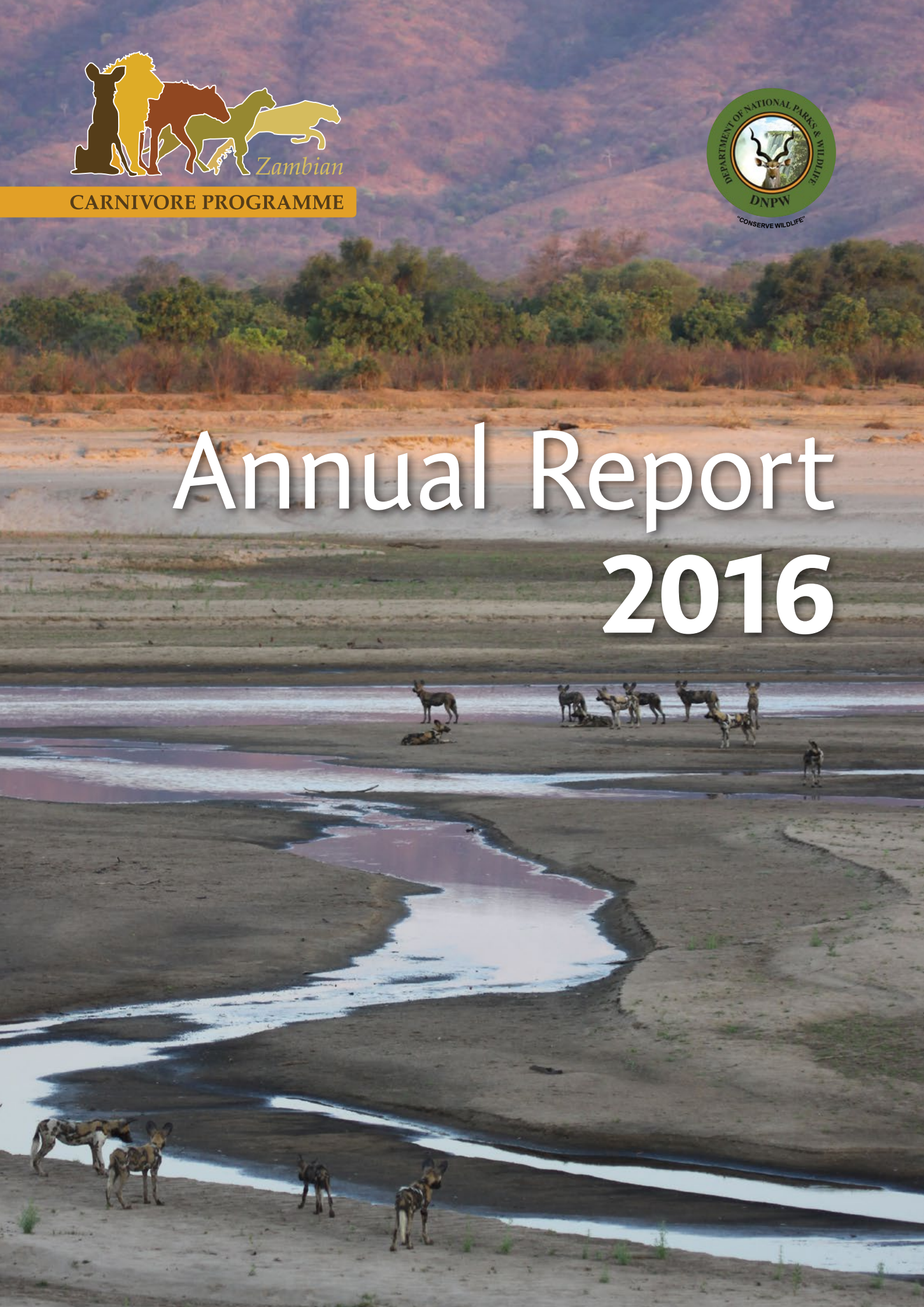
Zambian

CARNIVORE PROGRAMME

DEPARTMENT OF NATIONAL PARKS & WILDLIFE

DNPW

"CONSERVE WILDLIFE"



Annual Report 2016

A litter of four older cubs stops at a pan in Liuwa Plain National Park. With the alarming global decline in cheetah Zambia will be of increasing importance for this threatened species.

Table of Contents

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Zambian Carnivore Programme
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Cover: The Manzi pack, one of several large packs in the ZCP study area, prepares to cross the Luangwa river from South Luangwa National Park and into the Game Management Area. Regular movement across a gradient of protection exposes wild dogs and other carnivores to an array of human threats but also maintains critical connectivity and population exchange for these wide-ranging species. *Photo: Matt Becker*

The Year in Review

Like most everywhere else, the 2016 season had no shortage of challenges and surprises as we continued to conduct our long-term conservation projects across the country in collaboration with the Department of National Parks and Wildlife (DNPW) and an array of local and international partners.

Through work on all the large carnivore species and their prey in three of the Zambia's major ecosystems we continued to provide high quality science-based policy and management guidance not only on these species, their populations sizes, trends and the threats facing them, but also on an array of conservation and management topics including bushmeat poaching, trophy hunting management and human encroachment.

As informed by our research and monitoring work we worked with a diversity of partners to implement a wide spectrum of conservation actions aimed at addressing threats to species and ecosystems. These actions ranged from combatting the bushmeat trade and supporting anti-snaring work, to disease control and poisoning mitigation, to assistance in addressing encroachment, land-use planning, and trans-boundary conservation efforts.

And there were some highlights--in our longest-running Luangwa project we continued to see the fruits of our collaborative efforts by having record numbers of wild dogs and lions in our intensive study area, in the Kafue we continued to add to the known numbers of wild dogs and cheetah in the system, and in Liuwa we had the highest number of cheetahs in our study to date.

While these are small victories in the face of the work that needs to be done, nevertheless they were successes of note.

On the education front we expanded our efforts on intensive programmes by initiating secondary school Conservation Clubs across all sites. We sent multiple post-secondary students to advanced education and training programmes, and successfully graduated a Zambian PhD and Masters student at ZCP institutions in the United States, while committing to the graduate education of two more Zambian students.

Collectively this made sure that 2016 was productive, and perhaps most encouraging was the unprecedented interest and participation by aspiring Zambian conservationists wanting to get engaged in our work. Such a trend was due in no small part to the inspiring leadership and mentoring of our current team, and was best exemplified by one of ZCP's longest running researchers, Thandiwe Mweetwa. Thandi was awarded the prestigious 2016 National Geographic Emerging Explorer Award for her outstanding lion conservation and education work in the Luangwa valley. Her work, and that of so many of our team and partners, embodies ZCP's mission to conserve Zambia's wildlife heritage while inspiring and empowering future generations of Zambian conservation leaders. Such a movement bodes well for the future, despite what challenges await.

On behalf of everyone here thank you again for your support, and we look forward to a successful 2017.

Dr. Matthew Becker
Chief Executive Officer

Our Approach

Background

The Zambian Carnivore Programme is a Zambian-registered non-governmental organization dedicated to conserving large carnivores and the ecosystems in which they reside through a combination of research, conservation and education. ZCP works in close collaboration with the Department of National Parks and Wildlife (DNPW) to accomplish the following goals:

1. To safeguard large carnivores, their prey and habitat in Zambia through research, conservation and education.

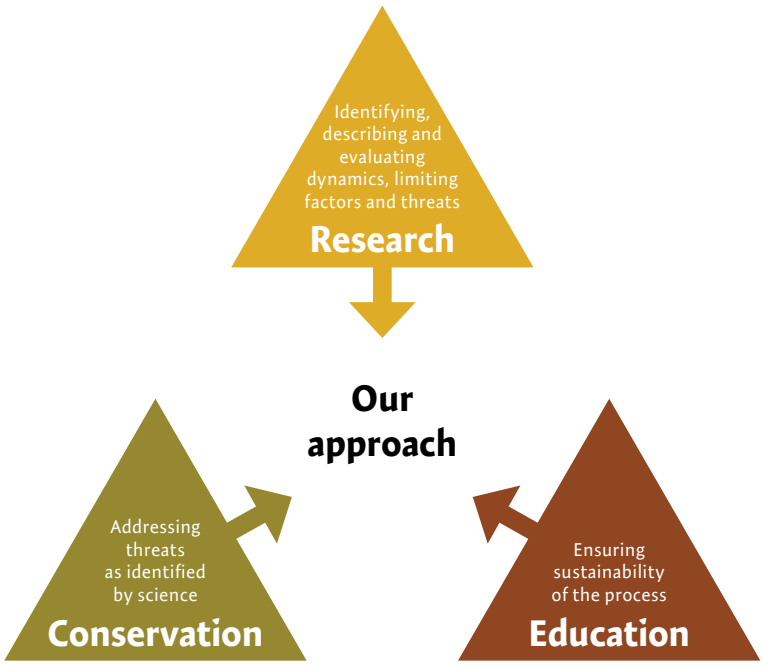
2. To utilize large carnivores and their prey as flagship species for large-scale habitat conservation, which in turn will benefit other species and promote wildlife-based economies.

3. To provide information and recommendations to DNPW and support them in efforts to safeguard wildlife species and ecosystems.

4. To increase knowledge and understanding of large carnivore and large herbivore dynamics and interrelationships and contribute to conservation of these species as a whole.

5. To build capacity within local Zambian organizations and government bodies for sustainable conservation of large carnivores and herbivores, their ecological functions and habitats.

The Zambian Carnivore Programme follows a three-tiered interdisciplinary approach of Conservation, Research, and Education & Capacity Building to fulfill its goal of conserving large carnivores and the ecosystems on which they depend. The success of this work fundamentally rests on our diverse and effective collaborations with local, national, and international partners, agencies, organizations and institutions that collectively provide the expertise, resources and energy to address the myriad conservation challenges facing Zambia.



ZCP researcher Stanley Mwanza radio-tracks in Liuwa. A former conservation club student in Mfuwe, SAWC scholar, and now field biologist and veterinary student, Stanley reflects the comprehensive ZCP mission.

Research

Fundamental to effective conservation is accurate and current information to guide actions and science-based management decisions. Given that very little is known about most of Zambia's wildlife species, research and monitoring programmes are of paramount importance. Identifying, describing and evaluating dynamics, limiting factors and threats to species and ecosystems entails variable scientific investigations, ranging from metapopulation dynamics, genetics, and disease, to predator-prey dynamics, behavioral and landscape ecology.

Conservation

Our conservation initiatives address the immediate threats to species and ecosystems as identified by research, with the goal to reduce current, and help reverse past, negative impacts on large carnivore populations across Zambia. ZCP collaborates with local partners to ensure that threats are addressed in a timely manner, through initiatives ranging from supporting anti-poaching and land-use planning work to species reintroductions, to mitigating human-wildlife conflict and reducing disease threats from domestic animals.

ZCP/CSL veterinarian Dr. Mwamba Sichande (L) and ZCP Researcher Henry Mwape treat a wild dog badly snared in the mouth.

Kafue Project Manager Caz Sanguinetti explains carnivore conservation work to students visiting Treetops Camp in the park.

Education & Capacity Building

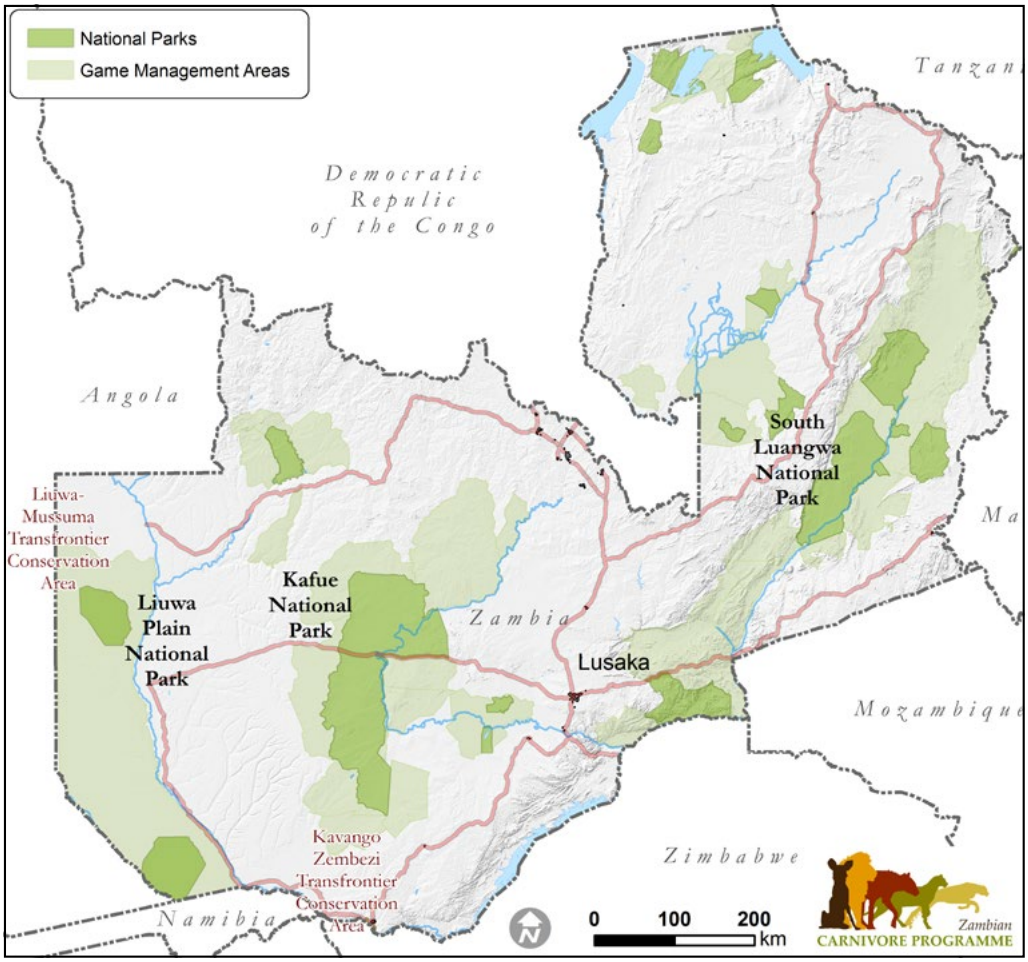
Too often the sustainability of research and conservation efforts is compromised because local communities are not effectively involved. We undertake a comprehensive multi-level approach to help ensure sustainability by training, educating, sponsoring, and employing young Zambian wildlife professionals from the secondary school level through to international graduate programs. Collectively, this helps to ensure that Zambia's best and brightest have the opportunity to contribute their talents to wildlife conservation now and into the future.

ZCP Study Areas

The Zambian Carnivore Programme's work centers primarily in three main ecosystems, namely the Luangwa Valley, Greater Kafue Ecosystem and Greater Liuwa Ecosystem.

All of these areas consist of a matrix of national parks and Game Management Areas (GMAs), which collectively comprise the majority of Zambia's large carnivore populations and are part of three Transfrontier Conservation Areas (TFCAs).

The Luangwa Valley contains the country's largest lion population and second-largest wild dog population; Greater Kafue contains Zambia's largest populations of wild dogs and cheetah and second largest lion populations; and Greater Liuwa contains recovering populations of all carnivores and important populations of cheetah and wild dog as well as Africa's second-largest wildebeest migration.



Land classifications of ZCP study areas in the Luangwa Valley, Greater Kafue and Greater Liuwa ecosystems.

Field Reports

Luangwa Valley

African Wild Dogs

The reporting period continued to see increasing numbers of wild dogs, with the highest numbers ever recorded in our study area. The 2007 Action Plan for African Wild Dogs estimated a total of fewer than 150 dogs for the whole of Eastern Zambia; however we continued to document record numbers of wild dog packs (13) and identified over 170 individuals in our intensive study area (<3,000km^2), despite continued and severe snaring problems in the Lupande and Lumimba Game Management Areas that continued to severely impact dog populations.

Three packs denned in the Main Safari Area of South Luangwa National Park in 2016, making dog sightings a daily occurrence for tourists. Intensive and collaborative anti-snaring work between ZCP, Conservation South Luangwa (CSL) and the Department of National Parks and Wildlife (DNPW) contributed significantly to the increase in wild dogs by minimizing snaring by-catch mortality through an array of anti-snaring work facilitated by being able to monitor and de-snare dogs via aerial and ground radio-tracking of collared packs and dispersing groups. The GMAs, where many dog packs resided, continued to provide evidence that such areas were functioning as demographic sinks to the dog population given the abundance of snares relative to the park, and the decreased

Pups from the Manzi pack, currently the largest pack in the Luangwa study area, denned in the heart of the main safari area in 2016 and the pack was seen almost daily by tourists. Current dog numbers make Luangwa a premiere destination for dogs.

The Manchesa pack of Lupande GMA attends to their new litter of pups. Because the probability of encountering a snare is much higher in the GMAs, intensive monitoring of these packs via radio-tracking of collared dogs has enabled these packs to survive, reproduce and populate additional packs with dispersers.

survival and pack longevity in the GMAs as a result. In addition in the reporting period we continued work on predation risk effects by beginning more intensive work on lion and wild dog interactions given lions are the major source of natural mortality for wild dogs and these interactions coupled with human impacts can significantly impact wild dog populations.

Lions

Similar to wild dogs, lion numbers continued to be at their highest recorded numbers for the study area. We identified and monitored 222 lions in 21 prides and 17 coalitions in our intensive study area. Substantially more males, cubs and subadults were present in the population, and there was higher survival across these age classes prior to that observed before the 2013-2015 hunting moratorium. While these data require more rigorous analysis a recent and significant increase in lions is clear. How these trends will be affected with the resumption of hunting with significant reforms in 2016 is a key question to be addressed with future work in collaboration with the DNPW.

In addition to ongoing lion work we published an important paper with DNPW Ecologists on the sustainability of lion trophy hunting entitled *"Assessing the sustainability of African lion trophy hunting, with recommendations for policy"*. The paper revisited the age-based harvesting recommendations derived from complex models in an abundant and stable lion and prey population in the fully protected Serengeti, but used standard matrix population models for a lion population experiencing strong human impacts in the form of snaring, prey depletion and human encroachment, i.e. the Luangwa study population. Such populations are representative for lions across their remaining range in Africa and typically consist of a strictly protected national park surrounded by buffer zones wherein hunting is permitted. Our results demonstrated that age-limits for harvesting should be increased to 7-8 years old, that age-based harvesting alone was insufficient without low quotas, and that periods of recovery significantly enhanced sustainability. Such findings emphasize the need for hunting to be part of a package of interventions for heavily human-impacted lion populations, with increased attention to prey depletion and poaching and other stewardship activities in the GMAs to reduce source-sink dynamics that often make hunting overly-reliant on park lions.

We also contributed to a paper entitled *"Aging traits and sustainable trophy hunting of African lions"*, published in Biological Conservation. The paper took data from known-age populations across Africa and evaluated aging characteristics consistent across populations, with a recommendation of over 7 year old males. We continued our demographic data collection on lions during the reporting period, the first in 4 years during which hunting occurred, and graduate student Thandiwe Mweetwa is expected to publish her analyses in 2017 on the impact of the ban on lion demography, which is expected to be significant.

The famous Luangwa male coalition Ginger and Garlic, whom ZCP has followed since they were cubs as part of the long-term lion demography work.

Lion cubs from the Big Pride. Lion numbers in the ZCP study area are at their highest in recent history following a three year moratorium on trophy hunting, significant changes to current hunting management, and intensive anti-snaring work.

A leopard and cub in SLNP. Densities of park leopards indicate it is a definite stronghold but substantially lower densities of leopard and their prey in the GMAs indicate strong impacts of poaching and prey depletion.

Similar to wild dogs, lions also were impacted by snaring by-catch and we worked to minimize such losses through collaborative anti-snaring work with CSL and DNPW which to date has had significant demographic impacts (see Conservation section below).

Leopards

We continued to conduct camera-trap based surveys of leopards and their prey during the reporting period and produced our first scientific paper on leopards with the publication of our 2012–2015 camera trap data entitled *"Effects of a protection gradient on carnivore density and survival: An example with leopards in the Luangwa Valley, Zambia"*. The study documented very high densities of leopard in the national park, but an over 70% decrease in density across into the GMA. Survival rates did not significantly differ but the probability of snare occurrence increased 5 fold across this gradient, making the probability of prey depletion lowering the carrying capacity very likely.

In addition the idea that leopard density is negatively impacted by lions was evaluated and we found no support for this given both species occurred at their highest densities in the same areas. Additional analyses of human and ecological factors influencing herbivore density and distribution are currently underway to further address the growing threats to ecological networks in Zambia. These data were provided to the Department of National Parks and Wildlife (DNPW) to accompany joint recommendations on leopard hunting (given leopard hunting began again in 2015).

Leopard work will continue to also evaluate the impacts of trophy hunting and other human impacts on populations in the study area.

Herbivores

Given the anthropogenic impacts on herbivores through poaching, encroachment and other activities, ZCP continued its studies of ecological and anthropogenic factors affecting herbivore abundance and distribution across a gradient of protection in the SLNP and surrounding GMA with both continued analysis of our existing data and with our first of two ground transect surveys throughout the Luangwa study area. We completed all analyses of the existing transect data and are currently finalizing this for publication. Analyses continued to demonstrate strikingly different densities of herbivores in the GMA relative to the national park, likely owing to bushmeat poaching, particularly snaring, being elevated in the GMA. Continued evaluation of this protection gradient impact and the impact of prey depletion on carnivores is the major focus of herbivore work for the near future.

We also continued to conduct long-term demographic studies of the geographically isolated Thornicroft's giraffe population through intensive mark-resight photographic methods to assist in informing conservation efforts for threatened giraffe populations.

A zebra grazes in the Luangwa's Nsefu sector. An array of human-impacts on zebra and other herbivores make evaluations of protection gradients across protected area networks critical for conservation.

Greater Kafue Study Area

Wild dogs

Improved aerial support, road access, communications and collaborations with lodges, guides and a continuing partnership with DNPW and Panthera's cheetah programme enabled monitoring of 16 packs and 127 dogs in 2016, with 39 pups recorded.

Average pack size was smaller than 2015 but the number of dispersing groups increased, with numerous dispersals recorded within the intensive study area and throughout the Greater Kafue. We also recorded the longest dispersal to date in the Kafue system with members of the Konkamoya pack of southern Kafue traveling over 100km north to form a new pack in the Chunga area. Collectively this demonstrated strong connectivity in the ecosystem and a large area.

Nevertheless snaring by-catch and road kills of wild dogs continued to pose major threats to the population (see conservation section below), with significant numbers of dogs snared and killed on the high-speed roads through and alongside the national park and dogs getting regularly snared in both park and GMA packs.

One of the most significant accomplishments was the addition of the 27 dog Tateyoyo pack into the intensive study population. Found on the M9 highway following the death of a pup by a vehicle, the pack was collared by ZCP and successfully denned during the reporting period. Given the dangers posed to this large pack from roadkill and snaring, ZCP will be working closely with partners to mitigate these human impacts on Kafue's wild dog population.

Dogs in the Musekese pack playing during a hunt. Additional collaborations with partners and stakeholders in Kafue have greatly improved our knowledge of Kafue wild dog dynamics.

The Tateyoyo pack feeds on a puku kill along the M9 highway. As the largest pack in the area these dogs are particularly susceptible to both roadkill and, given their proximity to high snaring areas, snaring by-catch mortality. In combination with partners ZCP will continue to intensively monitor this pack and work to mitigate these threats for dogs and wildlife in general.

Cheetah

We continued long-term studies and the collection of important data on Kafue's cheetah population in collaboration with DNPW and Panthera during 2016, intensively studying cheetah populations in the north and collaboratively monitoring them elsewhere in the GKE through sightings and photographs from tourists and operators. We intensively followed several collared coalitions while concurrently evaluating threats to cheetah and their habitat.

We continued to document wide-ranging movements of cheetah throughout the ecosystem and as with wild dogs also documented cheetah regularly crossing highspeed roadways such as the M9, making roadkills of cheetah an additional threat to this population. With the new partnership between ZCP and Panthera's Cheetah Programme in Kafue collaborative landscape scale cheetah conservation work was greatly enhanced, particularly given Kafue's link to the Kavango-Zambezi Transfrontier Conservation Area (KAZA).

In 2016 we collectively monitored 29 cheetah in the Greater Kafue, of which 13 were new to the study. Cubs belonging to three separate family groups from 2015 successfully dispersed from their mothers in 2016 and continue to be monitored as they range over large areas typical of dispersing cheetah searching for new territories and mates. With the assistance of a citizen science programme involving guides, operators and tourists' photos, new cheetah continue to be detected and monitored and data will continue to provide valuable information on demography, dispersal and habitat use throughout the GKE and in Zambian KAZA.

The Sausage Tree coalition of cheetah hunting in northern Kafue. Like many of the male coalitions these cheetah range widely in the ecosystem.

Two of four Moshi cubs hunt in Northern Kafue.

A young female from the Busanga Plain's Papyrus pride feeds on a freshly-killed lechwe. These species and other mid-sized antelope again comprised the main diet for Kafue lions.

Lions

Continuing the intensive research and monitoring work begun by the Kafue Lion Project in 2011, we followed 14 prides and 9 coalitions comprising 92 individuals in the Northern Kafue during the reporting period, while also expanding efforts into Musekese and the Chunga area in concert with work on wild dogs and cheetah. Six prides were recorded with cubs with a total of 17 cubs documented in 2016.

Pride sizes continued to be small and relatively invariant from prior years, with an average of approximately three adults and subadults per pride, while mean coalition size was 1.7 males. Kamasot pride on the Eastern side of the Kafue river was the largest pride with 12 animals and multiple breeding females. Several prides located in the center of the study area ranged widely through an area heavily frequented by fishing camps, potentially bringing them into conflict and exposure to high snaring risk. Similarly several of the prides on the Plains were infrequently sighted during the reporting period coincident with an apparent increase in poaching, particularly wire-snaring activity, in many areas of their range. We documented new male coalitions in the study area which initiated mating with resident prides.

Prey selection continued to consist primarily of mid-sized antelope such as puku, potentially contributing to the small pride sizes observed.

A Lufupa pride female stalks prey during a hunt.

Leopards

We continued our camera trap-based work on leopard and other large and mid-sized carnivore species during the reporting period, collecting additional seasons of data for estimation of leopard density and for evaluation of the effects of environmental and anthropogenic variables on leopards, their competitors and prey. In addition we will utilize continuing collaborative work with Panthera and DNPW in the coming seasons to evaluate herbivore and carnivore densities across protection gradients in the Greater Kafue using these techniques.

Herbivores

The reporting period saw the completion of two collaborative herbivore studies with the DNPW. Long-time researcher, former DNPW Head of Veterinary, and Kafue project co-manager Dr. Wigganson Matandiko completed his Ph.D. dissertation at Montana State University under Dr. Scott Creel. His study, entitled "Factors affecting the size and distribution of large herbivore herds in Kafue National Park, Zambia", utilized three years of ground-based transect surveys, conducted three times a year across a large portion of Northern Kafue National Park. The work entailed counting the herd sizes and compositions for all herbivores detected, analyzing these data using distance sampling methods, and evaluating what ecological (habitat, soils, predation, etc.) and anthropogenic variables (roads, camps, encroachment, etc.) were most influential. Given the very low densities of most herbivore species only 4 species had adequate data to estimate densities and herd sizes, and these species were all influenced by a complex array of factors, but differed in the composition of these factors. Similarly we completed analyses of DNPW walking transects for herbivores throughout Kafue National Park, finding strikingly different patterns of density and the factors affecting these densities across the different regions of the park. Both studies are slated for publication in 2017.

A roan antelope in Kafue National Park. The Kafue has the highest diversity of antelope of any park in Africa but increasing human pressures threaten these populations and the carnivores depending on them.

Lastly we continued intensive studies of two main antelope species in our study area with radio-collared female puku and impala researched for the second year to determine range, behavior, survival and reproduction in combination with ongoing large carnivore studies.

Lechwe herds in the Busanga Plains. Different ecological and human factors affect the distribution and abundance of the various herbivore species in the Greater Kafue.

A female cheetah and her four cubs feed on a kill. Intensive studies of cheetah have enabled collection of detailed survival, reproduction, diet and ranging data critical to evaluating the dynamics of this recovering population.

Greater Liuwa Study Area

Cheetah

The reporting period was excellent for cheetah as we continued to collect considerable demographic, spatial and ecological data through monitoring of 15 cheetah in four different groups, including three breeding females with cubs. Cub survival was relatively high, as was adult female survival, but unfortunately we lost the lone collared male of the study when he was killed in a poacher's snare. Cheetah diets continued to consist primarily of small antelope such as oribi, with wildebeest and scrub hare continuing to be important.

We also completed a study on cheetah responses to hyena and lion competitors in Liuwa with a study published in Ecology and Evolution entitled *"Spatial and temporal avoidance of risk within a large carnivore guild"*. The study found that cheetah, unlike wild dogs (see below), were able to co-exist with hyena and lion through a combination of temporal and dietary niche partitioning; cheetahs hunted more during the daytime (versus the nocturnal patterns of hyena and lion) and preyed more on oribi and duiker (versus wildebeest) to reduce competition between these larger and more dominant competitors. These findings also emphasize the importance of alternative prey species diversity and recovery, particularly the small antelope species, to allow for continued recovery of Liuwa's cheetah.

Three dispersing subadult cheetah killing a subadult wildebeest in Liuwa. While wildebeest comprise important components of their diet, small antelope such as oribi and duiker are the primary prey items and may help cheetah avoid competition with hyena and lions. However these small antelope are patchily distributed and subject to human impacts.

To help determine the status and distribution of Liuwa's cheetah and the extent of connectivity in the Liuwa-Mussuma TFCA, we completed a genetic population estimation of cheetah using detection dogs, entitled *"Using Dogs to find Cats: Detection dogs as a survey method for wide ranging cheetah"*, published in the Journal of Zoology. Conducting a survey across 2,432 km2 of national park and GMA in Liuwa we determined an effective population size of up to 18 individuals. Cheetah occurred out of the park in key connected areas for the TFCA, but in limited numbers, making protection of these areas high priority. Additional information on cheetah

population sizes and trends is still needed for the TFCA and will continue to be collected as the number of intensively studied animals in the Liuwa population increases. The survey was the first utilization of detection dogs in Zambia, following several years of development by the Department of National Parks and Wildlife and ZCP, and the success of the study has led to the acceptance and implementation of detection dog teams across the country for use in combatting the illegal wildlife trade.

Hyena

We continued to collect substantial demographic and ecological data on Liuwa's most abundant and dominant carnivore during the reporting period. Given that spotted hyenas typically share ecosystems with large numbers of their primary competitor, the lion, collaborative work on hyena demography in Liuwa not only provides management guidance for ecosystem recovery, given hyena effects on their prey and competitors (see below), but also key insights into the dynamics between lion and hyenas in a lion depleted system.

Such natural experiments are not typically possible in established ecosystems and provide an excellent opportunity to evaluate the dynamics of these two top carnivores, particularly as Liuwa changes and lions increase. As ecosystems continue to experience unprecedented rates of human-induced change and disturbance to lion populations in particular, these insights are of high conservation significance.

As part of Liuwa Project Founder Jassiel M'soka's graduate work we completed the first demographic analysis of hyena, with a paper in the journal Biological Conservation entitled *"Spotted hyaena survival and density in a lion depleted ecosystem: The effects of prey availability, humans and competition between large carnivores in African savannahs*". Studying 5 clans and over 260 hyena the study demonstrated high survival and reproduction, likely owing to high levels of prey, low numbers of lions and minimal human-carnivore conflict. While hyena typically do not receive much positive attention relative to their dog and cat counterparts, these findings provide strong evidence of management success in Liuwa, with carnivores recovering and tracking the abundant prey populations.

Hyena work continued during the reporting period as we intensively monitored five main clans comprising 186 individuals. Survival and reproduction was again high, especially relative to several prior years of drought, and we recorded 35 cubs, making over 450 animals in the database. These demographic data coupled with diet and spatial data will provide critical information as to carnivore impacts on prey populations, competing species such as cheetah and wild dogs, and the impacts of lion recovery on Liuwa.

Given some of the northern clans in the study area have many individuals disappear from the study area during the dry season, additional work slated for 2016 was to broaden carnivore work in the north given these range shifts, the importance of Upper West Zambezi GMA, and the likely effects of climate change shifting wildebeest range.

A hyena tends to her cub at a communal den in Liuwa. Hyena survival across all sex and age classes is extremely high, indicative of a growing population and a management success as the carnivores in Liuwa recover and likely track the abundant prey populations (M'soka et al. 2016).

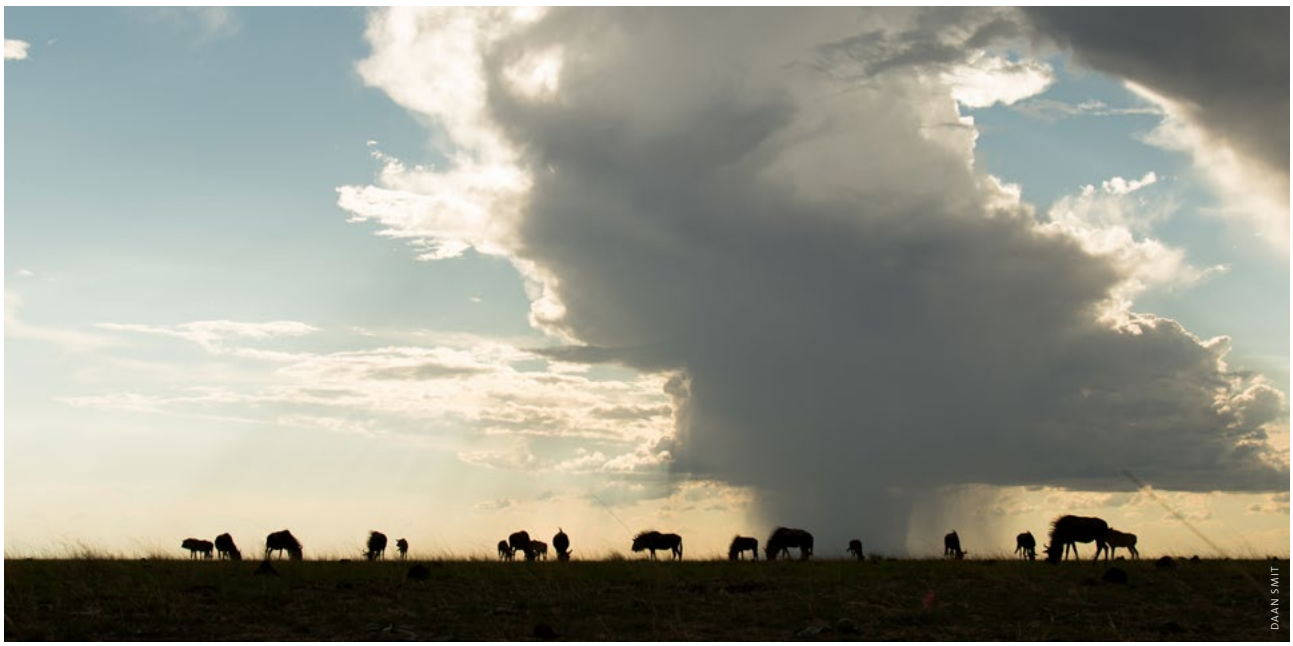
Lion

The reporting period saw the transition of Liuwa's three lion cubs into subadults as well as the birth of two more cubs into the pride. With two females hunting and a rapidly growing number of individuals in the pride, the impact of Luiwa's lions on the preybase and their competitors will only continue to increase as the species continues to reclaim its ecological role. With the maturation of the subadults, Liuwa now has three breeding females and four females overall, but is in need of a pride male. After intensive deliberation it was decided to source an additional male of similar age from the Greater Kafue Ecosystem which would be bonded with the current male and eventually breed with the females. An appropriate male was sourced from Mushingashi Conservancy in the Kafue area by DNPW, African Parks and ZCP. This male was successfully bonded with the existing subadult male in a boma within Liuwa for several weeks before being released in late 2016 as the next step in Liuwa's lion recovery. This combined with the birth of two new cubs in September has increased the lion population to eight.

Wild Dogs

Wild dogs continued to be absent from the main study area during the reporting period as they have been since the natural dissolution of the Sausage Tree pack in 2014 and since the documentation of a rabid domestic dog in late 2014 that attacked hyenas in the Lone Palm clan and was subsequently killed and tested by ZCP staff and found to be rabies positive. This combined with additional, albeit questionable, reports of rabid wild dogs by Liuwa communities indicate that disease continues to pose a major threat to wild dog recovery in Liuwa (see Conservation Section below). This urgently necessitates the continuation of vaccination programmes for domestic dogs and enforcement of land use plans mandating vaccinated dogs and no more than 2 dogs per household in the park. Local communities west of the park informed and directed ZCP to a wild dog den that had been used in 2015, indicating wild dogs are still in the Greater Liuwa ecosystem despite these challenges.

Additionally during the reporting period we completed an analysis of spatial and temporal avoidance in the large carnivore guild, specifically avoidance of lion and hyena by wild dog and cheetah. The paper was accepted in the journal Ecology and Evolution and was entitled *"Spatial and temporal avoidance of risk within a large carnivore guild"*. Wild dog exhibited spatial and temporal avoidance of lion and cheetah temporal avoidance, but all species preyed heavily on wildebeest, making avoidance through prey niche partitioning difficult given the simple preybase currently in Liuwa. In grassland systems wild dog populations can often go locally extinct due to intense competition from lions and hyenas; thus the small Liuwa dog population, in a high density hyena population and a simplified preybase with regular outbreaks of rabies, does not bode well for wild dog persistence without strong management intervention to mitigate these threats and maintain wild dog population recovery.



Wildebeest and Ecological and Human Drivers of Keystone Species

Given that wildebeest are the keystone species for the Liuwa-Mussuma Transfrontier Conservation Area (LMTFCA) and their historical range helps delimit the boundaries of the TFCA, the overall intent of ZCP's long-term wildebeest work is to determine the factors limiting wildebeest recovery, as well as to guide and evaluate changes in management, ecological factors and human factors, and their impacts, coincident with ecosystem recovery efforts. Under African Parks Zambia (APZ) management, the wildebeest population increased from an estimated 15,000 animals to 46,000 over the period 2003-2013. It was unclear however whether the population would be expected to continue growing, what sort of carrying capacity could be expected, what limiting factors and threats there were and of those, which could be managed, and what factors determined wildebeest movements and migration, or lack thereof. This collaborative study was therefore launched to address the near complete absence of any demographic or spatial data on the second largest wildebeest migration in Africa in order to inform and guide recovery efforts for this keystone species and the ecosystem at large.

In order to address these questions ZCP initiated an intensive study of adult female wildebeest (as per standard wildlife population studies) in May 2012. These animals have formed the basis of ZCP wildebeest studies during the life of the project and have provided a wealth of information on this keystone species' dynamics, threats, and conservation actions needed to protect the viability of the LMTFCA. ZCP's applied research and conservation activities are largely focused on identifying, evaluating and addressing the human and ecological factors shaping/driving wildebeest migration, recovery and population dynamics within the LMTFCA as well as the dynamics of the carnivore populations and competing herbivore species. This information is absolutely critical to guide the first conservation plan for an ecologically unique, intact migratory wildebeest population, about which little is known. Our science-based guidance will therefore play a central role in the protection of this unique ecosystem, spanning both Zambia and Angola.

Demography

We continued our demography work on a study population of approximately 40 wildebeest cows and their calves. Survival was relatively similar to past years and over 100 group counts of collared

A hyena clan feeds on a adult wildebeest kill. As the most abundant predator, the impact of hyena predation is very significant and is likely to vary with increasing lion populations and diversifying prey populations.

wildebeest (allowing for estimating herd sizes, cow:calf ratios and composition) were accomplished nearly every month. Our aging methodology based on toothwear was completed and submitted for publication, which will allow for us to effectively assess the impact of predation, poaching and environmental variables on survival and reproduction.

Spatial patterns and factors driving migration
We continued to collect extensive movement data from collared cows as well as nutritional and environmental data. While the 2014-15 rainy season was extremely dry, the 2015-16 rains were slightly better and the herds largely remained in the south. Continued analysis of fecal samples from wildebeest herds indicated that nutrition is very high in Liuwa wildebeest, and is highest just before calving. This provides further evidence that wildebeest are unlikely to be food-limited versus predation-limited, consistent with our data on survival and predation. Migration up into the dry season range began in June and analyses evaluating the drivers of movements are expected to be completed shortly.

Carnivore Demography, Predation and Competition: Through ongoing intensive carnivore studies we were able to collect demographic data on all carnivore species, as well as their prey preferences and diet selection. Ongoing intensive predator-prey work continued to provide key data on predator diets (over 1000 kills), with wildebeest being the primary prey species for all predators aside from cheetah, and an important prey item for all species. The fact that Liuwa is a simplified prey base with all carnivores predating wildebeest, means continuing recovery efforts to diversify and increase the herbivore prey base will not only reduce competition between carnivore species, but also decrease the predation impact on wildebeest populations.

A wildebeest cow and newborn calf. Understanding the ecological and human factors driving spatial patterns and migration is critical to restoring populations of wildebeest and their large-scale transboundary movements.

Poaching
We have documented significant wildebeest poaching throughout the course of the study, particularly snaring, which appeared to increase in the study area in the dry season, but reduced with the onset of the rains. As part of the demographic analyses we are currently evaluating the impact of poaching on wildebeest recovery and expect to complete it during the reporting period. The impacts of poaching, the factors driving it, and the links with strong land-use planning are all likely to be critical in the conservation of the Liuwa-Mussuma TFCA.

Genetics and Loss of Connectivity
It is unclear to what extent the Liuwa-Mussuma wildebeest population was shared between Zambia and Angola, and given we have no documentation of transboundary migration at present we are determining the extent of relatedness between populations through genetics. With a grant through ZCP collaborators at Northern Michigan University, we have nearly completed the first genetic description of the blue wildebeest, using tissue samples from darted individuals and over 100 carcasses from predated animals. This work will enable ZCP to provide the baseline genetic information on this species and the GLE population's diversity, as well as how closely related it is to Angolan populations (when samples are available), and how recent the losses of diversity, connectivity and relatedness may be.

Resource or "Bottom-Up" Limitation and Risk Effects of Predation
Given that large herbivores are regulated by an array of 'top-down' or predation-related factors and 'bottom-up' or resource-related factors, we continued to look intensively at bottom-up factors potentially driving wildebeest survival, reproduction and migration. We utilized fecal samples from herds to evaluate nutrition, primary productivity (see spatial section above) as well as vegetation samples and data on flooding, fire and habitat to assess nutritional factors influencing wildebeest. In addition, predators also affect ungulates through changes in behavior, habitat selection, nutrition and ultimately fitness; these effects of predation risk are easily misinterpreted as 'bottom-up' effects.

Consequently, the distribution of ungulates and their behavior is expected to be sensitive to the local density of predators and to attributes of the environment that affect the likelihood of predation. During the reporting period we completed our final year of the ongoing National Science Foundation work on predation risk

effects with wildebeest work to evaluate these factors (see predation above) with analyses ongoing. We successfully published our first herbivore paper in the African Journal of Ecology entitled *"Ecological and anthropogenic effects on the density of migratory and resident ungulates in a human-inhabited protected area"* that looked at the densities and distributions of wildebeest, zebra and oribi and found differing human and ecological drivers, and significant risk effects of humans.

We also submitted a paper on the relationship between direct predation and predation risk effects across the entire suite of large carnivores and their three main prey, in the journal Ecology, entitled *"The relationship between direct predation and antipredator responses: a test with multiple predators and multiple prey"*, one of several analyses expected from our work that will evaluate the strength of predation risk effects in large mammal systems and the impacts of these dynamics on ecosystems.

Addressing Climate Change

The impacts of climate change are unknown but likely to have serious impacts on flood-driven ecosystems like Liuwa. We therefore utilized the wildebeest work to continue fecal sample collections as part of our work evaluating the potential impacts of climate change on wildebeest and other herbivores.

Fecal cholorophyll is an index of primary productivity in plant communities utilized by herbivores. Primary productivity can strongly drive temporal and spatial patterns of species like wildebeest, and subsequently drive ecological interactions.

It is also a key methodology for studying climate change in heavily seasonal environments like Liuwa, and products from this study will be analyzed in concert with products on spatial patterns of wildebeest, with work expected to expand to our other systems in Zambia.

ZCP Liuwa researcher Stanley Mwanza scans for collared wildebeest amongst the herds as part of the long-term wildebeest study.

Conservation Action Reports

Conservation actions are guided by our research findings, and in 2016 ZCP collaboratively addressed an array of threats to large carnivores, their prey and the ecosystems they reside in, as well as the country's wildlife-based economies.

Combatting Snaring Deaths in Carnivores: The Importance of Radio-Collared Carnivore Groups

Our collaborative research and monitoring work has demonstrated severe impacts of snaring on carnivores and their prey, both through prey depletion and through snaring bycatch on the carnivores themselves. Fundamental to addressing snaring bycatch impacts on carnivores, particularly wild dogs and lions, is the ability to monitor populations of resident packs, prides and dispersers. Regularly locating animals that can range over thousands of square kilometers requires a full-time, year-round field effort and an intensive collaring effort to ensure that groups have individuals with a radio-collar to enable effective relocation and tracking.

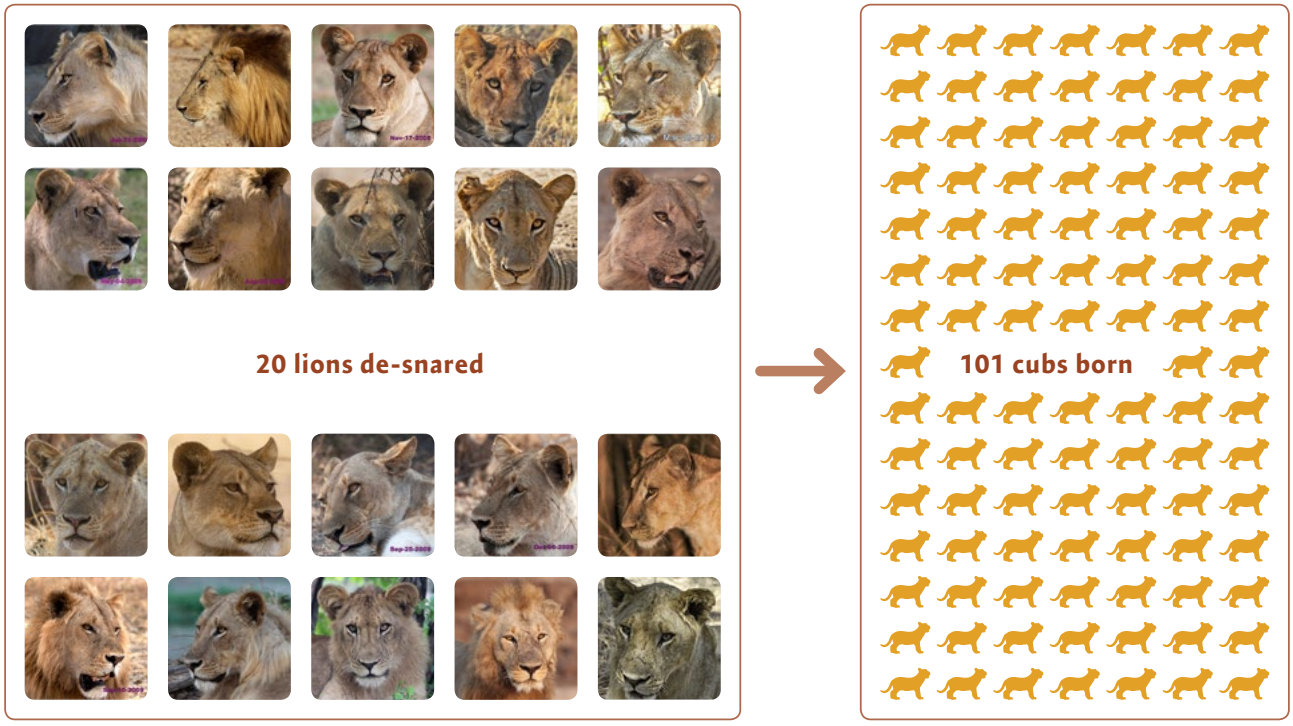
We are now at the point in the Luangwa where we can effectively evaluate the impact of these collaborative de-snaring operations on the demography of these threatened species. For lions our de-snaring work has resulted in substantial numbers of lions remaining on the landscape. The results are even more dramatic for African wild dogs in the Luangwa, with record highs of wild dogs in our study area, even after approximately 10% of dogs were snared in 2014 and the largest study pack had 60% of adults and yearlings snared at one point, and has now populated 5 additional packs with dispersers.

Snaring by-catch was similarly high in Kafue and Liuwa as well during the reporting period, perhaps owing to the unusually low rainfall in the preceding wet season. The addition of ZCP Kafue vet Dr. Kambwiri Banda substantially helped our ability to mitigate snaring by-catch in the Kafue ecosystem particularly by providing us a full-time field presence able to respond to snared animals both when they are opportunistically sighted and in the course of full-time monitoring of collared prides, packs and coalitions.

Dr. Kambwiri Banda--ZCP's full-time field-based wildlife veterinarian in Kafue—treats a badly-snared lion in the Busanga Plains.

Despite extremely high numbers of wild dogs snared in 2014, ZCP's collaborative work on radio-collared packs and groups has directly contributed to the highest numbers of wild dogs on record the last 3 years in the Luangwa.

Population effects from snared lion rescues



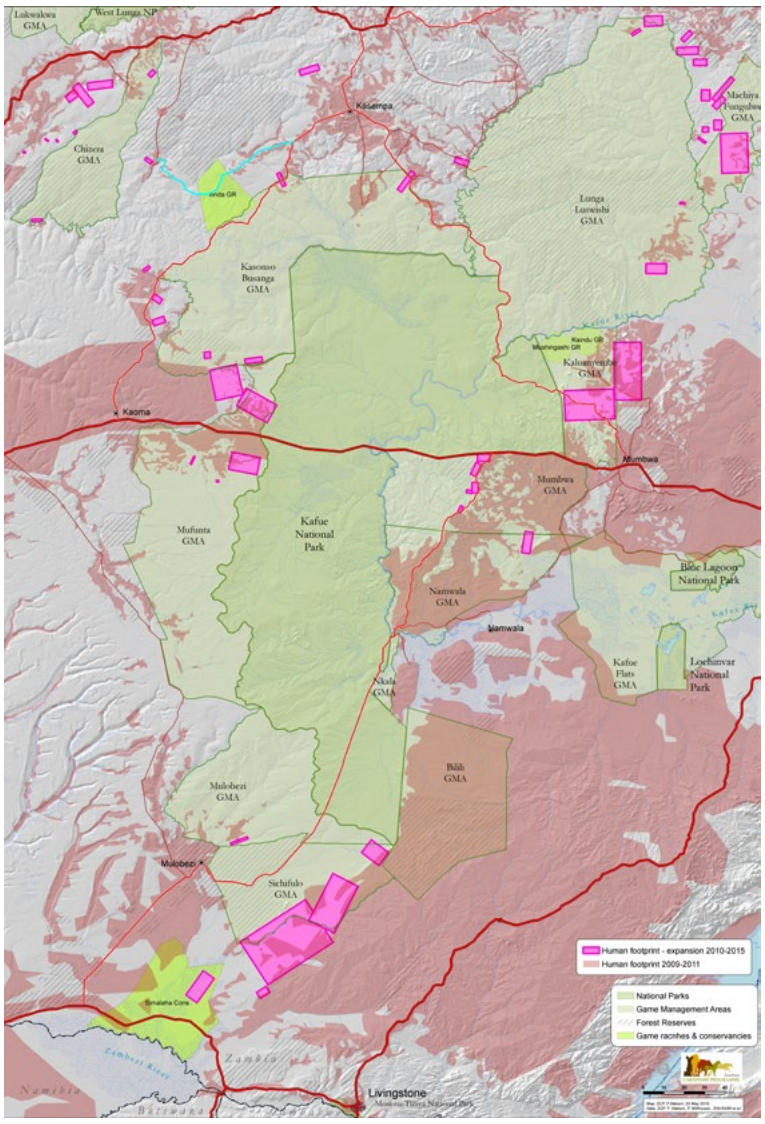
Demographic impacts of de-snaring on lions in the Luangwa. Such collaborative work is greatly facilitated by radio collars allowing for frequent detection and monitoring of prides and desnaring.

An example of the demographic impacts of de-snaring on wild dog populations in the Luangwa.

10% of dog population snared in 2014.

Dogs from this pack have created 5 new packs in South Luangwa.

Dispersing dogs have reached North Luangwa, Luambe, and Lukusuzi National Parks and multiple GMAs throughout Eastern Zambia.



Human encroachment analyses in the Zambian portion of the KAZA TFCA urgently demonstrate the need for preserving connectivity between the Greater Kafue and the rest of KAZA before it is lost.

Transfrontier Conservation, Human Encroachment and Land-Use Planning

Given the relation between encroachment, poaching, and problems with GMA management and effectiveness, land-use planning is a high priority for ZCP to be collaboratively involved in, both to provide government and communities science-based evaluations of current trends and patterns of land-use and human demographics in these protected area networks, and in providing outreach and information on effective practices and conservation models.

Our encroachment analyses continued during the reporting period with a near completion of a country-wide encroachment analysis of trends across all protected area networks, evaluating the rates and patterns of land use and human demography. These data have and will be utilized in land-use planning for GMAs and Transfrontier Conservation Areas (TFCAs) throughout the country. Our data is currently utilized in two main TFCAs in Zambia, namely the Kavango-Zambezi (KAZA) and the Liuwa-Mussuma. We attended multiple meetings for TFCA planning in 2016 for both areas and assisted in Greater Kafue work as part of the Kafue Carnivore Coalition, a subgroup of the KAZA Carnivore Coalition comprised of government, ngo, business and community representatives working together to garner support for conservation of Zambian KAZA. In addition our analyses continued in Liuwa, while encroachment data has been used in several ongoing analyses of herbivore density and distribution throughout the Kafue.

The Kavango-Zambezi (KAZA) Transfrontier Conservation Area is the world's largest remaining population of African wild dogs.

Roads

Encroachment analyses continue to demonstrate a strong association with road development, necessitating the need for land-use planning to mitigate impacts on wildlife and wildlife-based economies.

However, in addition to these impacts highspeed roads through the Kafue in particular also indicate a serious threat of highway mortalities from vehicle collisions on carnivores. Since 2013, 11 Wild Dogs, 5 Leopard, 2 Hyena, 2 Cheetah and 1 Lion have been killed by traffic collisions along the M9 highway (data primarily from DNPW and GRI). Of these, 1 Cheetah, 2 Wild Dogs, 3 Hyena and 1 Leopard were reported in 2016.

This year we have fitted radio-tracking collars on two dog packs, one Lion pride, and two Cheetah coalitions, whose home ranges span across the main road in an effort to better address mitigation measures for highway fatalities on carnivores and their prey.

The Pontoon pack pauses on the M9 highway in the Kafue during a morning hunt. This highspeed road results in significant roadkill of dogs and other wildlife and there is an urgent need for mitigation of wildlife mortalities caused by traffic collisions.

Disease Control and Mitigation with Domestic Animals

Domestic dogs are often the primary source of disease transmission to wild carnivores, and also pose human health threats from rabies and other diseases when not vaccinated. Given rapid growth in human populations it is imperative to implement disease control measures focused on domestic animals given the difficulties in vaccinating wild populations.

We continued our vaccinations, spaying and neutering programmes of domestic dogs and cats in Mfuwe through Dr. Sichande's office while also conducting field-based work in the more remote chiefdoms, particularly in the Mwanya area, where we worked with communities to promote better husbandry of domestic dogs to avoid both predation by lions and disease transmission between these species. Collectively this work lessons the risk of catastrophic disease outbreaks but is need of continuation and expansion throughout the other study areas.

A ZCP-CSL mobile outreach and vaccination campaign in the Mwanya area of South Luangwa aimed at reducing lion-domestic dog conflict

Dr. Mwamba Sichande at his clinic in Mfuwe.

Members of the Poisons Training Workshop demonstrate how to safely and effectively collect samples from poisoned carcasses in an effort to combat poisonings.

ZCP/CSL Wildlife Veterinarian Dr. Mwamba Sichande attends to five lions of the renowned Big Pride suspected to be poisoned from feeding on an elephant carcass in South Luangwa National Park. An initial 20-hour effort by DPNW, ZCP and CSL, followed by a week of continued treatment and monitoring, averted a catastrophe given the pride numbers nearly thirty lions and the two famous male lions, Ginger and Garlic, were also present at the carcass. While successfully averted this time, poisoning is rapidly increasing in frequency and impact in Zambia's protected areas.

Female 245, a badly poisoned pregnant female (3rd from bottom in the photograph above) with her new cubs that miraculously were carried to term.

Addressing Poisoning: A new and emerging threat to Zambia's wildlife

Poisoning is rapidly becoming one of the major threats for wildlife in Africa. While previously not significant for Zambia, over the past three years there has been an increasing trend of suspected poisoning events surrounding elephant and birds.

Consequently a Poisons Training Workshop was hosted in July at CSL base by Endangered Wildlife Trust's Andre Botha. Hosted by CSL, staff from ZCP, DPNW (WPO's and investigators) and FZS also attended. The intention of the workshop was to provide training and preparation for poisoning incidences. This was extremely fortunate as a poisoned elephant carcass, with most of the Big Pride of lions and the famous Ginger and Garlic male coalition, was found a poisoning catastrophe averted due to the combined efforts of DNPW, CSL and ZCP.

Poison continues to pose a serious threat to wildlife in Zambia however and much more work needs to be done to address it.

There is increasing evidence of illegal trade in carnivore skins and body parts in the Luangwa and Kafue.

Wildlife Crime and Illegal Trade in Carnivores

While much of the current wildlife crime in Zambia focuses on ivory and bushmeat, there is increasing evidence across our study sites of a trade in big cat skins and other parts. Trade in leopard skins occurs in Zambia, but very little is known about the extent and severity of it. Similarly the trade in lion bone has been suspected but not reliably documented and skins are also traded.

However, given that the Luangwa and Kafue are strongholds for both species and both poaching and regulated hunting of cats provide ready sources of skins and bones, determining the extent of trade and addressing it are of key importance. In addition cheetah and lion skins likely from Greater Kafue were recovered from poachers by DNPW and GRI/Wildlife Crime Prevention Project (WCPP) in 2016, also indicating a potential trade in this threatened species.

An ongoing partnership between DNPW, Conservation South Luangwa, Working Dogs for Conservation and ZCP allowed for initiation of training of the DNPW/CSL detection dog unit on leopard and lion skins, bones and other parts as well as cheetah skins. The detection dog team conducts searches at roadblocks, airports and other routes and hopefully this training will increase the ability of the government and partners to combat trade in carnivores.

Given that carnivore populations are wide-ranging and low-density to begin with, impacts from emerging carnivore trades may not be detected without intensive ongoing monitoring, further emphasizing the importance of ZCP's long-term carnivore projects in addressing the impacts of illegal wildlife trade in these species. We will continue to work together with partners to better understand and address this threat.

Cheetah skins and a lion skin seized from poachers north of Kafue National Park.

Capacity-Building and Education Reports

Primary School and Secondary School Education

Former Conservation Club Students from the local Mfuwe community in South Luangwa have received considerable training and educational opportunities through CWET, CSL and ZCP and now comprise much of ZCP's team throughout Zambia.

We continued to make strong progress in our primary school and secondary school educational efforts during the reporting period, working closely with partner organizations Chipembele Wildlife Educational Trust (CWET) in the Luangwa and Treetops School in Kafue, as well as initiating an educational programme with local schools within Liuwa Plain National Park.

In the Luangwa our work continued with CWET and Mfuwe Secondary school Conservation Club aimed at providing students practical skills and experience for advanced education and employment following graduation, using scientific research as the means for training. Long-time ZCP staff member, graduate student, and Education Manager Thandiwe Mweetwa continued to oversee this work and together with Education Coordinator Henry Mwape oversaw the development, implementation of a community survey conducted by Conservation Club students in the valley, aimed at determining levels of carnivore conflict. Collectively the work emphasized engaging

Conservation Biologist Training Programme, SAWC Scholar, Field Research Staff, UNZA Vet School Student

Conservation Biologist Training Programme, Field Research Staff, Secondary Education Staff

Women in Wildlife Conservation Trainee, Vet School UNZA

Conservation Biologist and Wildlife Vet Training Programme, Field Research Staff

Local Communities Conservation Club students

Wildlife Veterinarian, Ecologist

Graduate Student, Fulbright Scholar Finalist, Education Coordinator, Conservation Football Coach

Graduate Student, National Geographic Emerging Explorer 2016, Education Manager

Conservation Biologist Training Programme, Field Research Staff, Educational Staff

secondary school students in conservation issues, conducting research in collaboration with ZCP, continuing to provide students with key skills in computer software, technology, and critical thinking, writing and public speaking skills essential for advanced education and employment opportunities, as well as providing tutorials and additional assistance in preparation for final exams used in evaluations of university applications.

In the Kafue we continued to partner with Treetops to conduct weekly educational programmes to incoming school groups and expanded our collaboration with the addition of an educational volunteer able to invest more in full-day programmes with the students.

In Liuwa we initiated the first visits to schools by our field team to set up a Conservation Club programme with Mishelundu High School similar to what has been done in the Luangwa.

Safari Guide Collaborations

Given that safari guides are out every day observing carnivores we continued our long-term collaborative monitoring with guides in the Luangwa Valley Carnivore Monitoring Project (LVCMP) and with the Kafue Carnivore Coalition (KCC).

The KCC, a carnivore monitoring group set up by ZCP and Panthera, is a collaboration of partners, lodges, and guides cross the Kafue National Park that submit carnivore photos and locations on a daily basis either through whatsapp/phone calls or by alerting the research teams directly. These data have greatly improved and expanded our knowledge of Kafues carnivore populations and allowed us to monitor an area much bigger than our research teams could do alone.

The 2016 season was its second year in operation, and Panthera and ZCP hosted the annual KCC presentation and braai to report back on the year's results. In appreciation for their efforts, guides were presented with printed canvases of their best photo submissions of the year and lodges with maps showing carnivore locations in their area to pin up on their tourist information boards. The LVCMP annual awards banquet for the guides contributing the most sightings and photos is slated to be held in early 2017.

Former Conservation Club student turned ZCP Kafue Research Staff Lameck Sakala works with students at Treetops School as part of ZCP's educational efforts.

Students from Mfuwe Conservation Club conduct a community survey on carnivore conflict as their research project with ZCP/CWET

Guides in South Luangwa showing tourists wild dogs. Collaborative programmes with guides in the Luangwa and Kafue have greatly increased the contribution of citizen science to conservation efforts.

A pre-game Carnivore Cup rally.

The start of the championship.

Finalist teams enjoy South Luangwa National Park with ZCP and safari operators.

The Carnivore Cup

As part of our community outreach work ZCP collaboratively launched the first Carnivore Cup Football Tournament in the Luangwa in 2016. The tournament had a carnivore theme with "Take Pride in Zambia's Wildlife Heritage" as the motto and provided substantial opportunity for sharing information on carnivores and ZCP. Thirteen teams competed across the three chiefdoms comprising the ZCP intensive study area, and the tournament spanned five weekends with finalists from each chiefdom competing in the championship in November in Mfuwe.

Approximately 1500 people attended the semi-finals with 2000 attending the final. Players from the championships were treated to guided game drives into the national park courtesy of Flatdogs, Kafunta and Marula Lodge camps. Carnivore sightings included wild dogs and lions and for many players this was their first trip to see the park's wildlife. The success of the event has ensured that ZCP and partners will be making the Carnivore Cup an annual event.

Figure 35. ZCP's Thandiwe Mweetwa (L) trains Mercy Njobvu on wildlife research and monitoring techniques as part of the Women in Wildlife Conservation Programme aimed at getting more women involved in conservation biology.

Women in Wildlife Conservation Programme

Women are underrepresented in the conservation sector in general and in conservation biology in particular; thus in the reporting period we implemented a Women in Wildlife Conservation Programme run by ZCP's Education Manager Thandiwe Mweetwa and aimed at university or conservation club graduates interested in careers in conservation. Trainees receive intensive instruction in all aspects of wildlife research and monitoring and are also integrated into the secondary school and community conservation work to assist in both their outreach and communications skills and to help attract more students to the programme.

Mercy Njobvu was our first trainee and combined her work with the Wildlife Vet Training Programme prior to this, and will be applying for vet school following the programme. Ultimately, we hope to help train the next generation of wildlife conservationists, at the same time improving the representation of women in the field.

Dr. Kambwiri Banda (L) training APN and ZCP team members on cheetah immobilization and collaring as part of the Conservation Biologist Training Programme. Trainees include (right to left) Stanley Mwanza, who is now attending school to become a wildlife vet, Kings Chimungu, who is now enrolled to become a wildlife vet nurse, and APN scout Mboo Masilokwa, who is receiving training in wildlife research and monitoring.

Conservation Biologist Training Programme

With long-term projects across the country, ZCP's field sites offer unique opportunities for Zambian University students pursuing degrees in the sciences to gain much-needed practical field experience in ecological research, particularly given that Zambian universities are rarely able to offer field-based courses and training to students majoring in the biological sciences.

However given that a large array of skills are needed to effectively function as a field team member intensive training is required. Consequently ZCP expanded its ongoing Conservation Biologist Training Programme aimed at equipping incoming students with the theory and practice behind research as well as with practical field skills.

Students underwent intensive training in the theory and practice of ecological research, as well as hands-on training in Land Rover and motorbike servicing, repair, recovery and 4x4 driving skills. We trained and employed students from Copperbelt University and University of Zambia in addition to bringing on recently graduated students from local Conservation Clubs so that they may be employable in conservation fields and/or enter university studies grounded in practical field research experience.

We continued to employ recent graduates from Zambian Universities on all projects, with Copperbelt University and University of Zambia being the largest sources of interested students. Henry Mwape and Teddy Mukula our long-standing field research team members are slated to pursue graduate work contingent on funding.

In 2017 we will formalize a programme with DNPW to intensively train incoming Ecology staff on the array of large mammal research and monitoring techniques and accompanying statistical analyses in addition to the existing programme content.

Senior researcher and graduate student Teddy Mukula working in the field in Liuwa. A Copperbelt University graduate Teddy began work with ZCP in the Conservation Biologist Training Programme

Fitzgerald Makumbi (R) assists Dr. Mwamba Sichande in the immobilization of a lioness as part of the CSL-ZCP vet training programme. Fitzgerald is currently attending vet school and assists on his term breaks.

Wildlife Vet Training Programme

We continued our vet training programme aimed at giving prospective and current veterinary students interested in pursuing careers in wildlife conservation the opportunity to gain hands-on experience and skills under the tutelage of ZCP-CSL Vet Dr. Mwamba Sichande. The programme entails an attachment to Dr. Sichande's clinic at the CSL base in Mfuwe, where trainees assist in all aspects of the work, ranging from de-snaring of carnivores and herbivores in and around South Luangwa, to assisting in radio-collaring of lions and wild dogs, to providing support to Dr. Sichande in all aspects of running his domestic animal clinic. We had 4 trainees involved in the programme during the reporting period, ranging from Conservation Club graduates, to entering vet school students, to students currently in vet school and assisting on their term breaks. Collectively the programme has greatly assisted local students interested in pursuing careers in veterinary conservation.

DNPW scout Charles Kalambata radio-tracking carnivores in the Kafue. With ZCP support Charles will also be pursuing extended studies in wildlife and natural resource management.

Professional Training and Support to Scouts

With multiple DNPW scouts attached to all projects and assisting in the work, ZCP supports professional training, and advanced education as part of the attachments. In 2016 we continued to train additional scouts through attachment to the programme, including Charles Kalambata in the Kafue, who was an excellent addition to the team and with ZCP support will be pursuing extended studies in wildlife and natural resource management through the Livingstone International University.

In Liuwa we also welcomed a very committed and interested scout from one of the local villages, Mboo Masilokwa, who has received extensive training in all aspects of the work and looks to excel as a wildlife researcher in collaboration with ZCP and DNPW. With the success of this work in 2017 we intend to begin formalizing an educational fund for scouts and their families.

Graduate Students

The reporting period saw the graduation of ZCP's first cohort of Zambian graduate students, with Ph.D. student, Dr. Wigganson Matandiko, and Master's student Thandiwe Mweetwa successfully completing their research and obtaining their degrees at Montana State University and University of Arizona respectively.

In addition ZCP's first Master's student, Jassiel M'soka, returned to DNPW in 2016 as a Senior Ecologist after successfully defending his research in late 2015 at Montana State University with Dr. Scott Creel. Also with Dr. Creel, Dr. Matandiko's study evaluated the human and ecological factors influencing the abundance and distribution of large herbivores in Northern Kafue National Park, while Jassiel's research focused on large carnivore and herbivore dynamics in a lion-depleted system in the Liuwa Plain.

Thandiwe completed her master's work at the University of Arizona with Dr. Dave Christianson to evaluate the population dynamics of Luangwa lions during a trophy hunting moratorium.

Dr. Wigganson Matandiko and his advisor Dr. Scott Creel pose with Wigganson's newly minted Ph.D. from Montana State University.

Jassiel M'soka presents his research on large carnivore dynamics as part of his successful Master's defense, also at Montana State University.

Additional prospective graduate students Henry Mwape and Teddy Mukula continued to work on their preparation for the GRE graduate entrance exam and applying for fellowships and other means of sponsorship for entrance into University of Arizona and Montana State University respectively.

Media and Special Events

The reporting period continued recent media attention to the work of ZCP, DNPW and partners with the production of two films on our work in the Luangwa and Liuwa respectively, focusing on the long-term field studies of carnivores. The films will be aired on the Smithsonian Channel in 2017. The blue-chip 7-part BBC series "The Hunt" aired in multiple continents and continued to bring increased attention to Zambia's carnivores and ZCP's work.

Most notably was the announcement of ZCP's Thandiwe Mweetwa as a 2016 National Geographic Emerging Explorer. One of only a dozen Explorers to receive this prestigious award, Thandi spent 10 days in Washington, D.C. at National Geographic headquarters for the awards' media launch. Her talk can be accessed here: http://video.nationalgeographic.com/video/ng-live/160801-sciex-nglive-mweetwa-lion-conservation-lecture

Thandiwe also represented ZCP and her work at a National Geographic media workshop in Rwanda and as the Wildlife Conservation Network graduate scholarship representative at the WCN Expo in September.

Thandi Mweetwa back in the Luangwa researching lions following her successful Master's defense at University of Arizona.

Thandiwe Mweetwa speaks on her lion conservation work at the internationally broadcast National Geographic Emerging Explorers Awards in Washington, D.C.

Science-Based Conservation

ZCP Scientific Publications for Policy and Management

Given that the strongest measure of the validity of science-based management and conservation recommendations is publication in peer-reviewed scientific journals, ZCP endeavors to ensure that findings and recommendations undergo this process as much as possible.

We work with a variety of collaborating agencies, organizations, and institutions to accomplish this, and to ensure that these findings and recommendations are provided to managers and policy makers to help drive science-based conservation outcomes. To date ZCP has contributed to an array of scientific papers to provide science-based guidance on topics ranging from poaching, lion demographics and population estimates to genetics, disease, poaching, trophy hunting, fencing, community conservancies, land-use planning and human encroachment.

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