African wild dog dispersal study

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Botswana Predator Conservation | Maun | Botswana

Yearly Research Report to DWNP

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1. PROJECT OVERVIEW AND AIM

As part of a collaborative effort between the Population Ecology Research Group of the University of Zurich (www.popecol.org) and the Botswana Predator Conservation (BPC, www.bpctrust.org), few candidate dispersing African wild dogs have been fitted with GPS/Satellite radio collars. The aim of the project is to follow dispersers after emigration from the natal group and to i) investigate the effect of landscape characteristics on dispersal distance, time, movement patterns and habitat selection ii) gather crucial demographic parameters such as mortality rate, settlement success, reproductive success after settlement in a new territory iii) combine this novel information on dispersing individuals with long-term demographic information on resident groups collected by the BPCT over the past 25 years to produce population viability models.

Understanding mechanism and patterns of wild dog dispersal, and its demographic consequences is fundamental for the management and conservation of the species nationally, but also across the broader landscapes of Southern Africa such as the Kavango Zambezi Transfrontier Conservation Area (KAZA/TCA). We aim to provide scientific information and advice to policy makers, resource managers, stakeholders, and the public.

Results from this research will help predict population changes under changing scenarios and thus be crucial towards the management and conservation of free-living populations of the African wild dog.

2. FIELD ACTIVITIES

2.1. DISPERSAL MOVEMENTS

During 2021 we were able to resume normal field activities, which during 2020 were much reduced due to the COVID-19 pandemics and the consequent lockdowns. As we could not collar any new dispersing individuals during 2020, by the beginning of 2021, we were left with only one dispersing coalition with a working collar. All other collars had dropped (all our collars are fitted with a decomposable drop-off mechanisms). Following two main collaring activities in April/May and October/November 2021, **we are currently GPS monitoring nine (9)**

dispersing individuals/coalitions, which have either already dispersed or are expected to disperse in the near future. The collars used in this study (Vertex Lite, Vectronic Aerospace, Berlin) automatically record precise GPS positions several times each day and regularly send them to a base station through the Iridium satellite system. This technology allows to remotely follow the movements of collared individuals even in inaccessible places.

Two long-distance dispersal events are particularly noteworthy. A large coalition of brothers composed of two cohorts (males born in 2017 and 2019) left the natal pack in the Santawani area (NG 33/34) and headed North- East. They reached "Bottle Pan" airstrip before returning to the Santawani area. The round-trip (380 km) lasted only 6 days (Figure 1).

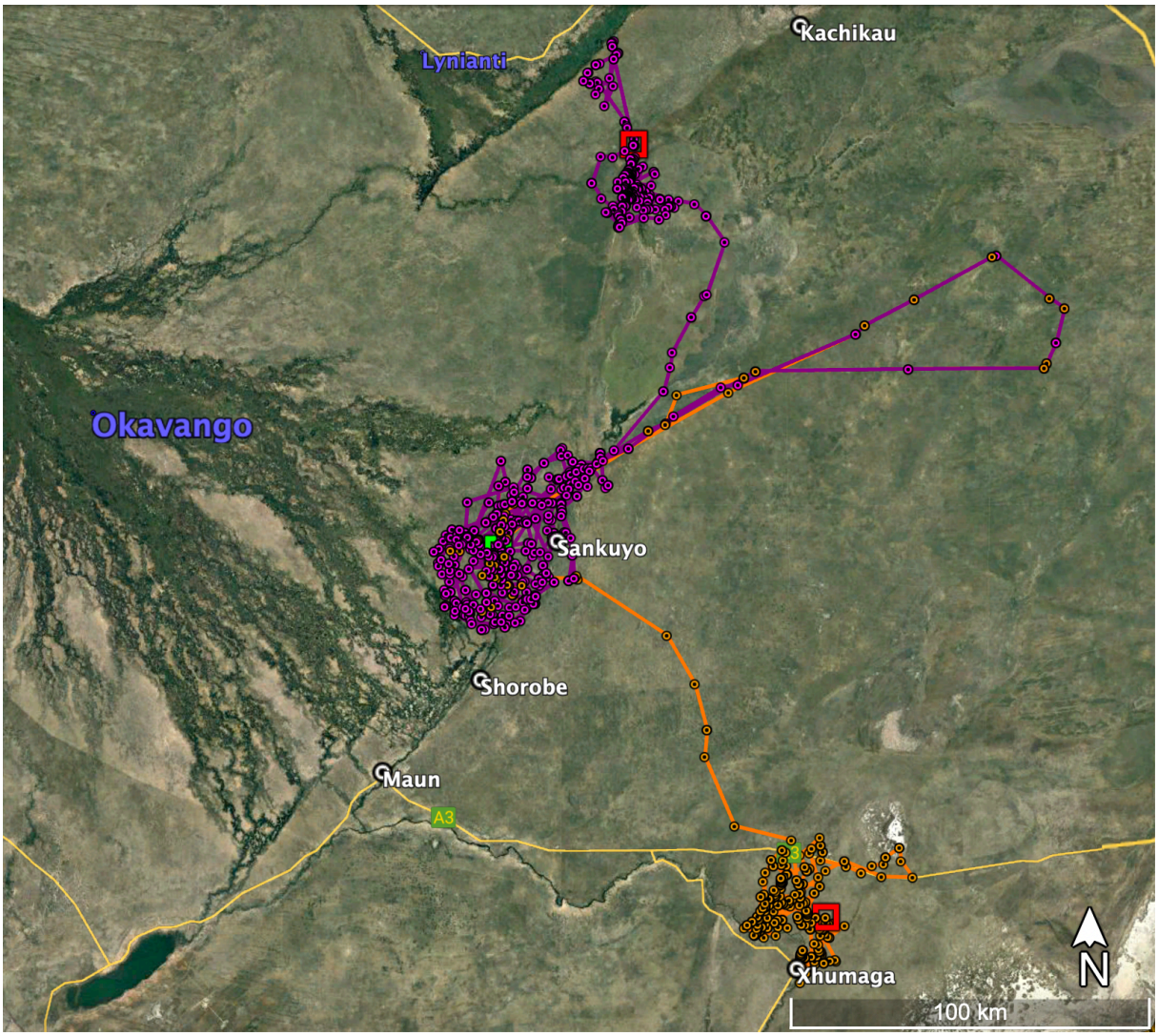


Figure 1: Trajectories of two coalitions (violet and orange) of male African wild dogs. After a first loop towards NE, the coalition split in two sub-groups. One group moved north towards Savuti/Lynianti, while the other moved south and settled in the Makgadikgadi National Park on the eastern banks of the Boteti River near Xhuamga. The green square depicts the collaring site, while the red squares the last obtained GPS locations. Dots represent intermediate GPS locations

On the way back, the coalition covered an astonishing **112 km in 24 h** (Figure 1). This is the longest ever-documented distance covered in one day by African wild dogs and **showcases the species' incredible dispersal potential**. Once back "home" in the Santawani area, the coalition split. The 2019 cohort (four males) moved ca. 100 km north towards Savuti (and Lynianti), which they reached in only four days, along what has already been identified as a well-established dispersal corridor (cfr. past reports). The males have now settled in Savuti where they have associated with unrelated females. The 2017 cohort (three males) headed South- East. They reached Baines Baobab in Nxai Pan NP after covering 170 km in 4 days. They subsequently moved west and stopped on the eastern banks of the Boteti River in the North-Western tip of Makgadikgadi NP. This is our **first recorded dispersal event south of the A3 road Maun – Nata** since the beginning of the project (Figure 1). Nonetheless, a direct link between the Okavango Delta ecosystem and the Central Kalahari ecosystem has yet to be observed. Due to the premature detachment of the collar, we are no longer able to follow the fate of this dispersing coalition.

2.2. CAMERA TRAPPING

During October and November, we placed camera traps for our long-term monitoring program. The reason for using camera traps is to monitor the distribution and abundance of prey species and carnivore species to better understand the dispersal mechanisms and dispersal routes of young African wild dogs that emigrate from their natal packs. Prey species are expected to have a positive influence on the movement trajectories and success of dispersal events, while other carnivores, such as for example lions, are expected to have a negative influence on dispersal. We placed 56 camera traps on a 4x4 km^2 squared grid, and equally sampled across the three major habitat types: mopane woodland, mixed shrubs acacia dominated, floodplains/grasslands (Figure 2). The camera traps use an infra-red flash and so are not visible at night and do not disturb animals and touristic activities.

Contrarily to other camera trapping projects conducted in the past and that are a short snapshot in time (e.g., a few months only), these camera traps will be deployed during the entire year and for several years. This setup will allow us to **investigate seasonal trends** (e.g., differences between dry and wet season) and **trends over several years**. The data recorded by the camera traps will be processed using an artificial intelligence algorithm developed in collaboration with the WildMe and Tech4Conservation organisations (please refer to Section 6). The first data will be available in 2022.

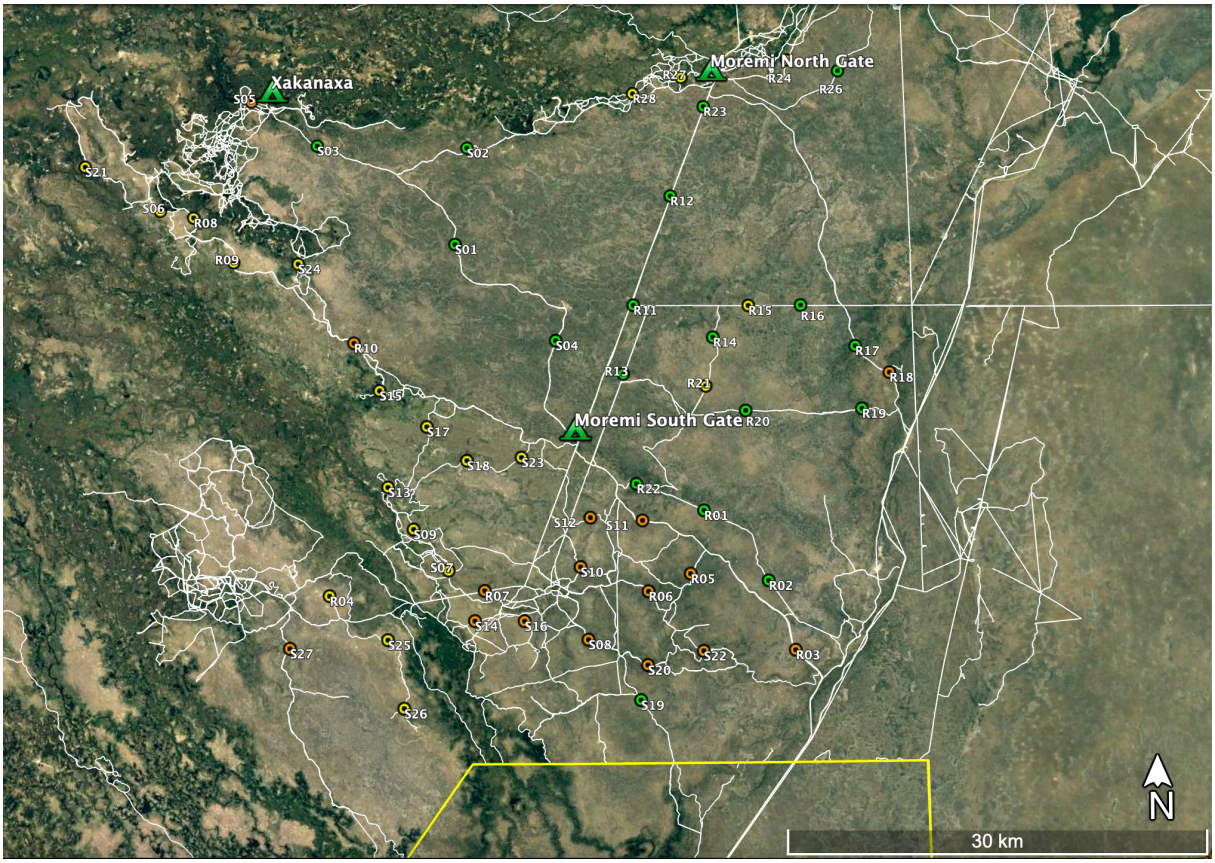


Figure 2: Camera trap survey setup north of the Southern Buffalo Fence (yellow line). Fifty-six cameras equally distributed across three main habitat types (green = mopane forest, yellow = grassland/floodplain, orange = mixed woodland acacia dominated) have been laid on a roughly 4x4 km² grid, and according to the road system (white lines). The cameras are part of a long-term monitoring plan aiming at gathering information on (i) seasonal patterns in habitat use and distribution and (ii) long-term trends in populations abundances. Information will be gathered both on large carnivores (the main competitors of African wild dogs) and herbivores (the main prey of African wild dogs). The study area (ca. 2'500 km²) covers the southeastern section of Moremi Game Reserve (NG28), NG31, 32, 33, 34.

3. MAIN SCIENTIFIC FINDINGS AND RELEVANCE FOR MANAGEMENT AND CONSERVATION

During 2021 we made some important progresses in the analysis of the data collected so far, and we were able to prepare two scientific articles that shall be published in their full length in 2022. Articles will be shared as soon as published. Both are of high relevance for management and conservation policies and efforts; I briefly summarizing them here.

3.1. IS MORTALITY DURING DISPERSAL AS HIGH AS WE THINK IT IS?

Dispersal is generally associated with high mortality as dispersing individuals move through unfamiliar habitats and compete for suitable breeding sites when settling. Mortality risk during dispersal likely influences individual decision-making and life-history strategies that determine the outcome of dispersal and, consequently, population dynamics. A reliable evaluation of mortality risk may only be achieved through an unbiased quantification and comparison of dispersal-related mortality with mortality of non-dispersing individuals. However, due to the inherent difficulty of following wide-ranging individuals under natural conditions, empirical information on mortality is often scarce and anecdotal as individuals often disappear under unexplained circumstances (later referred to as missing individuals). We took advantage of 30 years of data to and a novel analytical approach to infer the fate of missing individuals.

We found that **mortality was lower for dispersing wild dogs of either sex than for resident individuals** of comparable age, indicating that mortality is not necessarily a universal cost of dispersal. While mortality in resident individuals was related to pack size (i.e., the number of adults) and number of pups, mortality in dispersers was not related to dispersing coalition size. However, mortality risk (per unit time) during dispersal decreased with dispersal duration and increased during hotter periods. Our model predicted that **67% of the missing resident individuals and 79% of the missing dispersing individuals had survived**. These findings suggest that the majority of missing resident individuals emigrated from their natal pack and

the majority of missing dispersers separated from their dispersing coalitions, instead of having died.

Our results are in contrast with most previous studies on mammalian and avian species, which report higher mortality during dispersal, and have important conservation and management implications and consequences. Above all, the low mortality reported here means that **a large proportion of the wild dogs that disappear from the monitored population is, at least in the immediate future, alive and contributes to the overall population dynamics** across the larger ecosystem.

3.2 DENSITY-DEPENDENT PATTERNS OF DISPERSAL SHOW A POSITIVE OFFSET BETWEEN EMIGRATION FROM AND IMMIGRATION INTO THE FOCAL POPULATION

Emigration and immigration are important processes regulating the dynamics and persistence of animal populations. Understanding the offset between rates of emigration and immigration and, under which circumstances the one or the other rate increases or decrease, is paramount to understand under which circumstances a population may act as a source (i.e., emigration rate > immigration rate) or as a sink (i.e., immigration rate > emigration rate).

We used individual-based mark-recapture data collected between 1989 and 2020 on a free-ranging population of African wild dogs in Northern Botswana to investigate three questions: (1) under what circumstances are emigration from and immigration into our focal population in balance; (2) What are the factor influencing immigration into the local population (factors influencing emigration have been investigated previously, see yearly report 2020); and (3) what are the factors influencing the decision to form a new pack, respectively to join an already existing pack? Our focal wild dog population provided a unique opportunity to examine density-dependent effects on emigration and immigration, as it declined following a disease outbreak in 1996 and has since recovered.

We found that emigration from and immigration into the study area were not in balance, and emigration usually exceeded immigration. Over the entire study period, emigration exceeded immigration by 110 females (180%) and 136 males (168%), suggesting that **the study area generated more emigrants than it attracted immigrants.** At high population densities, the

study area generated more emigrants than it attracted immigrants, whereas the opposite effect was observed at low population densities.

Wild dogs immigrated into the study area either alone or in same-sex dispersing coalitions that varied in size from 1 to 5 ($\bar{x}$ = 2.4, SE = 0.2) females and 1 to 8 ($\bar{x}$ = 2.9, SE = 0.3) males. Dispersing coalitions formed by individuals that were born in the study area and that remained within the study area were on average larger ($\bar{x}_{females}$ = 2.8, $SE_{females}$ = 0.3; $\bar{x}_{males}$ = 3.3, SE_{males} = 0.2) than coalitions that immigrated into the study area. **The number of immigrants into the study population varied with population density and season**. Females' immigration increased at low population densities, was highest at medium densities, and decreased at high densities. Males were characterized by a negative relationship between immigration and population density. In both sexes, immigration peaked during the mating season in April and was more moderate prior to the onset of the rainy season in October.

Under average conditions (when all covariates were at mean values), dispersers of either sex were more likely to form a new pack rather than joining an existing pack. For both sexes, the probability of forming a new pack increased the larger a dispersing coalition. Females were more likely to join an existing pack when population density was high and to form a new pack when population density was low. Population density had no clear effect on the settlement type in male dispersers.

Our results highlight the **key role of our focal population that**, in conjunction with the wild dog ability to disperse several hundreds of kilometers, **may act as source population** for the surrounding landscape.

4. CAPACITY BUILDING, NATIONAL NETWORKING AND OUTREACH ACTIVITIES

During 2021, we continued to intensify and tighten our information exchange with tourists and tour operators in the tourism sector, with the aim to obtain wild dog pictures across the Okavango-Chobe and KAZA/TFCA ecosystems. **We have already received reports from over 550 sightings totalling more than 12'000 single pictures.** These span the entire Northern

Western and Chobe District (Figure 3). Collection of wild dog pictures at each sighting, and the ability to **individually recognize individuals** (see below) has three main purposes. Through pictures, we will be able to:

- follow the large-scale movements of dispersing dogs, for chances are that one dog photographed in one location will be photographed elsewhere in the future,
- assess survival/mortality of some individuals, for resighting confirms individuals are still alive, and
- obtain a minimum abundance estimate of the dogs living within the ecosystem.

Data analysis is planned for 2022.

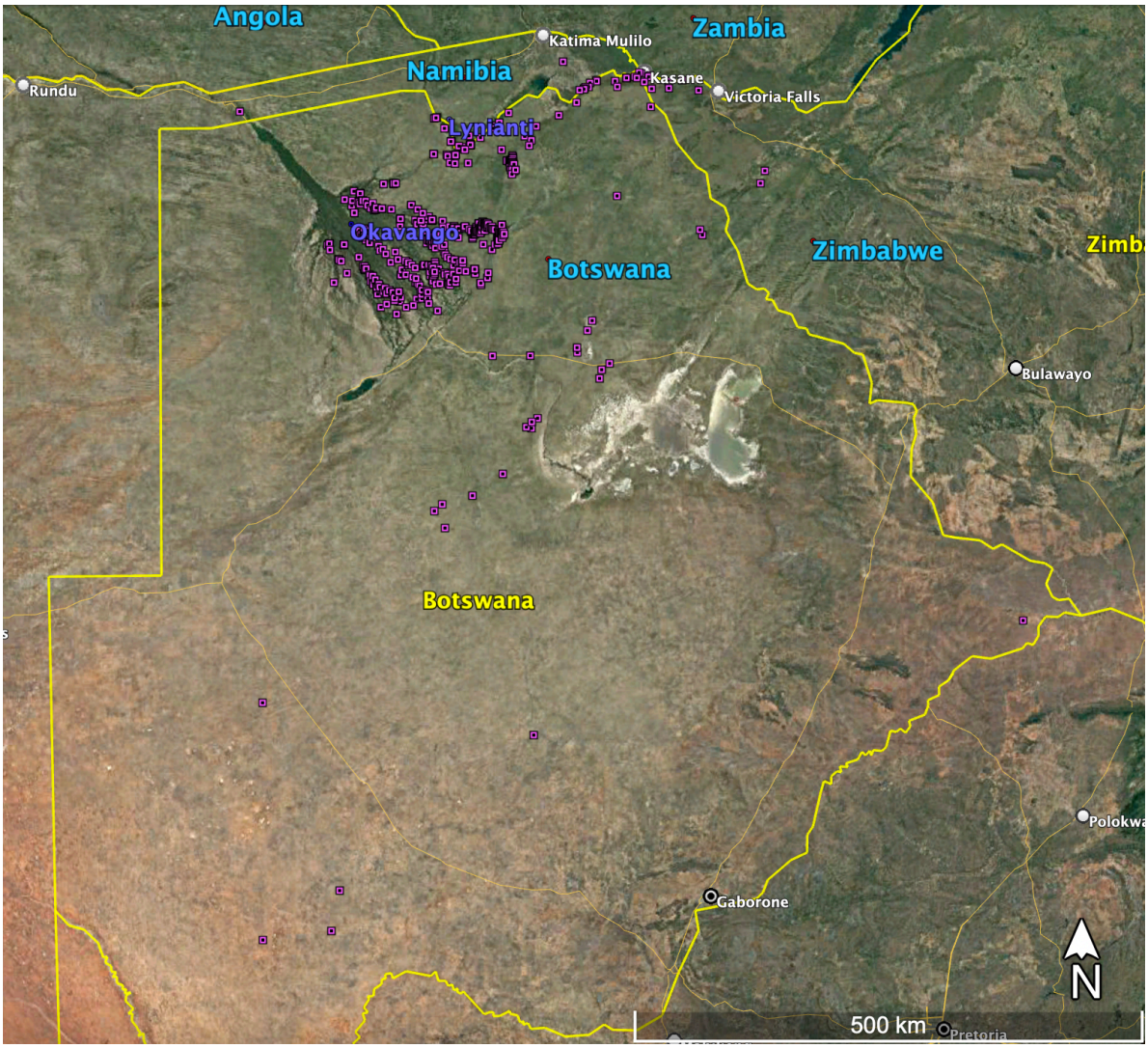


Figure 3: Distribution of sightings at the national level. Each square represents a sighting for a total of >500 sightings. National borders and roads are shown in yellow.

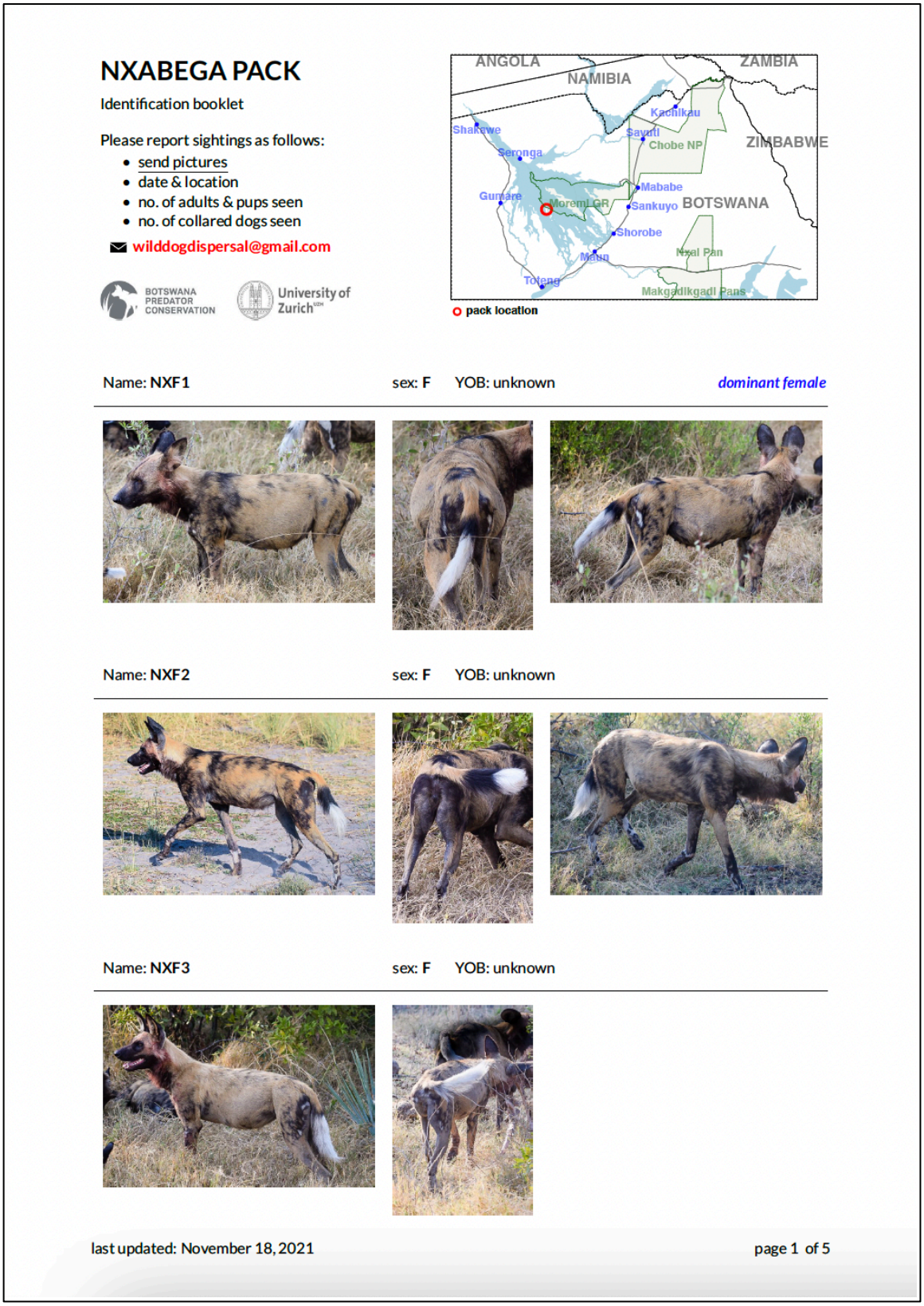
In April 2021 we hired a **local collaborator from the local village of Sankuyo** to take the role of **"communication officer"**. One of the main duties is to visit lodge and engage with the management and the guides and explain the details of our large-scale dispersal project. The main aim is to foster and intensify reciprocal information exchange. This initiative can simultaneously benefit researchers and the tourism industry. We, the researchers, can benefit from sightings from tourists and in return we can provide valuable information (for example in form of reports) back to them. For instance, following this initiative, we were already able to compile **six ID booklets** (which we shared with the interested parties) of packs resident in NG 12, 22, 27, 30, and Chief's Island in Moremi GR. An example of such booklet is shown in Figure 4. These areas are outside the range of our routine field activities.

We continue fruitful collaboration and data exchange with other researcher groups active at the regional/national level including, among others, Cheetah Conservation Botswana, WildCRU's Trans-Kalahari Predator Programme, Okavango Research Institute, Leopard Ecology and Conservation, Rhino Conservation Botswana.

5. TEAM UPDATES

Our team has developed and expanded:

- Olorato Dipuo, from Sankuyo, joined our team as communication officer in charge of maintaining and enhancing relationship with the tourism industry, the Department, and to monitor dispersing individuals.
- Dominik Behr successfully defended his PhD Thesis at University of Zurich. Title of his thesis is "Dispersal and demography of the endangered African wild dog (*Lycaon pictus*)".
- David Hofmann officially started his PhD at Zurich University. Tentative title of his thesis is "Dispersal and connectivity in a physical, seasonal, and social landscape".



NXABEGA PACK

Identification booklet

Please report sightings as follows:

- send pictures
- date & location
- no. of adults & pups seen
- no. of collared dogs seen

wilddogdispersal@gmail.com

BOTSWANA PREDATOR CONSERVATION

University of Zurich[UZH]

Name: NXF1 sex: F YOB: unknown *dominant female*

Name: NXF2 sex: F YOB: unknown

Name: NXF3 sex: F YOB: unknown

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Figure 4: Example of a Pack ID booklet. Communication and data exchange with the local lodges allows us to monitor movements of wild dogs outside our regular range, such as in the case of a pack of wild dogs in NG 27. Booklet are shared with the lodges interested.

6. INTERNATIONAL COLLABORATION

We continue to consolidate our collaborating with the US-based non-profit organisation Wild Me (https://www.wildme.org), which is specialized in patterns recognition analysis. The aim is to finalize an algorithm that will be able to automatically identify individual wild dogs from pictures. Such algorithm is the backbone of the African Carnivore Wildbook (http://www.africancarnivore.wildbook.org) platform, where images are uploaded and processed. This platform is curated by the Canada-based Tech4Conservation organisation (http://t4c.org). This platform, now allows **citizen scientists** to upload their wild dog sightings, which will contribute to increase the amount of information available to us.

Our team has been directly involved in the **organisation of a conference on African wild dogs** that will be held virtually between 14 – 18 February 2022 (https://wilddogs.org). The conference is hosted, among others, by Endangered Wildlife Trust, IUCN Canid Specialist Group, Zoological Society of London, African Wildlife Conservation Fund, Botswana Predator Conservation.

7. FUTURE PERSPECTIVES AND DIRECTIONS

Our project is a complementary project to the long-term wild dog research and monitoring program at BPC. We therefore see the dispersal project as a long-term project to be developed and integrated in other wild dog-related activities at BPC. The novelty of the dispersal project is that it adds a new spatial and population dynamic dimension to BPC wild dog research. However, the core of the dispersal project remains the wild dog population resident in the Okavango Delta, which acts as the source for the dispersing wild dogs focus of this study.

In the short term, we plan to continue our research, which focuses at understanding the fate of individuals that disperse from the main BPC study area across northern Botswana and use this information to assess population viability under changing environmental and anthropogenic scenarios.

In the medium to long term, we can foresee expansion of activities to a larger national (and international) extent, and this will be much dependent on the movement trajectories of the dispersing wild dogs. We would also welcome a collaborative effort with other researchers working in other areas of the country to gather information on dispersing wild dogs across different ecosystems. This information will be invaluable given the mosaic of ecosystems that characterize Botswana and the KAZA/TFCA landscape. Only through **long-term commitment and long-term data** we will be able to address some key questions whose answers will allow to help management and conservation of the species.

In accordance with the Botswana National Wildlife Conservation Research Action Plan, through our wild dog dispersal project we aim to provide scientific information and advice to policy makers, resource managers, stakeholders, and the public. The information gathered through the wild dog dispersal project will provide evidence-based information for the conservation and management of the African wild dog, nationally and internationally. In this respect, the spatial extent of the dispersal project can help support research and conservation across transboundary ecosystems such as the KAZA/TFCA, for which we identified Botswana as a key African wild dog conservation hub.

8. ACKNOWLEDGEMENTS

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