Trophy hunting & sustainability: Temporal dynamics in trophy size & harvesting patterns of wild herbivores

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Introduction

- Trophy hunting *vs.* artificial selection
- Possible loss of desirable phenotypic traits over time (Coltman et al 2003)
- Tourist hunters prefer hunting destinations with species of superior phenotypic traits (Lindsey et al 2007)
- Decline in trophy size of preferred species may reduce hunting destination competitiveness (Prodanovic et al 2012)
- Compromise the sustainability of trophy hunting as a conservation tool (Crosmary et al 2013)

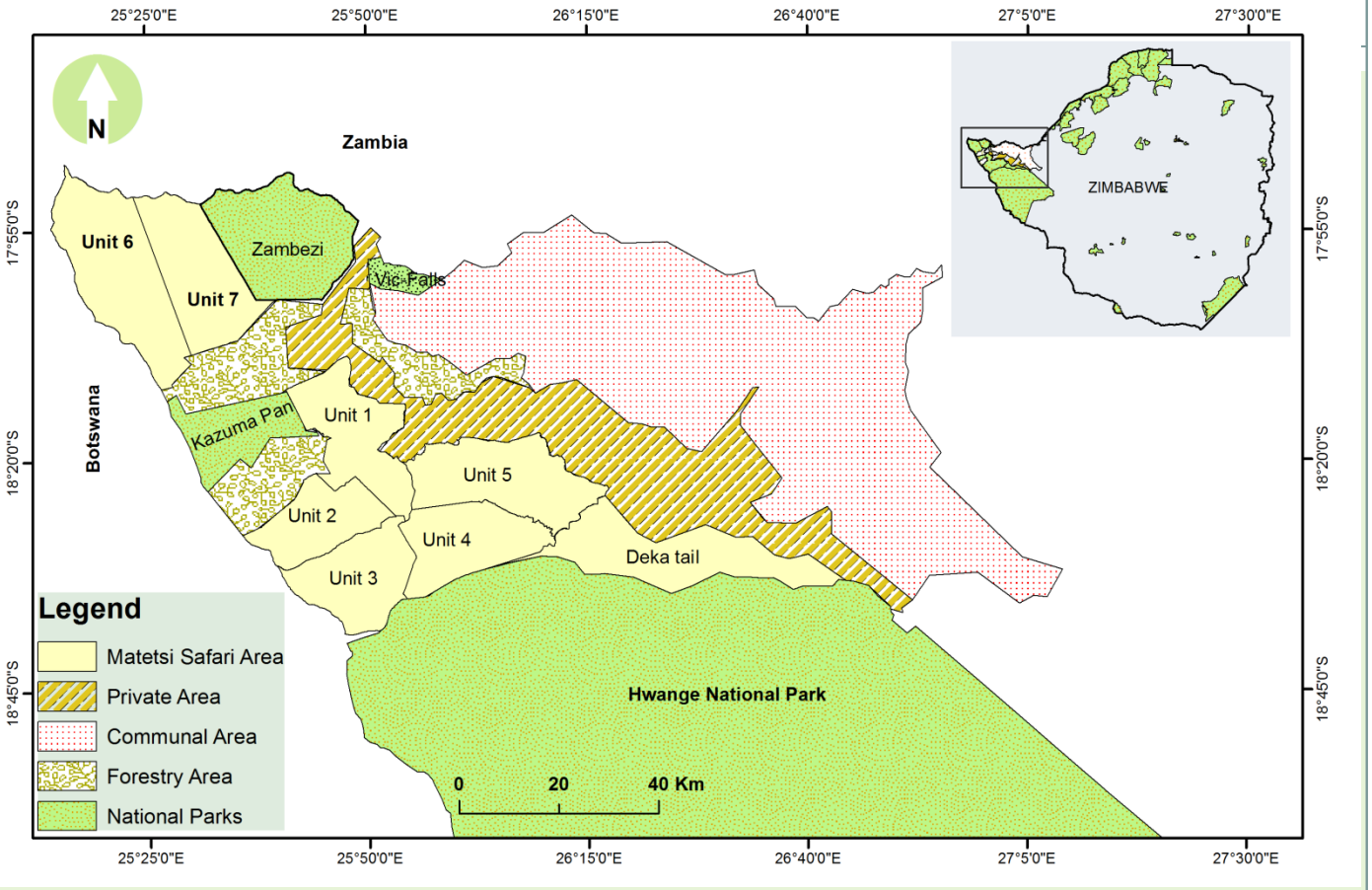
- Little attention given on trophy size of harvested species until recently
  - South Africa - von Brandis & Reilly 2007, 2008
  - Zimbabwe – Crosmary et al 2013
  - Tanzania - Wilfred 2012
- Worrying trend in trophy size decline for some species
- If quotas are conservative, then why the decline in trophy quality

Three hypotheses tested

1. Selective harvesting through trophy hunting may result in reduced horn or tusk size and age at harvest of selected wild herbivores with the passage of time,
2. Sustainable utilization management programs may reduce the quota size allocated for selected wild herbivores and their offtake levels over time commensurate with the population and trophy size trends in different hunting areas,
3. Economic and political status of the country between the period 2004-2015 would have an effect on quota size and offtake levels in Matetsi Safari Area, Zimbabwe.

Study area

Matetsi Safari Area- Unit 1-6 Within KAZA Transfrontier Open ecosystem with free animal movement Chobe NP, Kazuma Pan, Sinamatella, Zambezi



Notes on the six units of MSA

Unit	Concession holder	Hunting status	Area (km^2)
1	Private concession	Since 1973	398
2	ZimParks	Since 2013	475
3	Private concession	Since 1973	293
4	ZimParks	Since 2012	358
5	ZimParks	Since 2005	364
6	Private concession	Since 1973	592
7	Non-hunting concession	Since 1973	447

Study Species

- Four wild herbivores selected
- Mega herbivores:
  1. African elephant: density - 0.7 individuals per km^2
  2. Cape buffalo: density -1.4 individuals per km^2
- Medium sized herbivore:
  1. Greater kudu: density - 1.4 individuals per km^2
  2. Sable antelope: density - 0.7 individuals per km^2

Data collection

- The following data were collected from MSA Headquarters
  1. trophy size and age at harvest data
  2. Annual quotas allocation & offtake levels for the four species
- The data was for the period 2004-2015
- All trophy measurements followed the Safari Club International (SCI) scoring system
- Data on age at harvest was estimated using dentition and jaws

Data Collection

- Offtake level – number harvested off an allocated quota for each year
- Offtake growth rate per species - mean annual change in offtake size, formulae adopted from Rist et al (2010)

$\text{Log}(h_{t+1}) - \text{Log}(h_t)$, where h_t is the size of the total offtake in year t

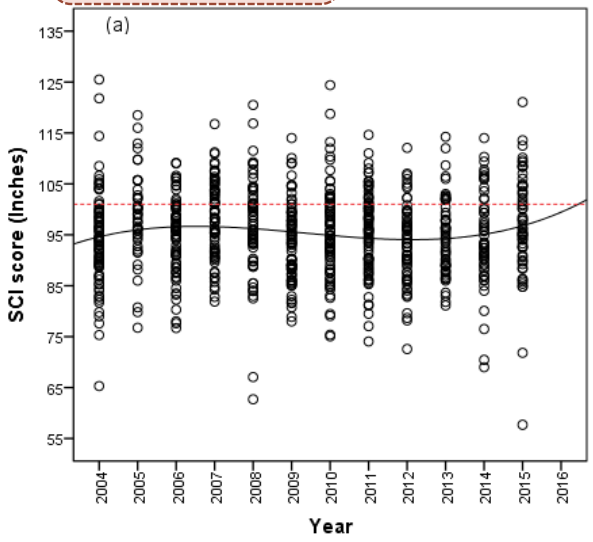
- Expected offtake rates to be analogous to population size as they happens to be positively correlated
- Can be used as proxy or index for population estimates of harvested species

Data Analysis

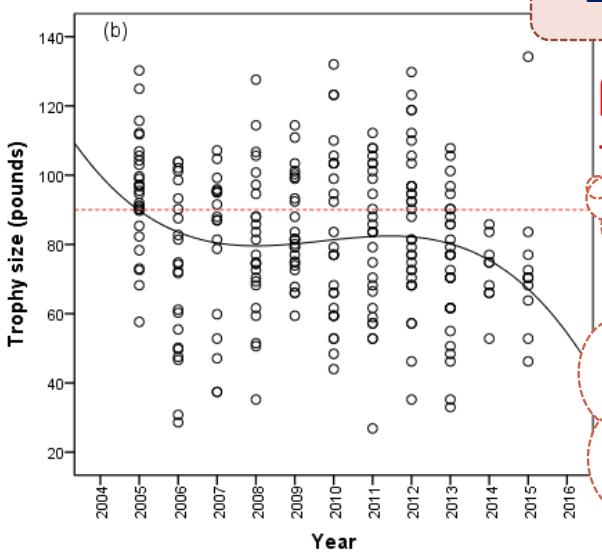
- Data collected: trophy size, age at harvest, quota size and offtake levels
  - Tested for normality - Shapiro Wilk test
  - Equality of variance - Levene's test
- Data conformed to the normality assumptions
- Grouped data on quota size and offtake levels into two time intervals based on the temporal economic status of Zimbabwe:
  a) period of land reform, hyper inflation and policy changes, 2004-2009, and
  b) period of political inclusivity, dollarization and 'economic recovery', 2009-2015

Trophy Size Trends

Buffalo



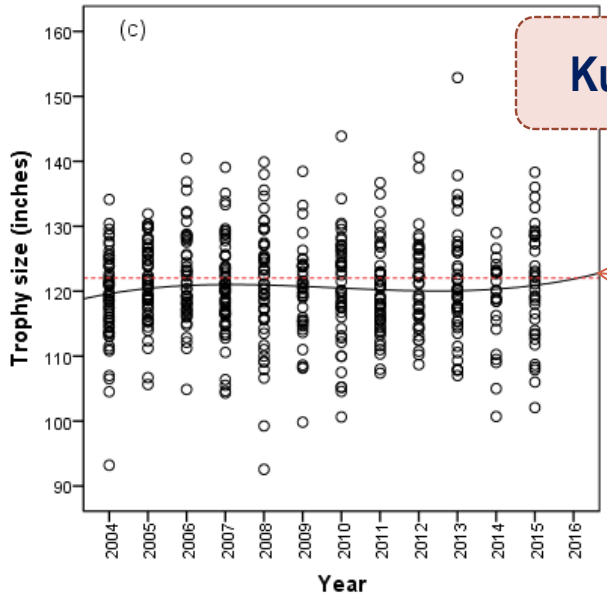
Elephant



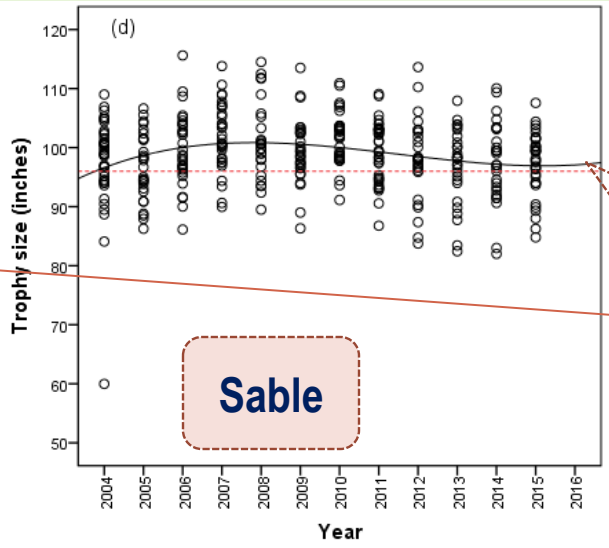
β ± SE: -1.03 ± 0.45, t = -2.29, p = 0.023

Could this be phenotypic plasticity or loss of desirable traits i.e. Horn size

Kudu



Sable



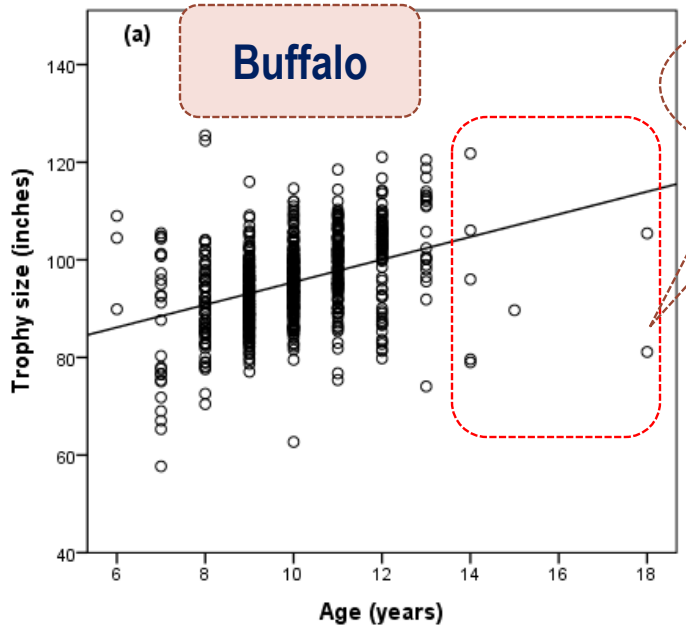
Declined by 6% (1974-2008)

Kudu increase by 14 % (1974-2008)

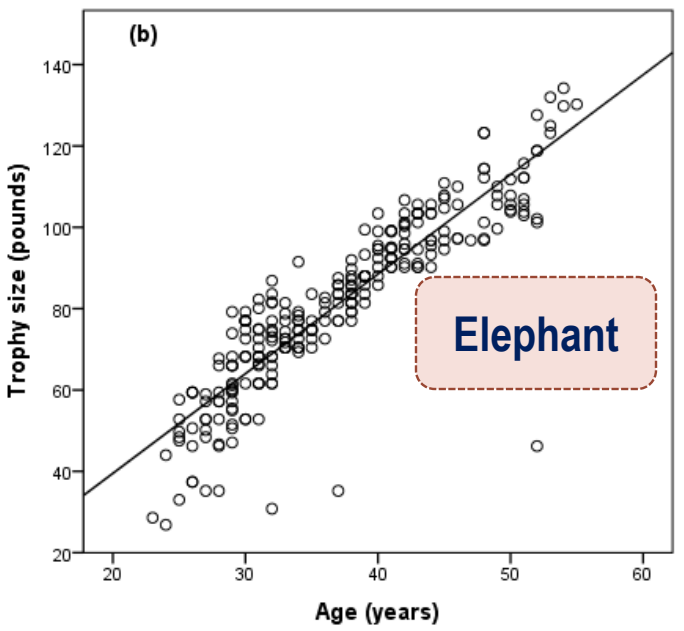
Observed *vs.* SCI minimum Scores

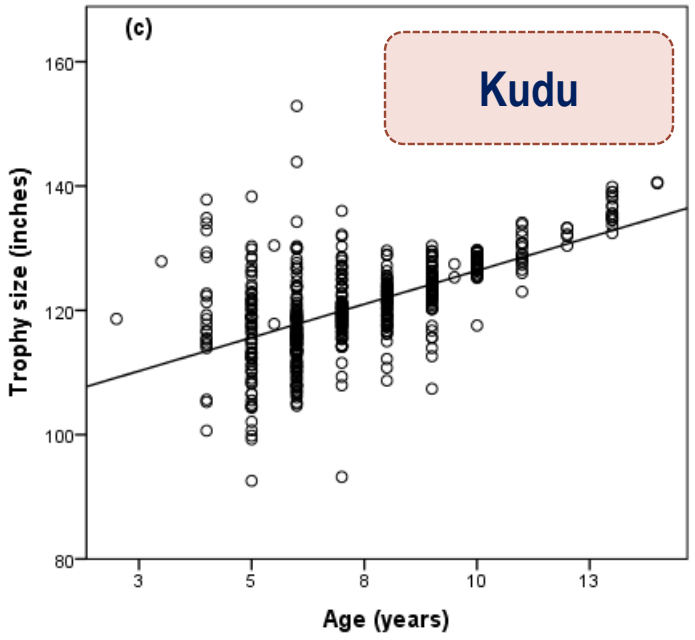
Table 2: SCI minimum score and the observed trophy sizes

Species	SCI Minimum Score	Mean ± SE of trophy size	t-statistic	p-value
Buffalo	101 inches	95.39 ± 8.66	$t_{(804)} = -18.41$	< 0.001
Elephant	90 pounds	81.40 ± 21.35	$t_{(257)} = -6.47$	< 0.001
Kudu	121 inches	120.47 ± 7.54	$t_{(564)} = -1.68$	0.094
Sable	96 inches	98.89 ± 6.34	$t_{(369)} = 8.76$	< 0.001



Gandy & Reilly 2004





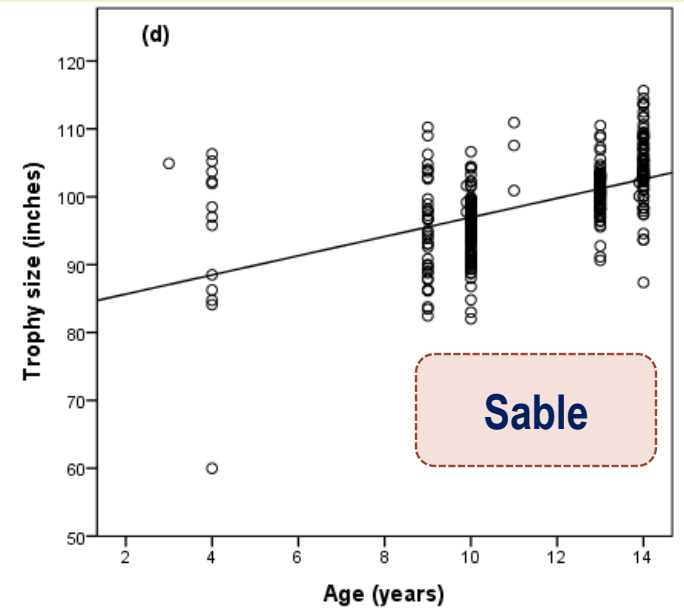


Table 3: Estimated marginal means (±SD) of age at harvest and the trophy size of the four species

	Cape buffalo		African elephant		Greater kudu		Sable	
Unit	Age (years)	Trophy size (inches)	Age (years)	Trophy size (pounds)	Age (years)	Trophy size (inches)	Age (years)	Trophy size (inches)
1	9.96 ± 1.35	95.94 ± 8.15	32.95 ± 6.42	68.53 ± 20.03	7.34 ± 2.11	121.27 ± 7.34	10.98 ± 2.44	98.46 ± 6.44
2	9.90 ± 1.36	93.56 ± 9.35	38.21 ± 7.27	86.35 ± 17.04	7.26 ± 1.99	119.56 ± 7.29	11.81 ± 2.39	99.90 ± 6.56
3	10.04 ± 1.53	97.39 ± 9.14	38.84 ± 7.16	85.81 ± 19.08	7.40 ± 1.89	120.13 ± 7.13	11.08 ± 2.18	99.11 ± 5.63
4	10.15 ± 1.51	95.77 ± 7.78	34.66 ± 7.53	75.30 ± 21.15	7.24 ± 2.27	120.23 ± 7.83	11.23 ± 2.63	97.08 ±7.99
5	10.25 ± 1.50	95.42 ± 8.86	36.15 ± 8.23	78.67 ± 22.16	7.06 ± 1.83	119.67 ± 8.02	11.00 ± 2.00	97.04 ± 5.50
6	9.61 ± 1.26	93.73 ± 8.26	41.37 ± 7.24	93.15 ± 19.33	7.14 ± 2.15	121.85 ± 7.70	12.33 ± 2.32	101.6 ± 4.93
F-statistic	3.18	3.758	7.24	8.22	1.35	0.242	3.27	4.35
p-value	0.008	0.002	< 0.001	< 0.001	0.385	0.859	0.007	0.001

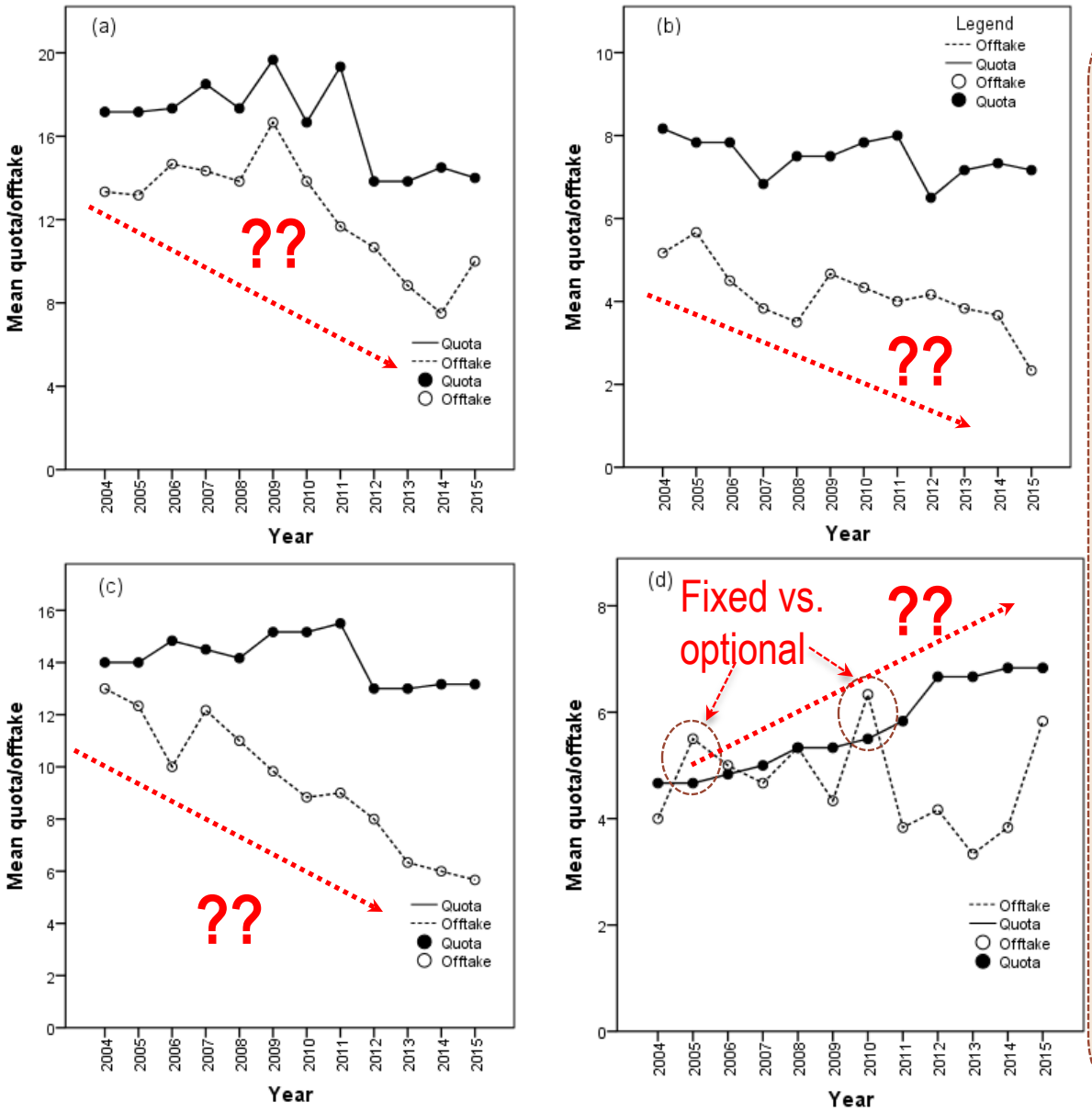
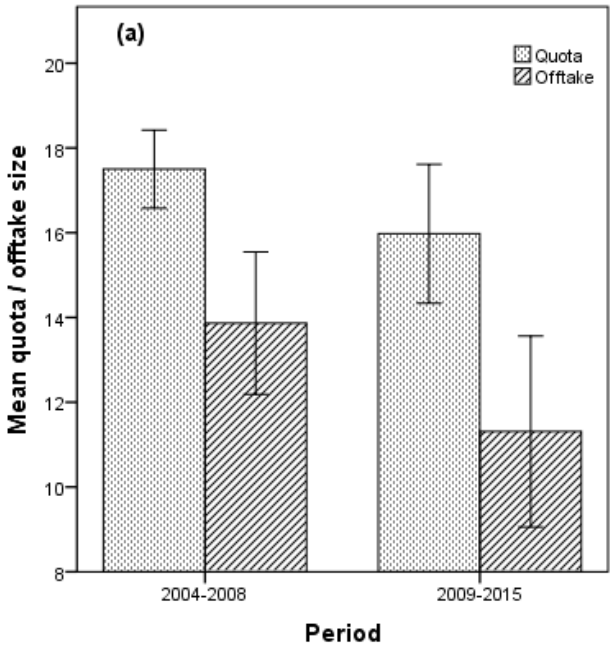
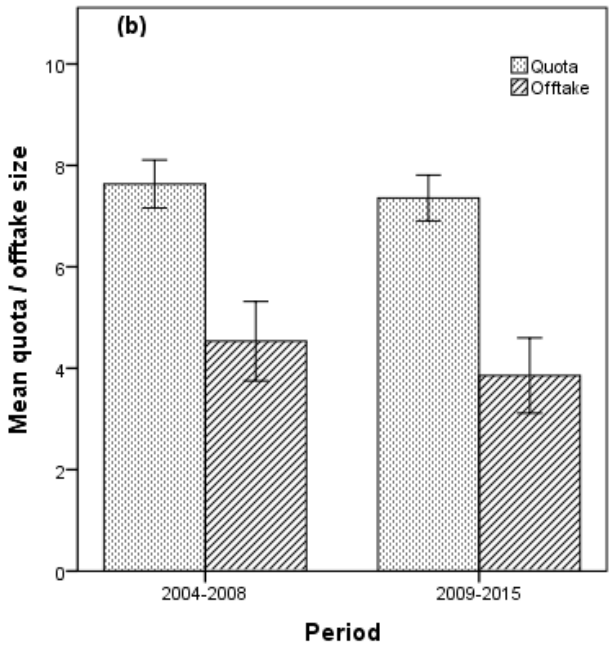


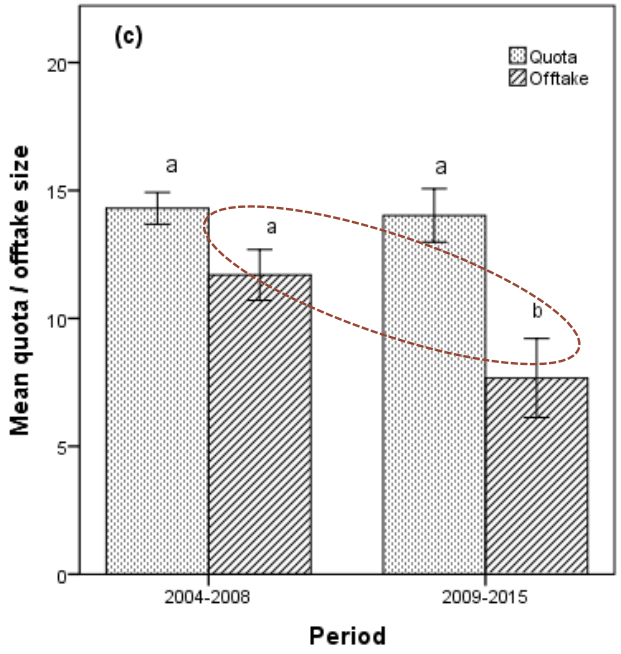
Figure 4: Quota size & Offtake levels over time

Are these harvesting patterns sustainable?

Are the quota being set following the adaptive management framework?







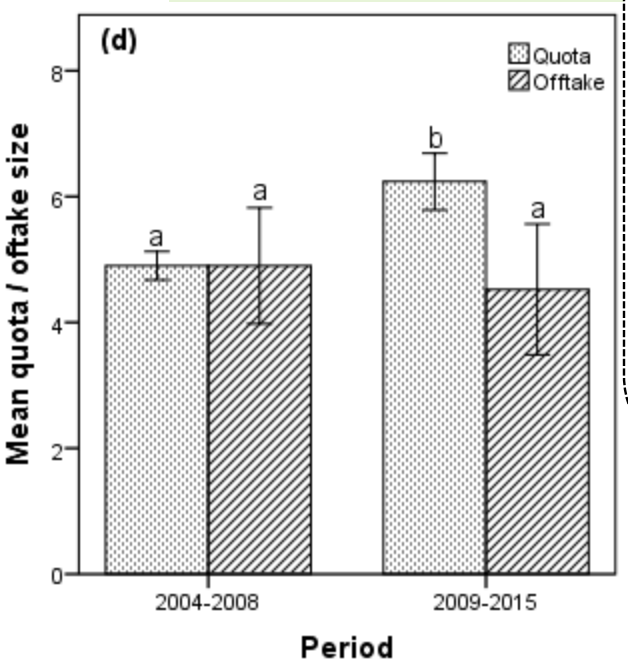


Figure 6: Observed mean quota and offtake levels for the four species for the two periods

****Significant differences for both quota and offtake for kudu**

Overarching issues on sustainability

- Traditional quotas - little inferences drawn from scientific evidence
- Harvesting patterns not sustainable
- Three out of six units under ZimParks- is this right?
- A regulator and player at the same time
- Who will police the 'regulator' – conflict of interests especially
- Mandate *vs.* income generation – this needs redress
- Conservation financing models in the country need to be reviewed

Recommendations

- Introduce fallow system related to units e.g.
  - about 5 year cycle (those areas with elephants);
  - medium-sized herbivores about 3 year cycle

What would be the opportunity cost??

- Promote harvesting regimes that are based on ecological data of targeted wild animal species
- Promote use of age-based harvesting system for all species
- Implement a trophy size based pricing system for all hunted species

Seeing beyond today!

Moving forward

Setting a New Research Agenda

1. Exploring the linkages between trophy size and genetic variability in selected wildlife species in hunting areas (use of ancient DNA techniques)
2. Investigating the attitudes and perceptions of trophy hunters on hunting destination attractiveness (Does trophy size really matter to them?)
3. Assessing the possible impacts of net conservation benefits for positive conservation efforts and reduced trophy hunting off-take levels through the use of wildlife conservation credits (Can we learn something from the carbon credit system?)

Acknowledgements

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-ZIMBABWE-
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