Population density estimate of leopards (*Panthera pardus*) in north-western Mpumalanga, South Africa, determined using spatially explicit capture-recapture methods

Supplementary Material

Leopard resting in a tree at Kruger National Park, Mpumalanga, South Africa.
Photo credit: Wayne S. J. Boardman

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Supplementary Material no. 1 - Electronic Coding on R

```
> library(secr)
This is secr 3.1.7. For overview type ?secr
> leo <- read.capthist(captfile ="Secr84Occs.txt", trapfile ="SCR20l
ocations83(UPDTD).txt", detector = "proximity", fmt = "trapID", covn
ames = "Sex")
No errors found :-)
> plot(leo, rad=30, tracks=TRUE)
> suggest.buffer(leo)
[1] 5729
> fit2 <-secr.fit (leo, buffer =7500, trace =FALSE)
> esa.plot(fit2,ylim =c(0,2))
> lospoly <- read.csv("lospolygons.csv")
> mask <- make.mask(traps(leo), type = 'trapbuffer', spacing = 500,
buffer = 6000, poly = lospoly, poly.habitat = FALSE)
> plot(mask)

MOD1 <- secr.fit (leo, model = g0~1, mask=mask, detectfn=0, CL=TRUE)
MOD2 <- secr.fit (leo, model = sigma~Sex, mask=mask, detectfn=0, CL=
TRUE)
MOD3 <- secr.fit (leo, model = g0~Sex, mask=mask, detectfn=0, CL=TRU
E)
MOD4 <- secr.fit (leo, model = list(sigma~Sex, g0~Sex), mask=mask, d
etectfn=0, CL=TRUE)

predict(MOD1, new=data.frame(h2=factor(c("F","M"))))
predict(MOD2, new=data.frame(h2=factor(c("F","M"))))
predict(MOD3, new=data.frame(h2=factor(c("F","M"))))
predict(MOD4, new=data.frame(h2=factor(c("F","M"))))

derived(MOD1)
derived(MOD2)
derived(MOD3)
derived(MOD4)


modelresult <-  AIC(MOD1, MOD2, MOD3, MOD4)
write.csv(modelresult, "modelresult.df.csv")
```

Supplementary Material no. 2

Population density estimate of leopards (*Panthera pardus*) in north-western Mpumalanga, South Africa, determined using spatially explicit capture-recapture methods

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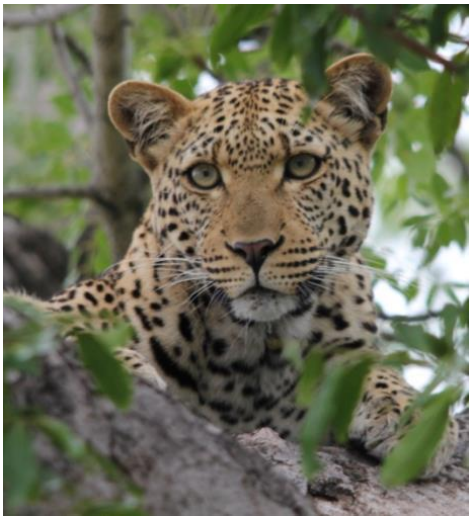
Highlights:

- The African leopard is currently facing the threat of extinction largely due to widespread habitat fragmentation that brings them into direct conflict with humans.
- Loskop Dam Nature Reserve is a protected area located in Mpumalanga province, South Africa. Almost no research has been conducted in the region, so little is known about the leopard population persisting on the reserve and the surrounding areas.
- We estimated that the leopard population density on LDNR was 7.7 ± 2.0 (range 4.7-12.6) individuals per 100 km2. This compared with other density estimates from nature reserves across South Africa which means that LDNR harbours a significant leopard population despite being quite isolated.



This article is part of a thematic collection of articles (Special Issue) of *Mammalian Biology* and covers the following topics and taxa (marked with ☑) addressed in the Special Issue:

Article Type

☑ Original Research ☐ Techniques ☐ Review ☐ Short Communication ☐ Concept Note

Taxon

Terrestrial

☐ Bats *(Order Chiroptera)*
☐ Carnivores : Bears *(Family Ursidae)*
☐ Carnivores : Canids *(Family Canidae)*
☑ Carnivores : Felids *(Family Felidae)*
☐ Carnivores : Hyenas *(Family Hyaenidae)*
☐ Carnivores : Mustelids *(Family Mustelidae)*
☐ Elephants *(Family Elephantidae)*
☐ Primates : Great Apes *(Family Hominidae)*
☐ Primates : Old World monkeys *(Family Cercopithecidae)*
☐ Ungulates : Bovids *(Family Bovidae)*
☐ Ungulates : Deers *(Family Cervidae)*
☐ Ungulates : Giraffes *(Family Giraffidae)*
☐ Ungulates : Horses *(Family Equidae)*
☐ Multiple taxa *(3 or more Families/Orders)*

Marine

☐ Baleen whales : Right whales *(Family Balaenidae)*
☐ Baleen whales : Rorquals *(Family Balaenopteridae)*
☐ Carnivores : Bears *(Family Ursidae)*
☐ Carnivores : Mustelids *(Family Mustelidae)*
☐ Dolphins *(Family Delphinidae)*
☐ Large toothed whales *(Families Delphinidae & Hyperoodontidae)*
☐ Pinnipeds : True seals *(Family Phocidae)*
☐ Porpoises *(Family Phocoenidae)*
☐ Sirenians : Manatees *(Family Trichechidae)*
☐ Multiple taxa *(3 or more Families/Orders)*

Topic

☐ Acoustic ID
☐ Aerial surveys
☐ Analytical innovations
☐ Automated pattern recognition
☐ Behavioural ecology
☑ Camera-trapping
☑ Conservation management
☐ Data management
☐ Demographic parameters
☐ Field methodology
☐ Genetic ID
☐ Health conditions
☐ Other: *(please specify)*
☐ Identification techniques
☐ Life-history
☐ Machine learning
☑ Mark-recapture analysis
☐ Morphometrics
☐ Network analysis
☐ Photogrammetry
☑ Population ecology
☐ Site fidelity & Movement
☐ Social ecology
☐ Software/Package development
☐ Thermal imagery

References

Karczmarski L, Chan SCY, Rubenstein DI, Chui SYS, Cameron EZ (2022a). Individual identification and photographic techniques in mammalian ecological and behavioural research – Part 1: Methods and concepts. *Mammalian Biology* (Special Issue), 102 (3) https://link.springer.com/journal/42991/volumes-and-issues/102-3

Karczmarski L, Chan SCY, Chui SYS, Cameron EZ (2022b). Individual identification and photographic techniques in mammalian ecological and behavioural research – Part 2: Field studies and applications. *Mammalian Biology* (Special Issue), 102 (4) https://link.springer.com/journal/42991/volumes-and-issues/102-4