measures

We use these figures as part of our evaluation of the wider impact of the Darwin Initiative programme. Projects are not evaluated according to quantity. That is – projects that report few standard measures are not seen as being of poorer quality than those projects which can report against multiple standard measures.

Please quantify and briefly describe all project standard measures using the coding and format of the Darwin Initiative Standard Measures. Download the updated list explaining standard measures from http://darwin.defra.gov.uk/resources/reporting/. If any sections are not relevant, please leave blank.

Code	Description	Total	Nationality	Gender	Title or Focus	Language	Comments
Training Measures							
1a	Number of people to submit PhD thesis	1	Zimbabwe	Male	Evaluation of lion guardian programme and HWC trends	English	Mr Lovemore Sibanda. D.Phil. undertaken at WildCRU, Oxford. To be submitted
1b	Number of PhD qualifications obtained	1	USA	Female	Evaluation of lion guardian interventions	English	Ms Lisanne Petracca
2	Number of Masters qualifications obtained						
3	Number of other qualifications obtained	1	Zimbabwe	Male	Post graduate diploma	English	Mr Liomba Mathe
4a	Number of undergraduate students receiving training	0					
4b	Number of training weeks provided to undergraduate students	0					
4c	Number of postgraduate students receiving training (not 1-3 above)	0					
4d	Number of training weeks for postgraduate students	0					

		Total	Nationality	Gender		Language	
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification (e.g., not categories 1-4 above)	1	Botswana	Female	MSc funded by project, via University of Botswana	English	Ms Tlamelo Matsoga
6a	Number of people receiving other forms of short-term education/training (e.g., not categories 1-5 above)	16	Zimbabwe/ Botswana	Male and female	Lion guardian training	English/ local language	
6b	Number of training weeks not leading to formal qualification	2	Zimbabwe/ Botswana	Male and female	Lion guardian training	English/ local language	
7	Number of types of training materials produced for use by host country(s) (describe training materials)						
Research Measures		**Total**	**Nationality**	**Gender**	**Title**	**Language**	**Comments/ Weblink if available**
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (ies)	0					Participatory process?
10	Number of formal documents produced to assist work related to species identification, classification and recording.	0					
11a	Number of papers published or accepted for publication in peer reviewed journals	3	UK/ Zimbabwe/ France		Bells, bomas and beefsteak: complex patterns of human-predator conflict at the wildlife-agropastoral interface in Zimbabwe Drivers of Foot and Mouth Disease in cattle at wild/domestic interface: insights from farmers, buffalo and lions	English	

						Water and cattle shape habitat selection by wild herbivores at the edge of a protected area		
11b	Number of papers published or accepted for publication elsewhere	0							Location?
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	0							
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	0							
13a	Number of species reference collections established and handed over to host country(s)	0							
13b	Number of species reference collections enhanced and handed over to host country(s)	0							

Dissemination Measures		Total	Nationality	Gender	Theme	Language	Comments
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	3	Zimbabwe/ Botswana. UK				See section 3, indicators for output 1
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	27	Zimbabwe/ Botswana. UK				See section 3, indicators for output 1

Physical Measures		Total	Comments
20	Estimated value (£s) of physical assets handed over to host country(s)	0	
21	Number of permanent educational, training, research facilities or organisation established	0	
22	Number of permanent field plots established	0	Please describe

Financial Measures		Total	Nationality	Gender	Theme	Language	Comments
23	Value of additional resources raised from other sources (e.g., in addition to Darwin funding) for project work	£	Multinational	N/A	NGO an government	N/A	

Annex 4 Aichi Targets

Please note which of the Aichi targets your project has contributed to.

Please record only the **main targets** to which your project has contributed. It is recognised that most Darwin projects make a smaller contribution to many other targets in their work. You will not be evaluated more favourably if you tick multiple boxes.

	Aichi Target	**Tick if applicable to your project**
1	People are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	X
2	Biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	
3	Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	
4	Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	
5	The rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	
6	All fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	
7	Areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	X
8	Pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	
9	Invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	
10	The multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	
11	At least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	
12	The extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	X
13	The genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and	

	implemented for minimizing genetic erosion and safeguarding their genetic diversity.	
14	Ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	
15	Ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	
16	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	
17	Each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	X
18	The traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	
19	Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	X
20	The mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	

Annex 5 Publications

Provide full details of all publications and material that can be publicly accessed, e.g. title, name of publisher, contact details. Mark (*) all publications and other material that you have included with this report

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. web link, contact address etc)
Peer-reviewed journal	Loveridge, A.J., Kuiper, T., Parry, R.H., Sibanda, L., Hunt, J., Stapelkamp, B., Sebele, L., Macdonald, D.W. (2017). Bells, bomas and beefsteak: complex patterns of human-predator conflict at the wildlife-agropastoral interface in Zimbabwe	Zimbabwe/ British	British	male	PeerJ	https://peerj.com/articles/2898/
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). Drivers of Foot and Mouth Disease in cattle at wild/domestic interface: insights from farmers, buffalo and lions	French	French	female	Diversity and Distributions	https://www.researchgate.net/publication/315750900_Drivers_of_Foot_and_Mouth_Disease_in_cattle_at_wilddomestic_interface_insights_from_farmers_buffalo_and_lions
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). Water and cattle shape habitat selection by wild herbivores at the edge of a protected area	French	French	male	Animal Conservation	https://www.researchgate.net/publication/322499095_Water_and_cattle_shape_habitat_selection_by_wild_herbivores_at_the_edge_of_a_protected_area

Annex 6 Darwin Contacts

To assist us with future evaluation work and feedback on your report, please provide details for the main project contacts below. Please add new sections to the table if you are able to provide contact information for more people than there are sections below.

Ref No	23-018
Project Title	Alleviating rural poverty through conflict mitigation and improved crop yields
Project Leader Details	
Name	Dr Andrew Loveridge
Role within Darwin Project	Principal Investigator
Address	
Phone	
Fax/Skype	
Email	
Partner 1	
Name	Roger Parry
Organisation	Victoria Falls Wildlife Trust
Role within Darwin Project	Project Partner
Address	
Fax/Skype	
Email	
Partner 2 etc.	
Name	
Organisation	
Role within Darwin Project	
Address	
Fax/Skype	
Email	

Annex 7 Supplementary material (optional but encouraged as evidence of project achievement)

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.	
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.	
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.	