The University of Cape Town Affects Mammal Diversity and Abundance

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1. I know that plagiarism is wrong. Plagiarism is to use another’s work and pretend that it is one’s own.

2. I have used the **UCT harvard** convention for citation and referencing. Each contribution to, and quotation in, this **report** from the work(s) of other people has been attributed and has been cited and referenced.

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**Introduction**

Habitat transformation and urbanization have large effects on biodiversity and habitat change. Some mammals may benefit from urbanization whilst others are disadvantaged (Concepion, 2015). Research from urban reserves worldwide reveal that small, generalist species are more likely to persist within and adjacent to urban areas (Fahrig, 2020). Additionally exotic species associated with human transformed land are more common in urban areas (Gaertner, 2017), while large predators are rare in urban and peri-urban spaces (McCabe, 2017). Urban areas may provide novel food sources, shelter and release from natural predators, but they also include new risks including pesticides, vehicles and domestic animals (Newsome, 2017).

In this study I compare mammal diversity in an urban landscape, the University of Cape Town (UCT) and compare this with the adjacent protected area of Table Mountain National Park (TMNP). I tested the null hypothesis that there is no difference in mammalian diversity, community structure and species richness on these two different lands. Evidence from previous research led me to the prediction that species diversity and species richness would be higher on UCT land because it provides access to novel food sources and protection from natural predators. I also predicted that the community structure would differ between UCT and TMNP, with larger mammals and predators less abundant on UCT land than TMNP.

**Methods:**

The study site covered an area of 1.37 square kilometers that includes both the upper campus of UCT and an adjacent section of TMNP. The climate is Mediterranean with hot, dry summers and cool, wet winters (Cowling, 2019). TMNP mainly consists of Fynbos vegetation but there are strands of exotic trees including pine, oak and acacia species.

I deployed 31 Bushnell Trophy CAM HD camera traps on a 400m2 grid that was centered on the Sarah Bartman Hall (Figure 1). Each camera was mounted at a height of 40cm above ground using a metal stake or by attaching it to a natural structure like a tree. The cameras were active from 19th March to 10th April 2022. Each camera trap was programmed to take three photos in succession following a triggering of the motion detectors. A sixty-minute time threshold between images was chosen to classify images as independent capture events.

Map

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**Figure 1:** An aerial photograph showing the extent of the study site (grey polygon) and the individual numbers camera trap stations on both the University of Cape Town (UCT) upper campus and Table Mountain National Park (TMNP).

The camera traps were visited during the survey and the battery life and capacity of the SD card was checked. At the end of the survey the SD card was removed, and photographs were downloaded and processed to remove the target taxon of the mammals (Table 2). I estimated Shannon’s diversity index to compare diversity between UCT and TMNP. Shannon’s Equitability was calculated to compare the distribution of abundance between UCT and TMNP. The effective number of species was also calculated for camera stations on both UCT and TMNP and combined (Table 1).

**Results**

There was an increase in species richness as more individuals or sample units are added (Figure 2A), although there was a plateauing for both Species Diversity and Sample Coverage within UCT and TMNP suggesting adequate sampling effort. The curve for TMNP stations flattened out sooner than UCT for species diversity, and the confidence interval was higher for UCT than TMNP (Figure 2A) suggesting that more effort was required at UCT, which had a higher diversity of mammals.

**Application

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**Figure 2:** Species accumulation curves for UCT and TMNP: A – Species Diversity, B – Sample Coverage.

More mammals were detected on UCT land (n = 7) than TMNP (n = 5).

TMNP had a lower Shannon’s Diversity Index than UCT (Table 1), while species eveness was similar. The relative abundance of mammals on UCT was higher than on TMNP and the effective number of species (ENS) was slightly lower for UCT than TMNP but the medians were not sugnificantly different (Kruskal Wallis test: H: median(TMNP) = median(UCT), p = 0.52). (Figure 3)

**Table 1:** Species Richness and Species Diversity for TMNP and UCT

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Land Use | | Species Richness | Species Diversity | | |
| N(Obs) | Shannon Diversity (H) | Shannon’s Equitability (Eh) | Effective Number of Species (ENS) |
| TMNP | Station-specific | 5 | 0.87 | 0.54 | 2.38 |
| Overall |
| UCT | Station-specific | 7 | 1.11 | 0.57 | 3.03 |
| Overall |

Caracal (*Caracal caracal*) were only found in TMNP (Table 2) while two invasive species: grey squirrel (*Sciurus carolinensis*) and domestic cat (*Felis catus*) were more than forty times more abundant in UCT land than in TMNP (Figure 2). Cape Porcupine (*Hystrix africaeaustralis*) had very even numbers in both TMNP and UCT, while water mongoose (*Atilax paludinosus*) and Rodent spp. (*Rodentia*) had slight differences in abundance between UCT and TMNP and had more detections on UCT than TMNP. Cape Genet (*Genetta tigrina*) had triple the number of sightings in UCT than in TMNP. Cape Grysbok (*Raphicerus melanotis*) had double the number of individuals seen in TMNP than in UCT.

**Table 2**: The mammal species and number of independent detections for each species on the University of Cape Town (UCT) and Table Mountain National Park (TMNP) land

|  |  |  |  |
| --- | --- | --- | --- |
| Common name | Scientific name | TMNP | UCT |
| Caracal | *Caracal caracal* | 29 | 0 |
| Cape Genet | *Genetta tigrina* | 2 | 7 |
| Cape Grysbok | *Raphicerus melanotis* | 6 | 3 |
| Cape Porcupine | *Hystrix africaeaustralis* | 99 | 95 |
| Domestic cat | *Felis catus* | 4 | 195 |
| Grey Squirrel | *Sciurus carolinensis* | 0 | 36 |
| Rodent | *Rodentia* | 0 | 3 |
| Water Mongoose | *Atilax paludinosus* | 0 | 2 |

There was not significant difference in the station specific effective number of species between UCT and TMNP (Figure 3).

Chart, box and whisker chart

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**Figure 3:** Box plots contrasting the median effective number of species for UCT and TMNP

**Discussion**

Urbanization drives changes in species assemblages and community structure (Concepion, 2015; Kondratyeva, 2020) a statement supported by the findings of this study which found that TMNP and UCT having different species assemblages. UCT has higher species richness and diversity than TMNP, although two of the seven species were exotic. Urbanization can promote high levels of diversity by the addition of non-native species (M. McKinney, 2008). Exotic species are strongly associated with urban landscapes which they have to exploit for human derived food sources and where they may refuge from predators in natural land.

There are many open waste bins on UCT’s upper campus, which provides animals with access to high caloric foods that can have dramatic effects on ecological communities (Newsome, 2017). UCT has permanent water which is important for Water mongoose and storm water drains that porcupine use both as a refuge and as a corridor linking patches of natural land with urban areas. American grey squirrel and Cape Genet may both benefit from the reduced natural predators, such as caracal, on UCT land (Parsons, 2018).

Spatial heterogeneity produces high levels of species richness and diversity (Wania, 2006). UCT is more heterogenous than TMNP and this may explain why mammal diversity was higher on UCT land than TMNP. Species richness tends to be higher in areas that have low to moderate levels of human development (McKinney, 2002) such as UCT. On the other hand, urban areas like UCT impose threats to many mammals including vehicle accidents, poisons and domestic animals (Seiler, 2006). This may explain why caracal and cape grysbok are more abundant on TMNP than UCT.

In conclusion, there are marginal differences in species richness, diversity, and community structure between UCT and TMNP. However time and effort would be required to verify the results obtained here. Weaknesses of the study included that there were multiple cameras within the home range of large species like caracal and thus it is likely that many of the detections were of the same individual. This is important in further projects of conservation for many of the species in TMNP affected by the rapid urbanization. This report also aims to serve as a source for future projects on the impact of the invasive domestic cat population. This cat population is growing and has a large effect on anthropogenic mortality to birds and mammals (Loss, 2013). Domestic cats create more homogenous environments and reduce genetic diversity (Mori, 2019) because they contribute to local extinctions and disrupt ecosystems. This is a serious problem for mammalian species on TMNP because domestic cats were spotted on TMNP land in this report, so strategies and research are required to diminish any issues caused by domestic cats.

**References**

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**Appendix**

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**Figure 4:** Species Accumulation Curves for combined UCT and TMNP: A – Species Diversity, B – Sample Coverage.