Serval *Leptailurus serval*

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Namibian conservation status	Near-Threatened
Global IUCN status	Least Concern (2015)
Namibian range	Central and northern highlands, north-central and north-eastern Namibia (291,000 km^2, approximately 35% of Namibia)
Global range	Occurs widely through sub-Saharan Africa, with the exception of tropical rainforest. Few records north of the Sahara
Population estimate	1,500–4,000 in Namibia
Population trend	Stable; possibly declining
Habitat	A combination of permanent water sources with sufficient vegetation cover and opportunities to shelter
Threats	▸ Habitat loss and fragmentation ▸ Drought, Climate change ▸ Accidental mortality (snares and roads)

DISTRIBUTION

Shortridge (1934) describes the serval as occurring chiefly in the northern parts of Namibia, with records from Damaraland (now northern Erongo and southern Kunene), and eastwards to the Waterberg. He further noted that servals are rare south of these areas, and confirmed that they are generally found near permanent water sources. The IUCN's initial distribution map reflects this description (Breitenmoser-Wursten *et al.* 2008).

An apparent extension of the serval's range southwards as far as Windhoek and the central highlands has been noted (Thiel 2019, extended further by Stratford *et al.* 2016). Importantly, Stratford *et al*. (2016) report historical records from Gaerdes (1978), which demonstrate that servals have been present in the central highlands for an extended period. This suggests a permanent population, albeit at very low density. It also suggests that the IUCN's inference (see below) that servals are recolonising areas may not be completely correct. Monitoring techniques, especially camera trapping, have provided significant improvements in detection of nocturnal cryptic species such as the serval.

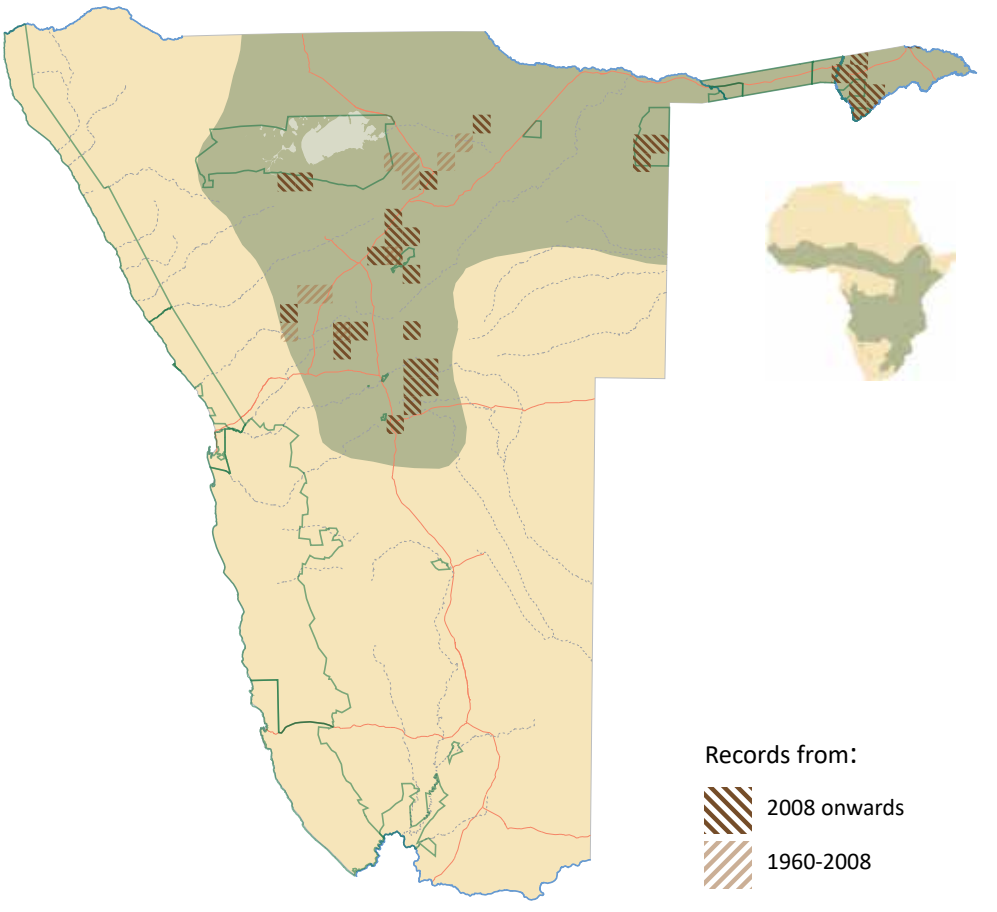
Some further range extensions have been reported: a sighting from 2015 in north-western Kunene might represent a population rather than a single dispersing individual. If this is the case, then it may be that in Namibia serval can extend their range by moving along waterways, as suggested in Thiel (2019). There is also a sighting from 2011 on the eastern edge of the Namib Sand Sea, at least 200 km south of what is thought to be the southernmost extent of the range. The status of this record is not known.

The serval occurs widely throughout sub-Saharan Africa, with the exception of tropical rainforests and deserts (Nowell & Jackson 1996a). In recent years there have been new records of servals in several areas such as Gabon,

Distribution records of serval, and present estimated area of distribution in Namibia.

Inset: African distribution of serval according to IUCN (Thiel 2019).

The Namibian distribution in the main map is more up to date, and expands the range of serval as shown by the IUCN.



eastern Central African Republic and south-western Uganda, implying an expanding population that is recolonising areas (Thiel 2019).

More recently, Finerty *et al.* (2019) have reported camera trap observations of servals in Botswana as far as 200 km south of the current IUCN range, suggesting that, where suitable conditions exist, servals may also occupy semi-arid landscapes. This would be consistent with Stratford *et al's* (2016) prediction that servals may occur in the central Kalahari savanna to the east of their southern range in Namibia.

POPULATION ESTIMATE AND TREND

Despite its status and wide range, the serval remains largely understudied (Ramesh & Downs 2013), and, until recently, density estimates have been limited to just five countries. Published density estimates for sub-Saharan Africa range widely: from 2.51–2.82 serval/100 km^2 in Senegal (Kane 2014) to 62.55–111.55 serval/100 km^2 in South Africa (Loock *et al.* 2018). However, such a high density estimate may be due to the industrialised nature of the study area (the Secunda Synfuels Operations Plant) attracting high densities of preferred prey species; in comparison Bohm and Hofer (2018) report a density of 10.37–11.81 serval/100 km^2 in the Republic of Congo's Odzala-Kokoua National Park, whilst Thiel (2011) reports a density of 9.9 serval/100 km^2 in Zambia's Luambe National Park.

Edwards *et al.* (2018b) present the first density estimates for Namibia, from two protected areas in the north-east. Density was estimated at 1.28 serval/100 km^2 (± 0.23, 0.82–1.56) in Khaudum National Park, and 0.63 serval/100 km^2 (± 0.51, 0.38–0.90) in the Mudumu North Complex. The latter is the lowest serval density published to date.

The projected distribution of servals in Namibia covers an area of approximately 291,000 km^2. The low density estimates from Edwards *et al.* (2018b) in the eastern areas, and the extremely low detection rate for servals in the central highlands (Stratford *et al.* 2016), suggest that servals in Namibia occur at densities that may well be as low as 0.50 serval/100 km^2. This would imply a population of as few as 1,500 individuals. Even if it is assumed that detection rates by the existing studies are compromised, and that the densities are as high as those recorded in Khaudum, the maximum population size is likely to be less than 4,000 adult individuals.

Given the paucity of information on this cryptic species, it is unknown whether the population is stable. However,

considering the threats (see below), it is unlikely that population numbers are increasing.

ECOLOGY

Servals are mostly found in and around marshland, well-watered savanna and long-grass environments, and are particularly associated with riparian vegetation types (Thiel 2019) that provide a high abundance of prey species, such as small mammals (especially rodents), birds and reptiles. These form their mainstay diet (Bowland 1990, Bowland & Perrin 1993, Geertsema 1984, Ramesh & Downs 2015b, Thiel 2011). Servals can tolerate agricultural areas provided there is available cover and prey, and can use features such as waterways to move between suitable patches (Hunter & Bowland 2013, Ramesh & Downs 2013), suggesting local populations may exist in smaller areas across their broad distribution range (Sunquist & Sunquist 2002). Stratford *et al*. (2016) show that servals can also exist in the semi-arid *Acacia*-dominated landscape of Namibia's central highlands – this provides patches of dense vegetation and suitable habitat for their preferred prey species.

Ramesh *et al*. (2016) suggest that the status of servals in mosaic agricultural landscapes is reduced, particularly their movement patterns in response to habitat fragmentation. This is supported for Namibian serval populations by the extremely low detection rates in the central highlands of Namibia (Stratford *et al.* 2016). Serval exhibit lower occupancy rates in cropland but increased occupancy with higher human abundance (Ramesh & Downs 2015b, and see the high densities recorded by Loock *et al.* 2018). However, serval are likely to be sensitive to fragmentation due to habitat specialisation (Ramesh *et al*. 2016). Ramesh & Downs (2013) found that they preferred native wetland with a higher percentage of less disturbed, large-sized patches and also avoided or used croplands less (Ramesh & Downs 2015a).

THREATS

The major threat to servals is the loss and degradation of wetland and associated grassland (Thiel 2011, Ramesh *et al.* 2016). Wetlands have high rodent densities when compared with other habitat types, and form the core areas of serval home ranges (Bowland 1990, Ramesh & Downs 2015a, Thiel 2019). Anthropogenic modification of grasslands through annual burning, overgrazing by livestock and intensive wildlife/livestock farming, can result in a significant reduction in prey species and suitable habitat. First-order anthropogenic sources are not the only drivers of loss of suitable habitat. The anticipated decline in rainfall, rise in temperatures and increased severity of droughts associated with climate change will also lead to a reduction in serval habitat.

Other threats include land-use change, increased anthropogenic structures (e.g. roads, buildings) and invasive alien plants. However, the very high densities found near an industrial plant (Loock *et al.* 2018) suggest that servals are able to take advantage of conditions in novel anthropogenic landscapes – as is being seen across many mammalian species (Fleming & Bateman 2018). Thus, while Ramesh and Downs (2013) found serval density to be similar across a

range of farmland management intensities, the continued degradation of core wetland areas may ultimately threaten viable serval populations, especially if they are reluctant to move through hostile habitat such as open cropland (Ramesh & Downs 2015a). Within agricultural landscapes, servals select areas with minimal disturbance and a high proportion of natural habitat (Ramesh & Downs 2015a), thus highlighting that only landscapes with a mosaic of modified to natural habitats will be suitable, and emphasising the importance of undisturbed habitats. In Namibia these habitats are under particular pressure as agricultural use increases.

Other threats within Namibia include road mortalities, accidental persecution by farmers intent on killing other carnivores (Power 2014), and incidental snaring as part of the bushmeat trade. Although servals are non-target animals (and are actually beneficial to crop farmers due to their predilection for rodents), many die in traps set out for carnivores such as black-backed jackals, which are perceived as a problem animal on many farms. Additionally, servals occasionally prey on poultry, which may lead to direct persecution. Similarly to leopards, the trade in South Africa for serval skins for use in ceremonial traditions is an important threat (Balme 2019), and also contributes to a suspected ongoing decline in mature individuals. Trade in serval pelts for ceremonial or medicinal purposes is widespread throughout Africa (Thiel 2019), and pelts are often worn as a substitute for leopard pelts. It is unknown whether this constitutes a significant threat for Namibia's servals.

Hunting of servals is not restricted in Namibia, although they may only be hunted with a permit in Angola. Hunting is prohibited in the neighbouring countries of Botswana and South Africa (Cape Province only). However, serval are not thought to be a common target for trophy hunting.

Hybridisation with feral cats may be a minor threat in Namibia, although this is not as severe as it is for other species, such as African wild cat. Hybridisation with the African wild cat has been documented in captivity (Skinner & Chimimba 2005). Deliberate hybridisation with the feral cat has resulted in a newly registered breed, the "Savanna Cat" (Eckermann-Ross 2014), which has been facilitated by the fact that many small felids are susceptible to domestication (Cameron-Beaumont *et al.* 2002). However, the males tend to become sterile after a few generations (Davis *et al.* 2015). There has, however, been no indication of a threat from this issue in Namibia.

CONSERVATION STATUS

Until now, the serval has been classified as Least Concern in Namibia. This document reports new information on population size and density, and therefore justifies a reassessment. While Namibia's serval population meets some of the criteria for a Vulnerable (VU) listing (e.g. population is fragmented and consists of less than 10,000 mature individuals), there is insufficient longitudinal data for an evaluation of the state of flux of the population. Given that the perceived threats are likely to increase, it would appear prudent to elevate the status of serval in Namibia to Near Threatened (NT).

The serval is listed in CITES Appendix II, although hunting of this species is not prohibited in Namibia. Indeed, there are no hunting regulations listed for serval in Namibia's Nature Conservation Ordinance Act (1975). Effective conservation of serval populations requires wide areas of native habitat,

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in particular well-preserved wetlands in mosaic landscapes (Ramesh & Downs 2013, 2015a, 2015b). Wetlands form islands of suitable habitat and provide reservoirs of small mammal populations that constitute the main prey of servals (Bowland 1990). Maintaining the quality of remaining natural wetland habitats, as well as artificial wetlands, will contribute to the persistence of serval subpopulations. For example, management actions such as retaining ground cover, reducing grazing pressure or keeping a buffer of natural vegetation intact around the wetland can reduce the impacts of damaging farming practices and contribute to the preservation of healthy population of rodents (Bowland & Perrin 1993, Driver *et al.* 2012). Restoration and maintenance of such habitat patches is the only means of improving functional connectivity in modified landscapes; these are especially relevant for a species that exists at very low densities (Ramesh & Downs 2015a). Additionally, artificial wetlands that provide protection, prey base and shelter can be integrated into landscape-scale conservation plans.

ACTIONS

Management

The impact of Namibia's small serval population on livestock is likely to be insignificant, therefore policy makers should work towards getting serval listed as a protected species under Namibian conservation legislation.

- Management should aim at conserving the prime habitat of serval, i.e. Namibia's wetland areas. Serval are known to forage away from wetlands and therefore such habitat management should also include conserving woodlands with good grass cover. Serval have been found to be abundant on South African farmlands; therefore maintaining good veld condition, especially in areas with riverine habitat, is identified as an important management practice.

- Monitoring serval should be introduced as a compliance measure in Environmental Impact Assessment reports of developments which affect wetlands.

Awareness

Report sightings, including road-kills and camera trap records from private individuals on virtual platforms (for example, the EIS), especially outside protected areas.

- Do not purchase or import hybrid "Savanna Cats" and ensure domestic cats are sterilised, especially in rural areas in which serval are known to occur.

- Report snaring or illegal hunting incidents to Ministry of Environment, Forestry and Tourism, Namibia's Intelligence Support Against Poaching (ISAP) and conservation NGOs.

Research

As yet no spatial data from free-ranging servals within Namibia has been collected. Edwards *et al*. (2018b) suggested Namibian serval might have relatively large home ranges which could explain the low densities recorded for the Mudumu North Complex and southern Khaudum National Park. The collection of spatial data from both sexes of serval in a variety of habitats using GPS/satellite collars will enhance the knowledge of serval ecology in Namibia.

- Across their range, serval should be monitored to determine density and population trends. Ramesh and Downs (2015b) suggested serval to be useful ecosystem indicators for the influence of habitat fragmentation within agricultural landscapes, therefore monitoring in such habitats, and in protected areas, is suggested as a high priority.

- Individuals translocated or released from rescue centres should be monitored using GPS/satellite telemetry, following their release. There is currently limited data on the success of such releases and obtaining relevant information would help guide future management decisions.

- Investigate the role of serval as a controller of agricultural pests and promote findings within local communities and the agricultural sector. At the same time, establish the degree of hunting pressure and persecution of serval in Namibia.

- Basic distribution data of serval across Namibia should be collected through structured questionnaire surveys. Results will highlight key areas that will need to be studied further.

- Obtain genetic samples from serval in Namibia to study connectivity across different populations.

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