African wild dog dispersal study

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Botswana Predator Conservation Trust | Maun | Botswana

Second Year Research Update
1.1.2018 – 01.12.2018

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 Trust (BPCT, 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. Fieldwork

Over the past two years, we have deployed 18 GPS/Satellite radio collars on candidate dispersing African wild dogs. The collars used in this study 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 where field conditions are prohibitive, and to more easily locate animals on the ground to collect the needed information. Collars are fitted with an

independent VHF beacon that allows locating individuals in the field for routine monitoring during the dispersal events, and retrieving the collars after they detach from the animals. All collars have a drop-off mechanism timed to last 18-24 months.

Collared animals were visited regularly during the week after anesthesia to ensure no time lagged negative effects due to anesthesia or handling. We did not experience or observe any negative events (e.g. injuries, casualties) neither during anesthesia nor during the days following anesthesia. All wild dogs collared were regularly monitored. This applied to both wild dogs that had not yet dispersed and were still within the natal pack and to wild dogs that had dispersed. Monitoring was done in collaboration and coordination with BPCT activities and staff and, under normal circumstances, was at bi-monthly intervals. At each visit, information on group composition, physical condition, health status, and behaviour were collected. Dogs were monitored more frequently and closely immediately after they dispersed, to timely gain important information such as association with opposite-sex dispersing groups. We also immediately visited animals following reception of "mortality signals" (a mortality signal is sent to our computer if the collar does not record any activity for a period of 24 h). A mortality signal may be due to the collar opening (all collars are equipped with a degradable drop-off mechanism) or to the animal carrying the collar being actually dead (see below).

3. Findings from recorded dispersal events

The major findings stem from collared wild dogs that dispersed between 2016 and 2018. Some individuals/dispersing coalitions were not collared but we were able to obtain information on them following association with collared individuals. We also took advantage of own opportunistic sightings, and reports from lodges, tour operators and self-drivers (see below).

3.1. Age at and timing of emigration

The majority of dispersing females were between 1.5 and 2.5 years of age when they emigrated from their natal pack. Compared to females, males delayed dispersal and emigrated between 2 and 3 years of age (Fig. 1). Both males and females showed seasonal peaks in timing of emigration (Fig. 1). The majority of females dispersed in March (beginning of the mating season), whereas males typically dispersed in July (coinciding with the

denning season) or December (beginning of the rains) (Fig. 1). These findings help us to anticipate which individuals are more likely to emigrate from their natal pack and are thus considered when targeting individuals for collaring.

A first preliminary analysis also shows that emigration increases with pack tenure length and pack size (Fig. 2) and, against expectations, these two metrics are not correlated to each other. Very few individuals emigrate during the first two years after new pack formation. This means that relatively small and newly established packs only marginally contribute towards dispersing individuals. As colonization of unoccupied areas mainly depends on successful dispersal, it appears that a quick turnover of packs could have negative consequences, for it would translate in very little dispersal. Any management intervention that aims at increasing tenure length of relatively large packs should be prioritized.

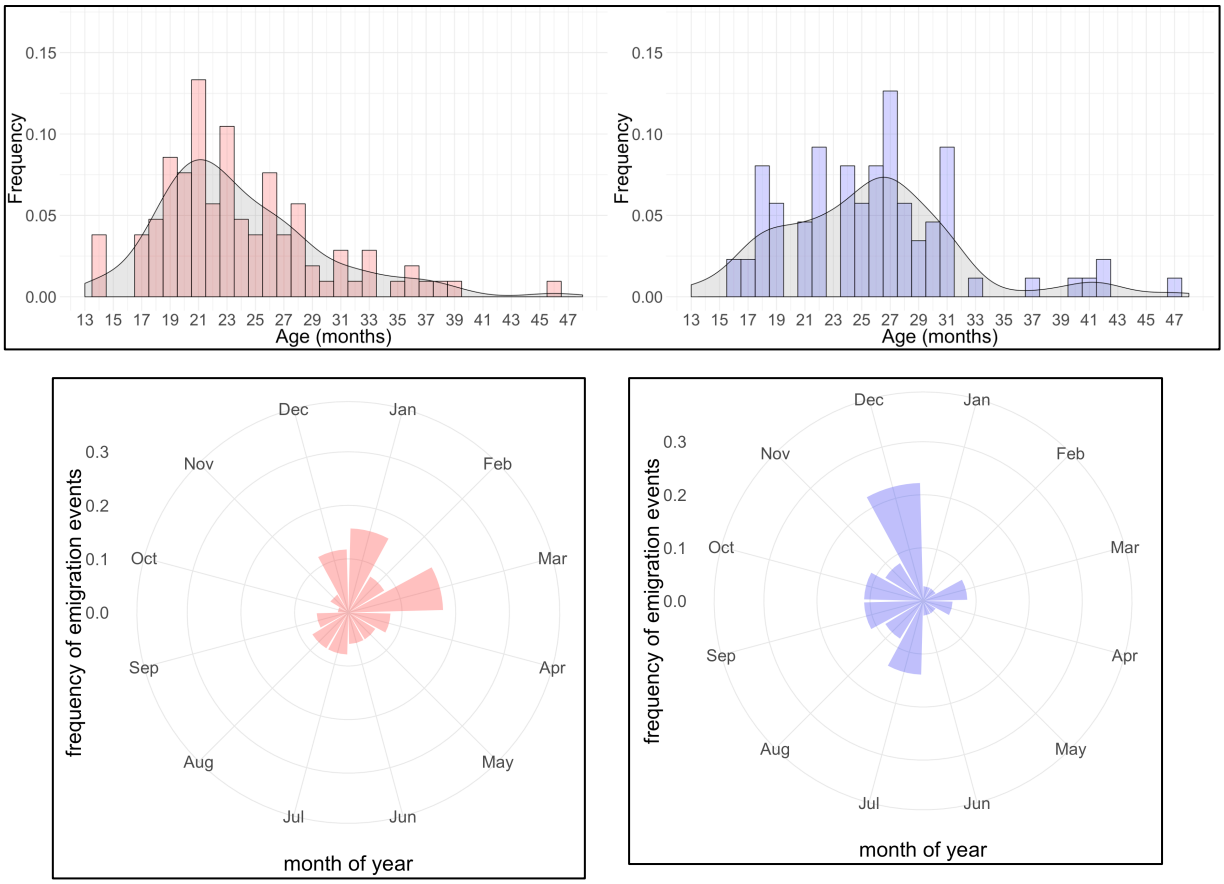

Figure 1: Age at dispersal (top two panels) and dispersal seasonality (bottom panels) for wild dog females (pink) and males (blue)

3.2. Dispersal distance

Five female coalitions (in total at least eight individuals, possibly ten) and three male coalitions (in total seven individuals) dispersed well outside the main BPCT study area, which comprises NG 31-34 and the western section of Moremi Game Reserve. Two female coalitions (in total nine individuals) and three male coalitions (in total eleven individuals) dispersed within the main study area (Table 1). This means that 70% of the female coalitions that dispersed and 50% of the male coalitions that dispersed moved into areas outside the main study area. Long-distance dispersal may thus be more prevalent than so far expected, and should therefore not be neglected.

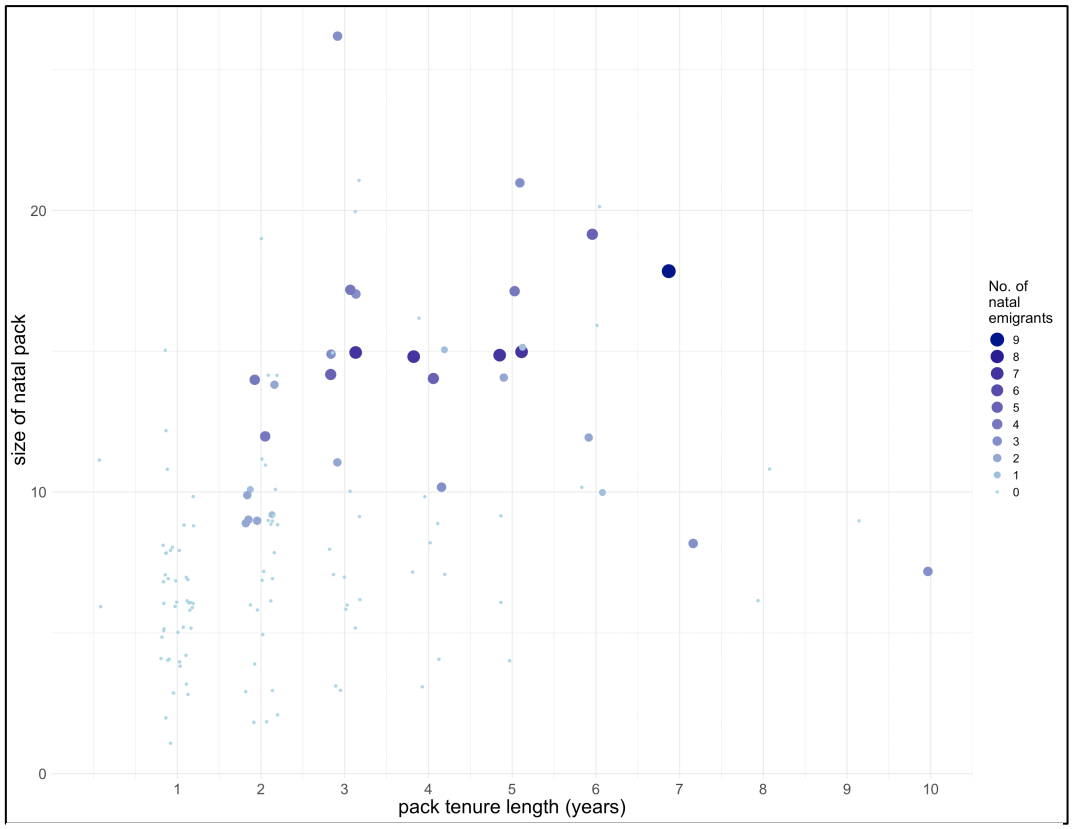

Figure 2: Number of emigrating individuals in relationship to pack size and pack tenure length. Irrespective of pack size, very few individuals emigrate within the first two years after group formation.

If we consider the number of individuals across all collared dispersing coalition, 47% (possibly 52%) of the females that dispersed and 38% of the males that dispersed left the main study area. Therefore, and despite the limited sample size, our data suggest that the fate of about 40–50% of the individuals that reach adulthood and emigrate from their natal pack would be unknown to a project that does not specifically target dispersing individuals and only focuses on a well-defined core study area. Knowledge on the fate (e.g. survival and

reproduction; see below) of such a significant number of individuals is crucial for a thorough understanding of population dynamics and viability.

Long-distance dispersers ensure connectivity and gene flow between sub-populations and recolonize vacant territory. Data in hand suggest that during dispersal African wild dogs cover an average distance of 20 km each day. This is 2.5 times more than the distance covered by resident individuals. Long-distance dispersal seems to be characterized by three distinct phases (Fig. 3): a very directional movement path with long daily displacement (over 20 and up to 70 km/day); a more tortuous movement path with long daily displacement (about 20 km/day); a tortuous movement path with shorter daily displacement (10 km/day). These three phases may coincide with the search of the presence (e.g. scent) of unrelated individuals of the opposite sex (phase 1), the actual search for them in a restricted area (phase 2) and settlement in a new territory (phases 3). Based on this information, wild dogs that emigrate from the Okavango region can be expected to easily reach the Namibian Caprivi border in five or six days. They can equally be expected to reach the Kaudom region in Namibia, and the Zimbabwean border in two weeks when moving along a fairly straight line. The possible effect of landscape features on dispersal movements is described below.

3.3. Landscape features:

- *Densely populated landscapes:*

Densely populated landscapes appear to represent a real obstacle to the movement of dispersing wild dogs. We recorded several occasions of dispersers that, coming from a northeastern direction, headed towards the densely populated stretch of land along the Shorobe-Maun-Toteng axis and immediately bounced off it and back to where they came from (Fig. 4). On the other hand, landscapes dominated by cattle posts do not appear to be a major obstacle to the movement of dispersing individuals. Those areas nonetheless appear to significantly influence the survival rate of dispersers (see below).

- *Other human-made features*

The Buffalo Fence does not represent an obstacle to the movements of dispersing wild dogs, which repeatedly crossed it (Fig. 4). This result is in line with knowledge on resident packs that also appear not to be restricted in their movements by the fence. At present, we have no information on the effect that main paved roads may have on dispersing wild dogs. Additional investigation is need in this respect, and also to quantify possible effects of roads

on dispersers' survival (collision caused mortality). For species living at low densities like the African wild dog, this source of mortality may not be negligible.

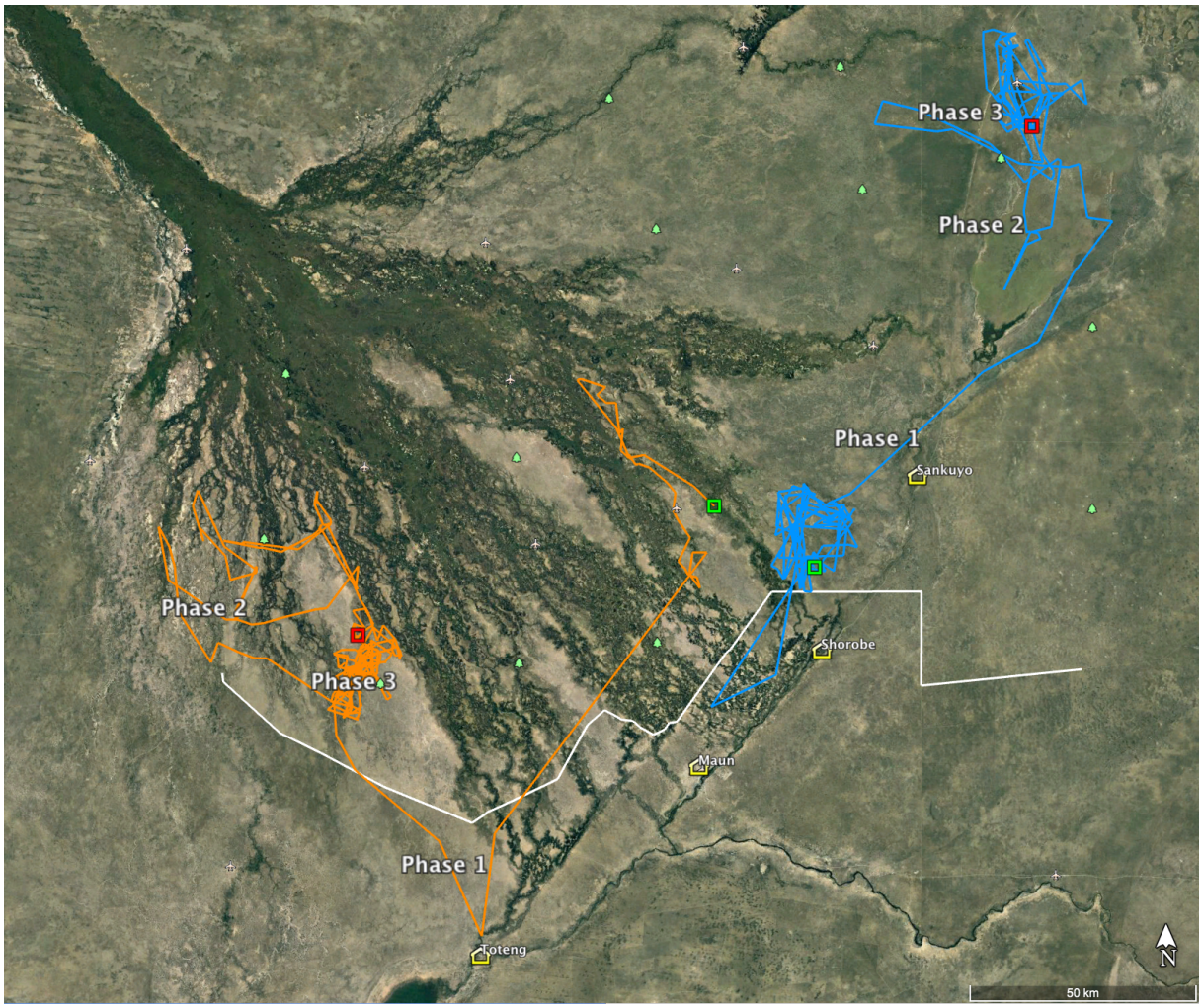

Figure 3: Long-distance dispersal trajectories of two distinct coalitions (orange and blue). Three phases can be distinguished (see main text for details). Green square: collaring location within natal territory; red dot: last recorded locations in new territory; white solid line: buffalo fence.

- *Natural landscape features*

In the wet environment of the Okavango Delta, flooded areas and water channels can be expected to hinder wild dog movements. This is surely the case for resident packs that hardly ever cross water bodies and may in fact use them as easily "defendable" territory boundaries. Our data on dispersers show, however, that water may be less of a barrier to the movement of dispersing individuals. We recorded several occasions where dispersing individuals crossed temporarily flooded areas or channels. It is nonetheless worth mentioning that the majority of the crossings took place between September and December, when water levels are not at the highest. Only one individual repeatedly crossed the Gomoti Channel in July (peak water level), but these crossing events happened at the

distal end of the Gomoti (discharge into the Thamalakane channel) and so in fact crossings may have happened on swamped grasslands, rather then across open water bodies. Of particular interest is one individual that dispersed 85 km in five days through the swamp north of NG31, and eventually settled in the swamp right in the middle of Moremi Game Reserve. Large rivers like the Okavango in proximity of the "Panhandle" or the Zambesi possibly represent impassable barriers. As our preliminary data is not conclusive, more information is needed to assess the real effect of water on dispersing wild dogs, this is particularly important for thoroughly evaluate connectivity across northern Botswana. Additionally, to be considered is mortality linked to crossing of water bodies, as it is not unheard of crocodiles killing wild dogs in the proximity of water.

At present, we have no information to believe that other natural landscape features may represent an obstacle to wild dog dispersal. In fact, given the high mobility of wild dogs and the distance that they can cover in few hours/days, we believe that they may be able to quickly move through harsh and prey-poor unsuitable habitats. Nonetheless, this needs to be empirically investigated.

3.4. Settlement:

Settlement and successful reproduction in newly formed packs is the quintessential of dispersal, for new packs have the possibility to rescue small subpopulations or to re-colonize vacant territories. In total, we recorded eleven settlement events; nine comprised collared individuals and two uncollared individuals known to us and that we could monitor opportunistically through own sightings and reports. Of the nine collared individuals, two settled in accessible areas deep in the Delta, and we can only assume that they had formed a pack (we were not able to visit them before the collar dropped).

Five of the newly formed packs have successfully established a new territory and reproduced. Three of those packs already had more than one litter and managed to successfully rear pups to adulthood. The remaining two packs only produced their first litter in 2018. All five packs settled in protected areas north of the Buffalo Fence.

Three additional packs settled partly or entirely on communal grazing land. Two packs reproduced and had pups once. Of these, one pack is known to have been poisoned, and

one pack is believed to have disappeared to human causes (Table 2). The dominant female of the third pack was heavily pregnant when shot by farmers. All three packs were unsuccessful in long-term settlement and reproduction and ceased to exist due to human-caused mortality.

Finally, one pack formed only recently and missed the 2018 reproductive season. It is therefore possible that the pack will still move in search of a more suitable territory where to settle permanently.

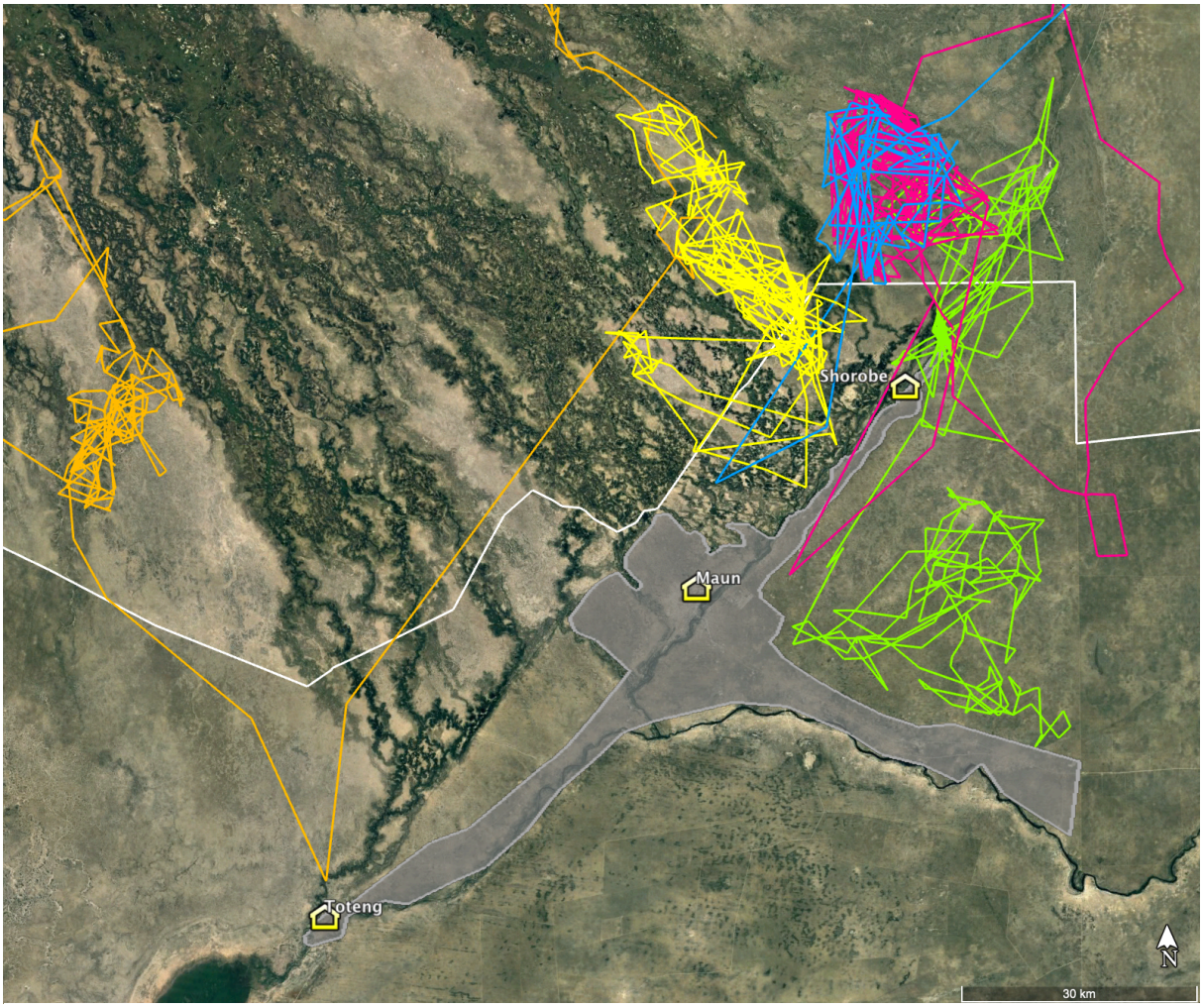

Figure 4: Dispersal trajectories of 5 collared individuals (color coded). Dispersers appear to be blocked by densely populated landscapes (opaque grey polygon) around major villages and along the main connecting roads. Center of the villages is represent by the yellow icon; white contiguous line represents the buffalo fence.

3.5. Mortality:

Of the four confirmed mortality incidents recorded, three were due to human causes and only one to natural cause (Table 2). Not only the number of incidents but also the average number of dead wild dogs per incident was higher when due to human causes. This is,

unfortunately, not surprising. While predation by leopards or lions on wild dogs may result in the loss of one or two individuals, shooting and particularly poisoning can easily wipe out an entire dispersing coalition or pack.

Two mortality incidents involved dispersing wild dogs that had not yet formed a new pack and settled in a new territory (cfr. the first two rows of Table 1). One dog died in Savuti, presumably to another large carnivore. The other incident was observed at Shokomokwa Gate, where two dispersing sisters were found dead. The presence of dead vultures around their cadavers indicated poisoning. Since the two females had not been in the area prior their poisoning, and therefore could not be responsible for any possible conflict with local livestock owners, it is conceivable that the poison was placed there to target other individuals.

The two other mortality events (cfr. rows three and four of Table 1) involved newly formed and settled packs. Both packs had settled partly or entirely on communal grazing land around Morutswe Gate and north of Chanoga village, respectively. Whether they were responsible of livestock losses is not known, but assumed unlikely for the pack around Morutswe.

Table 1: Summary of the observed causes of death among dispersing individuals. Collared individuals are part of the 'original coalition' that eventually joined unrelated individuals of the opposite sex

Nr. individuals in original coalition	Nr. individuals that joined	Nr. of dead individuals	Cause of death	Comments
2	0	1	Natural	Survived coalition partner returned to natal pack 2 weeks after death event
2	0	2	Poisoning	Poisoned vultures also found on site (secondary poisoning)
1	3	2	Shooting	Other dogs may have been shot too and were not found, or they left the area. Pack was anyways disrupted as the only female got killed
2	3(4)	7	Poisoning	Poisoning at den site. Dead individuals included 3 of the 5(6) adults plus 4 pups. Other adults likely died but cut not be found.

4. Conservation and management implications

In this section, we discuss some conservation and management implications of the main findings highlighted in section 3.

Despite the limited sample size, our data suggest that the fate of about 40–50% of the individuals that reach adulthood and emigrate from their natal pack would be unknown to a project that does not specifically target dispersing individuals and only focuses on a well-defined core study area. Knowledge on the fate (e.g. survival and reproduction) of such a significant number of individuals is crucial for a thorough understanding of population dynamics and viability. We advocate that more research should be undertaken in this direction.

Considering the high mobility of dispersing wild dogs, it can be anticipated that they are capable to move across vast stretches of unfavorable natural habitat in a short time. Under these conditions, a minimum level of gene flow between subpopulation spaced a few hundred kilometers apart can be expected. The level of permeability of densely populated landscapes and water bodies remains, however, to be precisely quantified. These could substantially reduce connectivity even between close subpopulations. Particularly medium to densely populated areas appear to represent an important barrier. In this regard, we have so far not recorded of any wild dogs dispersing across the human-dominated stretch of land along the A3 highway. The Delta and the Linyanti-Chobe region, on the other hand, appear connected. We believe it to be premature to expand our knowledge to the broader KAZA landscape.

During the transient phase of dispersal, the high mobility of dispersing dogs may also indirectly protect them from direct persecution by humans. It can be speculated that, in case of livestock losses to transient wild dogs, wild dogs may have already moved further before local people notice their presence and retaliated due to the losses. To the contrary, dispersing wild dogs that form a new pack and settle in human dominated landscapes can be expected to encounter high resistance and be exterminated through shooting or poisoning. Efforts should be made to mitigate conflicts and increase acceptance.

Extinction of new packs that settle outside protected areas can also have important conservation implication for the connectivity of subpopulations further than few hundred kilometers. Connectivity between far-apart subpopulations can be expected to progress stepwise, through secondary dispersal or dispersal of individuals born in the new pack. In this regard, new packs may be considered as stepping-stone islands between distant sub-

populations. As newly formed packs rarely contribute to dispersers during the first two years of tenure, ensuring their medium to long-term survival is important for connectivity and re-colonization of far territories.

5. Outreach and communication

Significant progresses have been made to share and communicate the main findings of our research to third parties. We have also started a very fruitful communication channel through flyers to obtain information about wild dogs from lodges, tour operators and self-drivers.

5.1. Lodges and tour operators

We have started very fruitful communication channels with the lodges and tour operators likely to come in contact with any of the collared wild dogs. This mainly includes lodges in NG31, NG32, NG33, NG34, Moremi Game Reserve and Savuti, and more precisely Wilderness Safaris, &Beyond, Machaba Safaris, Under one Botswana Sky, Calitz Safaris, Desert & Delta Safaris. We regularly update them on the fate of the collared dogs so that they can engage with their clients and make their experience more memorable. As guides develop an intimate link with their wild dogs, they are enthusiast to know where the dogs go after they leave the pack and whether they are successful in dispersal. We also provide updated ID-sheets for them to keep track of the dogs in their areas. We receive constant updates from lodges and tour operators about their sightings. This helps us in our constant monitoring effort, and particularly where direct access is complicated.

5.2. Flyer

We have attached a flyer to both entrances of Moremi Game Reserve (South Gate and North Gate) asking tourists to report of any wild dog sighting (Fig. 5). The flyer also has the dual scope of informing tourist of our work. Over a four-month period we received 27 reports from tourists with up to 127 pictures per single report. We matched each picture with pictures from our database. In the area of digital cameras, this method appears to work very well. We are very keen to continue in this direction and to attach the flyers at other locations. This type of monitoring can, for instance, be expanded to other species that can be individually identified such as the leopard and the cheetah, and offer a baseline monitoring technique.

University of Zurich[UZH]

Botswana Predator Conservation Trust

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African Wild Dog Dispersal Study

WANTED

Have you seen any African wild dog?

Please send us information on number of adults, pups, collared individuals, date and location (coordinates or a rough description). Pictures are of particular value as they allow identifying single dogs based on their unique coat pattern.

Email: wilddogdispersal@gmail.com

WhatsApp: +41 77 4352783

The project in a nutshell

The African wild dog is Africa's most endangered large carnivore. One major threat to the survival of the species is the loss and fragmentation of suitable habitats. As a result, wild dogs are forced to live in isolated and small subpopulations, which are particularly vulnerable to extinction. Through emigration and immigration, dispersing individuals lead to the formation of new groups, can rescue small subpopulations, and recolonize unoccupied areas. Understanding how and where wild dogs disperse, and assessing connectivity between subpopulations is thus fundamental for the management and conservation of the species across large wildlife landscapes such as the Kavango Zambezi Transfrontier Conservation Area (KAZA/TFCA).

We deploy GPS/Satellite radio collars on sub-adult African wild dogs that disperse from their natal pack, to collect information on dispersal movement patterns, habitat use during dispersal, survival, settlement success in a new territory, and reproductive success of newly formed packs. Finally, we will merge this novel information on dispersing individuals with existing data on resident packs to create a demographic model and assess population extinction risks under changing environmental and anthropogenic scenarios. Results from this project will be used to inform management plans to conserve this highly endangered species.

This project is a collaboration between the University of Zurich and the Botswana Predator Conservation Trust, and it is supported by the Botswana Department of Wildlife and National Parks. Please do not hesitate to visit our webpages (www.popecol.org and www.bpctrust.org) or to contact us by e-mail for more info.

Despite the newest technology implemented in the collars facilitates our work, following dispersing wild dogs over several hundred kilometers still represents a major challenge. Your help is therefore essential and much appreciated!

Your dispersal team

Figure 5: Flyer attached at Moremi South Gate and North Gate to inform about our project and ask tourists to report their sightings.

6. Scientific output

Due to the nature of the work, data collection is slow and sample size limited. Fieldwork is nonetheless proceeding according to plan. With information from additional dispersing individuals that we hope to collar and follow in the years to come, we will be able to shift from a qualitative to a quantitative analysis. Results from a rigorous quantitative analysis will be the basis for evidence-based information on wildlife management and conservation.

7. Future perspectives and directions

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

In the medium to long term, we can foresee expansion of activities to the North-West District, 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.

In accordance with the 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.