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Original Research Article

African wild dog population status in the Selous-Nyerere landscape, southern Tanzania: Insights from camera trap surveys

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ABSTRACT

Despite being one of the world's most endangered carnivore, there is a deficiency of recent information on the status of African wild dog (*Lycaon pictus*) in some of the few landscapes where viable populations are thought to still occur. One example is the Selous-Nyerere landscape in southern Tanzania, a critical stronghold for the species that has not been studied since the 1990s. We use data from seven camera trap surveys deployed over 4674 km^2 in Selous Game Reserve (GR) and Nyerere National Park (NP) from 2020 to 2022 to provide an update on wild dog status in the landscape. We identified a total of 222 wild dogs, of which 38 % were male, 38 % were female, and 24 % were of unknown sex. We applied spatially explicit capture-recapture (SECR) modelling to the data from 2565 km^2 of Selous GR to estimate an over-dispersion adjusted population density of 2.14 ± 0.45 adult and yearling wild dogs per 100 km^2 (95 % confidence interval: 1.42 – 3.21). This study demonstrates the ways in which camera trap data can be used to

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improve our understanding of wild dog populations in data-limited settings, but also highlights some limitations of this data type for the species. Our findings suggest that the Selous-Niassa ecosystem is one of the most important remaining populations of wild dogs in Africa. Although this study did not directly investigate mortality, we recommend long-term monitoring and a number of conservation actions to tackle the species' apparent threats in the landscape, and help secure this stronghold into the future.

1. Introduction

The African wild dog (*Lycaon pictus*, hereafter "wild dog") is among the world's most endangered large carnivores (Itambu, 2021; Woodroffe and Sillero-Zubiri, 2020) and is one of Africa's most endangered large mammals (Fanshawe et al., 1991). Wild dogs are rarely sighted, even in areas where they are reasonably widespread, and populations appear to have always existed at extremely low densities (Creel et al., 2004; Fuller et al., 1992). These characteristics make them a particularly difficult species to research and monitor, and there remain significant knowledge gaps about their current status (Woodroffe and Sillero-Zubiri, 2020). This presents a challenge for the species' conservation, as understanding population density and abundance is critical for identifying threats and developing effective conservation measures (Twining et al., 2022).

The latest available data suggest that the continental wild dog population comprises approximately 6600 adults in 39 sub-populations, of which only 1400 are mature individuals (Woodroffe and Sillero-Zubiri, 2020). This already small population is at risk of decline due to ongoing habitat fragmentation, prey declines, conflict with humans, and infectious diseases, and is consequently classified as *endangered* by the IUCN Red List (Woodroffe and Sillero-Zubiri, 2020).

Historically, wild dogs inhabited 39 countries in sub-Saharan Africa, excluding lowland rainforests and the driest deserts (Woodroffe and Sillero-Zubiri, 2020), but the species is now found in just 14 countries, having lost nearly 93 % of its original range (Wolf and Ripple, 2017). Most of the remaining populations of wild dog are concentrated within a few landscapes with relatively low human densities in southern and eastern Africa (Woodroffe and Sillero-Zubiri, 2020). The largest remaining populations are thought to persist in southern Africa – particularly within the Kavango Zambezi (KAZA) ecosystem which spans Angola, Botswana, Namibia, Zambia and Zimbabwe – and across southern Tanzania and northern Mozambique in East Africa (Woodroffe and Sillero-Zubiri, 2020).

Tanzania has long been considered a stronghold for wild dogs, particularly in Selous-Nyerere in the south, which was the site of the first in-depth study of the species (Creel and Creel, 2002). Serengeti NP was also previously home to an important wild dog population which underwent local extinction in 1991 (Burrows et al., 1994), and efforts are ongoing to re-establish the population in the park.

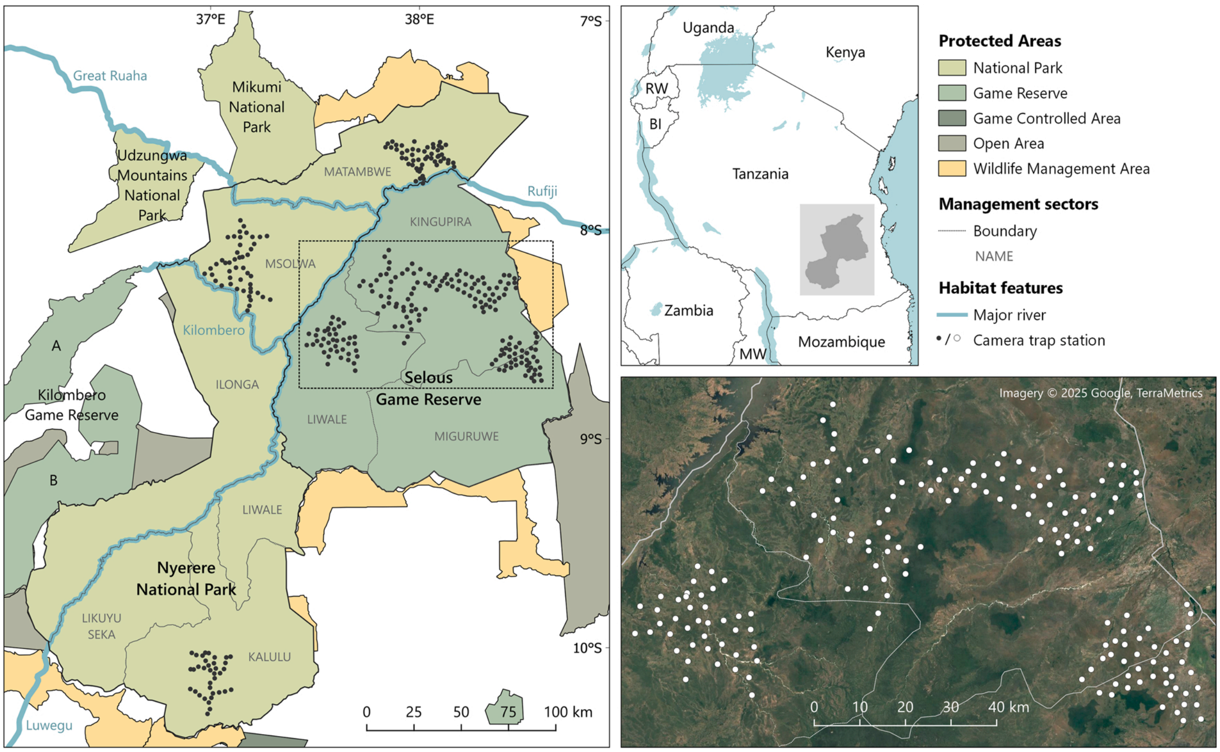

Fig. 1. 2020–2022 camera trap surveys in Selous-Nyerere, southern Tanzania. Each point represents a paired station of two camera traps, with one on each side of the road. The bottom-right map shows the camera trap stations in Selous GR which were combined for population density analysis.

Other wild dog populations are known to exist elsewhere in the country (such as the Ruaha-Rungwa ecosystem in central-southern Tanzania, Mkomazi NP in the north, and western Tanzania); however, little is known about the status of most of these populations (Strampelli et al., 2022, 2023; TAWIRI, 2016; Wilfred, 2017). Currently, the trans-boundary Selous-Niassa ecosystem, which spans an area across southern Tanzania and northern Mozambique, is considered to harbour East Africa's largest wild dog population (Woodroffe and Sillero-Zubiri, 2020). However, despite the ecosystem's critical role in wild dog conservation at the national, regional, and global level and the rising pressures from human activities, there has been no update on this wild dog population's status and threats in the last 25 years.

Our research aims to bridge this knowledge gap concerning the population status of wild dogs within the Selous-Nyerere ecosystem. Our findings provide the first SECR-based estimate of wild dog population density from camera trap surveys in the landscape, and one of the few SECR-based estimates of wild dog density across their entire range. We use our findings to provide recommendations for how best to secure this wild dog stronghold.

2. Methods

2.1. Study site

Our study was conducted within the Selous-Nyerere landscape, a UNESCO World Heritage Site in southern Tanzania which has been under protection since 1896 (UNESCO, 2025). Selous-Nyerere was previously managed as a single unit, Selous GR, before being split into two protected areas of different categories in 2019: Nyerere NP (30,893 km^2) and Selous GR (18,020 km^2; Fig. 1). Due to their large size and management complexity, both protected areas are divided into administrative sectors. Nyerere NP is used for photographic tourism and Selous GR is used for trophy hunting tourism, although hunting of wild dogs is prohibited.

Selous GR and Nyerere NP together cover 48,913 km^2, equal to 5 % of Tanzania's total area (947,300 km^2; World Bank, 2025), and are surrounded by a number of other protected areas of various protection categories which provide a buffer with unprotected land. The southern edge of Nyerere NP links through the Selous-Niassa Wildlife Corridor to the Niassa Wildlife Reserve in Mozambique, which covers 42,000 km^2; together, the trans-boundary Selous-Niassa ecosystem spans a 154,000 km^2 network of wildlife protected areas (SADC, 2025). This makes the landscape ideal for the conservation of wild dogs, as they occur at low densities and range widely, and therefore require large reserves to attain their ecological needs (Cozzi et al., 2020).

Selous-Nyerere is dominated by a mosaic of miombo woodlands covering 75 % of the landscape (Olson et al., 2001). The dominant plant species are those of genus *Brachystegia, Julbernardia, Combretum, Ptelopsis, Terminalia,* and *Acacia,* and long grasses of genus *Sprobolus, Andropogon,* and *Setaria* (Creel and Creel, 2002). The landscape has uni-modal rainfall distribution, with the dry season lasting from late May to early November. Annual precipitation ranges from roughly 750 mm in the east to 1300 mm in the west, with temperatures ranging from 13°C to 41°C. Altitude gradually rises across the landscape from 80 m in the east to 1300 m in the south.

Table 1
Survey design details and summary results for the seven camera trap grids in Selous-Nyerere from 2020 – 2022.

Protected Area	Selous GR				Nyerere NP		
Survey	Kingupira East	Kingupira West	Miguruwe Northeast	Liwale North	Matambwe Lakes	Msolwa South	Kalulu Central
Survey period	Jul-Nov 2021	Nov 2021-Feb 2022	Aug-Nov 2021	Jul-Nov 2021	Sep-Dec 2020	Aug-Nov 2022	Aug-Dec 2022
Survey duration (nights)	121	99	94	97	93	114	121
Camera trap stations	44	53	45	41	53	47	36
Trap nights	5304	4987	3943	3902	4350	5069	3922
Mean spacing between stations (km)	3.01	3.24	2.71	3.12	2.23	3.35	2.78
Sampled area (km^2)[a]	525	1124	409	507	527	1045	537
Proportion of photos identifiable[b]	92 %	92 %	84 %	84 %	92 %	89 %	81 %
Independent capture events[c]	152	55	266	76	48	42	17
Adult & yearling individuals[d]	53	19	73	30	14	24	9
Male	21	3	32	11	7	8	2
Female	18	9	30	12	6	5	4
Unknown sex	14	7	11	7	1	11	3

[a] Calculated based on a minimum bounding geometry around all stations within that survey

[b] Containing at least one identifiable individual; based on all photos of adult/yearling wild dogs.

[c] Based on identifiable right flank captures of adult or yearling individuals only; multiple captures of the same individual at the same station were not classified as independent if they occurred within the same 24-hour sampling occasion.

[d] Nine adult/yearling individuals appeared in more than one sub-grid of Selous GR used for analysis: two males, five females, and two individuals of unknown sex.

2.2. Camera trap surveys

We carried out seven camera trap surveys in Selous GR and Nyerere NP from 2020 to 2022 (Fig. 1; Table 1). Sites were selected based on accessibility and their representativeness of the wider protected area complex – including different habitat types, areas used for photographic tourism and those used for trophy hunting, areas of varying distance to boundaries, areas with different levels of tourism intensity, and trophy hunting areas with and without investors. Data collection was largely carried out throughout the dry season, with one grid (western Kingupira sector) extending into the early wet season (Table 1).

2.2.1. Survey design

The design of each survey grid – in terms of the total area covered and spacing between stations – was optimised for population density estimation of lion (*Panthera leo*), leopard (*Panthera pardus*) and spotted hyaena (*Crocuta crocuta*). To maximize survey coverage while maximizing the recapture of individuals, each grid comprised 36–53 stations covering approximately 500–1100 km^2, with a distance between stations of 2–5 km (Tobler and Powell, 2013; Table 1). Each grid was surveyed for approximately three months, with checks every 2–6 weeks.

Given the wide-ranging nature of wild dogs (Cozzi et al., 2020), analysing each of the seven surveys individually would likely lead to density overestimation (Foster and Harmsen, 2012). However, the four surveys in Selous GR were sufficiently close to one another that wild dogs could move between them, and we were thus able to meet the SECR modelling requirement of having a sufficiently large survey area to accurately capture movement by combining them into a single analysis (Table 1, Fig. 1). Data from the surveys in Nyerere NP were used for individual identification only.

2.2.2. Camera set up

We used xenon white flash cameras (Cuddeback Professional Color Model 1347, Non Typical Inc., Wisconsin, USA) to obtain clear images for individual identification through coat patterns. All stations were placed on roads to maximize the capture of large carnivores, as carnivores often travel along roads (Cusack et al., 2015; Searle et al., 2021). Each station consisted of a pair of cameras to increase the chance of photographing both flanks of any animal passing through and thus detections (Wong et al., 2019). To maintain the camera position and to protect them against animal damage and easy removal by humans, all cameras were mounted on trees in protective cases and secured with binding wire.

2.3. Individual identification

We used ExifPro software (Kowalski and Kowalski, 2010) to add tags to all images, containing information on which species was captured, whether it was a photo of the left or right flank, whether there was more than one individual, and any other noteworthy information, such as if the animal was snared or wounded. We extracted all photos of wild dogs and separated the right and left flank photos captured in each grid into separate folders for individual identification.

Identification was carried out for the flank with most captures (right) by comparing the unique coat patterns of the photographed individual with individuals in other photos. Each identified individual was given a unique numerical ID, and any images where the individual was not clearly identifiable were classified as unknown and excluded from analysis. Each individual was assigned to an age class based on their physical characteristics (adult, yearling, pup) and sexed based on visible external genitalia; if sex could not be confidently assigned, they were classified as unknown sex. Identification was completed by one observer and confirmed by a second observer.

2.4. Pack size

A wild dog pack is a group containing at least one potential breeding pair; pack size is defined as the maximum number of adults (at least 2 year of age) plus yearlings (1–2 years of age) in a given year (Creel and Creel, 1995; Courchamp and Macdonald, 2001)

We first classified individuals into packs based on the camera trap data. Individuals photographed within a twenty-minute time frame in the same location (camera trap station) were classified as belonging to the same pack. This spatiotemporal grouping was selected on the basis that there is overlap between the territories of different wild dog packs (Jackson et al., 2017) but direct interactions between different packs are infrequent (Jordan et al., 2017). The information was then pieced together so individuals could be grouped into packs based on those photographed together over successive capture events.

We then used data from opportunistic direct sightings of wild dog packs during the study period to assess the effectiveness of the camera trap data for determining wild dog pack membership. Whenever wild dogs were encountered during fieldwork, field teams would record the location and the number of individuals present, and take photographs of as many individuals as possible. The directly sighted individuals were then individually identified based on their unique markings; individuals that were already identified through the camera trap photos maintained the same ID, and newly identified individuals were allocated new IDs. The composition of packs identified using camera trap data were compared to those using the direct sighting data.

2.5. Density estimation

2.5.1. Accounting for group association

Standard SECR models assume that individuals are distributed and detected independently of one another (Efford, 2001). This assumption is violated by group-living species like wild dogs, which can result in a positive bias in density estimates and overstated precision (Bischof et al., 2020). While group-level SECR models are available (Emmet et al., 2022), individual density can only be calculated from such models by multiplying group density by known information on average group size, which is often not possible in data-limited settings.

A cluster SECR model was recently developed to address this challenge by simultaneously estimating individual density, group density, and group size while accounting for dependence in detection between individuals within groups, validated using wild dog data from the Okavango Delta (Emmet et al., 2022). While this model has substantial potential for improving wild dog density estimation, it can only be used in well-studied populations in which group membership of detected individuals can be definitively assigned (a challenge shared with group-level models). As this was not known for our study population, we could not apply the cluster model to our dataset and instead fitted an individual-level model. However, we acknowledge that our density estimate must therefore be treated with caution (Bischof et al., 2020).

2.5.2. SECR modelling

We combined the data from the four camera trap surveys in Selous GR to estimate the population density of wild dog (defined as the number of adult/yearling individuals per 100 km^2) via SECR analysis (Efford, 2011), using package *secr* version 5.2.0 (Efford, 2025a) in R version 4.4.0 (R Core Team, 2024) and RStudio version 2024.04.1 (RStudio Team, 2024). We did not use the data from Nyerere NP to estimate density as each of the three surveys (which were not contiguous) did not cover a large enough area to be likely to accurately capture wild dog movement.

Density was estimated based on right flank captures of adult and yearling individuals. To avoid truncation bias in our density estimate (Efford, 2025b), the width of the buffer was selected using the functions *suggest.buffer* and *esa.plot* (Efford, 2025a) and validated by increasing buffer width by 1 km increments to ensure the density estimate had stabilised (Efford, 2011).

We tested the goodness-of-fit of the model by carrying out a Monte Carlo goodness-of-fit test with the function *MCgof* (Choo et al., 2024). To account for the issue of wild dog activity centres being over-dispersed (clumped) relative to a Poisson distribution, we applied a variance inflation factor to the density estimate based on the number of individuals detected at each detector (Bischof et al., 2020) using the function *adjustVarD* (Efford and Fletcher, 2024; Efford, 2025a).

We calculated the half relative confidence interval width for the initial and adjusted density estimates to assess the population change that each estimate would have a reasonable probability of detecting (Dröge et al., 2020).

All model inputs and results can be found in Appendix S1.

3. Results

3.1. Survey coverage and effort

The 319 paired stations across seven surveys covered 4674 km^2 (calculated by summing the area of the minimum bounding geometry around each survey; Table 1) and resulted in a total sampling effort of 31,477 trap nights. For the four Selous GR surveys combined, the 183 paired stations covered an area of 2565 km^2 (note that the effective sampling area will be larger than this). This area – which does not account for the spaces between each survey across which some individuals were detected – is much larger than the previously estimated average annual home range of wild dog in the landscape (379 ± 79 km^2, min. 206 – max. 851; Creel and Creel, 2002), and close to the largest home range sizes documented for the species (150 – 3800 km^2; Fuller et al., 1992).

3.2. Individual identification

The seven surveys together yielded 1591 photos containing one or more wild dogs. Counting only right flank photos, there were a total of 759 images of individual wild dogs, of which 659 (87 %) were suitable for individual identification. From these, we identified 222 adult/yearling individuals. Sex was confidently assigned to 168 individuals (84 female and 84 male; 76 % of all individuals identified) and was unknown for 54 individuals (24 % of all individuals identified; Table 1). Three individuals showed evidence of snare injuries: one in the lakes area of Nyerere NP's Matambwe sector, one in the eastern Kingupira sector of Selous GR, and one in the north-eastern Miguruwe sector of Selous GR.

The data from Selous GR used for density analysis included 166 individuals (65 male, 64 female, 37 of unknown sex). Of these, nine individuals were captured in more than one of the four surveys (see Appendix S2). Individuals included in the SECR analysis had a mean of 3.3 independent captures (minimum 1 – maximum 23) and were captured at a mean of 2.6 stations (minimum 1 – maximum 19).

3.3. Population density

Based on the capture history used for SECR analysis, the mean maximum distance moved by wild dogs in Selous GR was 11.95 km. The maximum distance between two stations where the same individual was captured was 42.37 km. 8 % of the individuals identified (14 out of 166) were captured at stations more than 20 km apart (see Appendix S2).

Buffer width stabilised at 28 km. Population density was estimated at 2.14 ± 0.18 adult/yearling wild dogs per 100 km^2 (95 % confidence interval: 1.82–2.51), with a capture probability (g0) of 0.0061 ± 0.0005 (95 % CI: 0.0052–0.0073) and movement parameter (sigma) of 6920 ± 203 (95 % CI: 6533–7330).

The goodness-of-fit tests returned statistically significant results for individual-trap (yik, $p = 0.00$) and traps (yk, $p = 0.00$) but not individuals (yi, $p = 0.26$), indicating the presence of unmodelled spatial heterogeneity in the data (Choo et al., 2024). After adjusting for over-dispersion factor c-hat ($\hat{c} = 6.35$), the final density estimate was 2.14 ± 0.45 adult/yearling wild dogs per 100 km^2 (95 % confidence interval: 1.42–3.21).

Half relative confidence interval width was 16 % for the initial density estimate and 42 % for the over-dispersion-adjusted estimate.

3.4. Pack size

Based on the camera trap data, we grouped 141 individuals into 24 packs (mean size: 5.9 adult/yearling individuals, range: 2–23). An additional 25 individuals were not associated with any other pack members (see Appendix S3).

We gathered additional pack information through direct sightings of six packs during the camera trap survey period. These packs ranged in size from 5 to 28 individuals (5, 6, 9, 9, 12, 28), with a mean size of 11.5 adult and yearling individuals. Information from these direct sightings was used to evaluate and improve the camera trap-based pack groupings.

Of the six packs we saw through opportunistic direct sightings, four were unchanged from their camera trap-based grouping. One pack (the largest known pack in our study area) was updated to include two additional individuals which had not been associated with any other individuals based on the camera trap data. Another pack seen directly was classified as two separate groups based on the camera trap data, which were combined into a single pack with the inclusion of the direct sightings data. Together, these direct sightings-based changes resulted in 143 individuals grouped into 23 packs (mean size: 6.2 adult/yearling individuals, range: 2–25), and 23 individuals with no associated pack members.

4. Discussion

4.1. Population status

Our study provides evidence of a globally important African wild dog population in the Selous-Nyerere landscape, with an over-dispersion-adjusted density estimate of 2.14 ± 0.45 adult/yearling wild dogs per 100 km^2 (95 % confidence interval: 1.42–3.21). This is in line with a SECR-based density estimate of approximately 2.3 adults/yearlings per 100 km^2 obtained using a similar survey design in northern Botswana (Rich et al., 2019).

Past research in the former Selous GR estimated densities of 1.6–2.4 adults/yearlings per 100 km^2 in miombo woodland habitat and 4 adults/yearlings per 100 km^2 in the open lakes habitat in the northernmost part of the landscape (the Matambwe sector, which is now part of Nyerere NP – see Fig. 1; Creel and Creel, 1998; Creel and Creel, 2002). While it is important to note that both these estimates were derived using non-spatially explicit methods (based on direct sightings of uncollared packs and collared packs, respectively), which are likely to underestimate the effective area surveyed and thus overestimate density when the area surveyed is not boundered by hard edges (Efford and Boulanger, 2019; Twining et al., 2022), this means our estimate from the predominantly-miombo survey area within Selous GR is broadly in line with the historical estimate from the same habitat type. Although we were unable to estimate density in the lakes habitat of Matambwe due to the surveyed area likely being too small to accurately capture wild dog movement, a number of mortalities have been documented in recent years, particularly from poisoning, and based on direct sightings the number of wild dogs in this area appears to be lower than at the time of the previous study (Lion Landscapes, unpublished data). Given that Selous-Nyerere is widely marketed as one of Africa's top destinations to see wild dogs (Briggs and McIntyre, 2023) and almost all photographic tourism investment in Nyerere NP is concentrated in the lakes area, this likely decline has important implications for revenue and thus conservation funding for the ecosystem.

Our model exhibited poor fit, and over-dispersion in the underlying data resulted in a relatively wide adjusted confidence interval. This highlights the limitations of applying individual-level SECR models to group-living wild dogs, which exhibit intermediate aggregation and high cohesion (Bischof et al., 2020; Emmet et al., 2022), particularly as the variance adjustment is unlikely to actually solve the problem of over-dispersion (Efford and Fletcher, 2024). However, the models currently available to estimate density for such species require group membership to be confidently known for all individuals, which is often not possible except in already well-studied populations. In this context, a poor-fitting model can be preferable to no model at all (Choo et al., 2024; Royle et al., 2014), although it is important to acknowledge the resulting uncertainty in the estimate produced. Given the limited data available for most wild dog populations, we encourage efforts to extend the cluster model to allow pack membership to be unknown for some individuals (Emmet et al., 2022). This would be especially valuable as it would make it easier to monitor wild dog density as part of a multi-species monitoring framework (although programmes of this kind must ensure surveys cover a large enough area to adequately capture wild dog ranging patterns).

The latest estimate from northern Mozambique's Niassa National Reserve placed the area's wild dog population at ~350 individuals (Begg and Begg, 2009 – but note that this estimate is now more than 15 years or three wild dog generations old; Woodroffe and Sillero-Zubiri, 2020). It would not be appropriate to extrapolate our population density estimate to obtain an overall estimate of wild dog population abundance across Selous-Nyerere due to the uncertainty inherent to such calculations (Suryawanshi et al., 2019); however, if we assume similar or even slightly lower wild dog densities in most of Selous-Nyerere (which we believe from our knowledge of the system to likely be the case), our findings provide further evidence for the Selous-Niassa ecosystem being one of the two most important remaining strongholds for wild dog in Africa, alongside the transfrontier KAZA landscape in southern Africa (Woodroffe and Sillero-Zubiri, 2020).

Considering the naturally low density and wide-ranging characteristics of wild dogs, it is likely that the size and relative intactness of the ecosystem plays a key role in ensuring the conservation of such a large population of the species (Creel et al., 2020; Pomilia et al., 2015).

4.2. Population structure and pack size

We were able to assign sex to 76 % of the 222 identified individuals, with an equal number of males (n = 84) and females (n = 84). Other wild dog studies have found a male-biased adult sex ratio (McNutt and Silk, 2008; Spiering et al., 2010) – albeit with an approximately equal ratio of alpha males and alpha females (Woodroffe and Sillero-Zubiri, 2020) – but as we could not determine sex for 24 % (n = 54) of all identified individuals, we could not draw conclusions about the sex ratio of the study population from our data.

Direct sightings data were limited but suggested a mean group size nearly twice as large as that suggested by the camera trap data alone (11.5 versus 5.9 adults/yearlings), highlighting the limitations of camera trap data for accurately inferring group structure. This is a particularly important consideration when data are from white-flash camera traps, which have a flash recharge time of ~20 seconds between subsequent captures at night. Data from infra-red cameras, which don't have this requirement, would likely provide more reliable information on pack size, although individual identification is usually more challenging from infrared images due to black-and-white night-time images and motion blur. Nevertheless, as we were able to associate the majority of identified individuals with at least one other individual based on camera trap captures, including the largest known pack in our study area, our findings demonstrate that camera trap data can provide some insights into wild dog pack membership which can be valuable in data-limited settings or as a complement to direct sightings data. However, care must be taken when grouping based on camera trap data, as there is a non-zero possibility of misgrouping individuals from different packs that happen to be in the same location at a similar time.

Where studies seek to understand wild dog demographics and group structure, we recommend combining data from camera traps with direct sightings data, which are a more efficient and reliable way of not just assigning group membership to individuals but also of determining sex. If group membership can be determined with confidence for all individuals, this also opens up the option of applying the cluster SECR model to estimate population density (Emmet et al., 2022), which is better able to account for wild dogs' group-associated movement patterns.

The mean pack size suggested based on direct sightings is in line with previous estimates from the northern part of Selous-Nyerere, where pack sizes ranged from 3 to 20 adults and 3–44 individuals including yearling/pups (Creel and Creel, 1995), and is larger than mean pack sizes estimated elsewhere in the species' range (Woodroffe and Sillero-Zubiri, 2020). The largest pack observed in this study was a group of 28 adult/yearling individuals (26 of which were grouped together based on the camera trap data and 2 of which were captured but not grouped together based on the camera traps) which were seen with 11 pups, bringing the total number of individuals to 39. This represents one of the largest pack sizes reported in the literature.

4.3. Conservation recommendations

Our findings highlight that the Selous-Nyerere landscape remains an important stronghold for African wild dogs. However, the population is facing a number of threats that require urgent action.

Bush-meat poaching is an increasingly prevalent issue in the landscape (TAWA & TANAPA, unpublished data). This can directly cause injuries and death among wild dogs when they are accidentally caught in wire snares (Becker et al., 2024; Woodroffe et al., 2007), but also has less immediate impacts on wild dog survival, reproduction, and population density by reducing wild prey numbers (Creel et al., 2025). We recommend a programme of wild dog collaring and focal monitoring of packs in at-risk areas to enable rapid treatment of snare injuries, combined with de-snaring patrols in the worst-affected areas.

Another major threat is intentional poisoning due to human-wildlife conflicts (Ogada, 2014): between 2016 and 2024, eight poisoning incidents have been detected in the landscape, two of which resulted in the deaths of multiple wild dogs (TAWA & Lion Landscapes, unpublished data). Tackling this threat requires both top-down and bottom-up interventions, including coordinated action across a number of governmental departments to limit the accessibility of common poisons (agricultural pesticides) and work with communities to reduce conflict and discourage the practice.

The presence of unvaccinated domestic dogs in villages along the landscape's boundaries also poses a threat, as they can harbour and transmit diseases such as rabies and canine distemper which can rapidly wipe out entire packs (Prager et al., 2012; Woodroffe et al., 2012). We recommend a disease monitoring and surveillance programme in these areas, ideally as part of a One Health approach that benefits both wild dogs and human well-being (Cunningham et al., 2017).

Finally, habitat degradation and conversion is on the rise in buffer areas: the cattle population within the ecosystem has more than doubled in the last ten years, and an increasing portion of the remaining habitat outside protected areas has been converted to agriculture (TAWIRI, 2015, 2023). Wild dogs' wide-ranging behaviour exposes them to significant edge effects which will be exacerbated as these boundaries harden (Woodroffe and Ginsberg, 1999). As a result, efforts should be made to forecast likely scenarios of habitat loss in the coming years, to quantify its potential impact on the population and identify priority areas for conservation.

Ethical statement

The research observed all the ethical requirement from obtaining research permits from all relevant Authorities in the United Republic of Tanzania and adhered to ethical data collection procedures without harm to the species under research or its habitat.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.gecco.2025.e03621.

Data availability

Data will be made available on request.

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