

**KUDU POPULATION DYNAMICS**  
with special reference to the  
**PERIODIC OUTBREAK of**  
**RABIES AMONGST GREATER KUDU**  
*(Tragelaphus strepsiceros)*  
**IN CENTRAL NAMIBIA**

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## **Background:**

- It is widely believed that the periodic outbreak of rabies amongst kudu in Namibia is related to high population density. When first approached by Mr Harald Marggraff and Dr Rainer Hassel concerning general support for an envisaged “epidemiological survey of rabies in kudu and the development and evaluation of a practical method of oral anti-rabies vaccination” the following was suggested by the NAPHA EXCO:
  - a) NAPHA’s full support of the project
  - b) the project should be accompanied by a kudu population dynamics study
  - c) mutual press releases highlighting the importance of sustainable use of wildlife, with special reference to the trophy hunting sector should accompany the survey
- a) The epidemiological survey as such is under way by now and Dr Hassel will give feedback later during this meeting. NAPHA fully supports the study, in particular out of responsibility towards a bigger picture, namely the veterinary concerns of the Agricultural Sector, as well as because of the human health risks the disease entails. The NAPHA membership moreover has approved a financial contribution of 200 000 N\$ to the survey.
- b) For financial reasons a Population Dynamics Study suggested by NAPHA could not be part of the “epidemiological survey”. On request two NAPHA members have accommodated a researcher, Mrs Jannemieke van Avezaart, for a three-month research period. It, however, turned out that this was a miscommunication, because Mrs van Avezaart is not a population dynamics researcher, but rather an epidemiologist. Mrs van Avezaart, assisted by Mr Ernst Scholz, however, agreed to conduct a very basic survey on kudu population density. It is felt that the main aim of the Kudu Rabies Project, namely to “protect the vital wildlife asset of Kudu by means of an effective, practical and cost effective form of oral vaccination”, without understanding of the population dynamics and subsequent proper population management, would not serve the purpose of maintaining intact ecosystems and healthy wildlife populations. It is the aim of this presentation to suggest possible management actions for improved health of our kudu population and the maintenance of intact natural ecosystems.
- c) The press coverage until now was not what the NAPHA EXCO had in mind. While the hunting sector as such is mentioned as one of the major sectors affected by the rabies epizootic, the voice of the sector does not come to its bearing in the best interest of hunting and with well founded background on natural connotations and the role sustainable off-take should play in maintaining healthy ecosystems, in particular under the present worldwide negative publicity trophy hunting receives.
- d) This presentation does not attend to any veterinary aspects. It was actually born out of frustration as we could not find or afford a scientist to conduct this urgently necessary study. It’s intention and aim is to attend to population dynamic aspects, which seem to be underlying to the rabies epizootic in Namibian kudu and to offer suggestions for discussion amongst the NAPHA Membership, as how to apply kudu specific management practices in an effort to contribute to long-term healthy kudu populations and balanced habitat in Namibia. It moreover aims to offer suggestions as how to enhance a better understanding for hunting and sustainable off-take amongst the general public at the hand of the kudu population dynamics.

## Some Relevant Background on Greater Kudu *Tragelaphus strepsiceros*

- As the kudu is so well known to all of us I don't want to waste any time with describing the species or its distribution and rather concentrate on a few issues which are relevant for the topic.
- The kudu is wonderfully adapted to concealment (Estes). It needs habitat with sufficient cover in the form of thick bush or broken country.
- This is a very important characteristic in so far that an animal, which is well camouflaged and adapted to concealment, should not easily seen in suitable habitat. There thus is a very likely tendency to underestimate the population density.



*Photo: Ernst Scholz*

Photo of 5 kudu bulls in rather open terrain, underlining how well they blend into their surroundings, sent to me by Ernst Scholz with the very appropriate caption: "You see them, but you don't"



- The kudu is almost exclusively a browser. He drinks in the dry season, but can subsist in waterless regions. He makes wider seasonal movements than other *Tragelaphus* species, dispersing in deciduous woodland in the rains and concentrating in ecotones (riverine, hillside base) where the richest, most varied vegetation is found in the dry season. (Estes).
- In an arid country like Namibia, as we all know, kudu (and warthog) are the species most severely affected by drought.
- Life expectancy according to “Smithers' Mammals of Southern Africa”, is 15 years; females first calf at 2-3 years age. According to Estes in “The Behavior Guide to African Mammals”, well-nourished females can breed at 2 years when still immature, females mature at 3 years.
- Typical herd 1 – 3 females and their offspring (Estes and others).
- It seems important to point out that under natural conditions, with drought mortalities and predators, female herds average 2 – 6 animals.
- Home Range of female herds is 360 – 520 ha in Kruger NP, probably much larger in drier areas (Smithers' [Apps], Estes)
- We estimate that in an arid habitat like Namibia the range is very likely to be 1000 ha or more.
- Bull range 1100 ha (Estes)
- We have observed that bulls at times make wide movements although they during certain times of the year remain in home ranges of probably 1000 ha.
- The kudu is an important prey animal for Lion, Wild dog and spotted hyena in NE Namibia (Khaudum and Nyae Nyae, pers. observation)  
23% of wild dog kills in Hwange NP, 8% in Kruger NP (Smithers')  
15% of spotted Hyena kills in Kruger NP (Smithers').
- This is a very important aspect concerning the population dynamics as in central Namibia lion, spotted hyena and wild dog are absent.

### **Some hunting related remarks:**

- In our marketing we all use the “grey ghost”-slogan or like to call the kudu “shy and elusive”.
- Quotes from literature:  
“If only I could see one!” (Ernest Hemingway; Green Hills of Africa).  
“I asked myself where are all these kudus coming from after so many days of searching” (Richard du Pont; A Tendala Mkubwa from Tum)

- All this underlines the fact that the kudu, although it may appear in very healthy numbers, is not easily seen. If no kudu are seen in suitable habitat (meaning sufficient cover), it is very likely that there still is a very healthy population. Should kudu be encountered often in its preferred habitat with abundant cover, there very likely is an overpopulation.
- It also underlines though that the kudu is a very challenging game animal. Add to this the majestic appearance and the marvellous trophy and you have one of the most desired species on earth. We should therefor take great care to manage our kudu population properly and fully exploit the unique attraction of this shy and elusive species

## General Population Dynamics

- We would like to quote from Ron Thomson, *A Game Wardens Report*, “Societies Conservation Priorities” as follows:
  - “1. Number One Priority – the soil  
Man’s most important conservation consideration concerns the protection and/or wise use of the soil – for without soil no plants can grow; and without plants there can be no life on planet earth.
  - 2. Number Two Priority – the plants  
Man’s second conservation responsibility is for the protection and/or wise use of plants. Plants appear second on the list – **before animals** – because without plants animals cannot exist.
  - 3. Number Three Priority – the animals  
Man’s third - and last - conservation responsibility concerns the protection and/or wise use of animals.”
- This is of paramount importance, because there is a tendency to allow or create unnatural densities of animals in hunting areas, which inevitably results in deterioration of habitat and general health of the population.
- I moreover would like to quote from Dr. Heribert Kalchreuther, *Die Sache mit der Jagd*:

*“Diseases can always reach epidemic proportions, if a high population density makes the infection of many animals possible. And all the more so if they are already weakened by food shortage.” (“Krankheiten können immer dann epidemieartig auftreten, wenn eine hohe Bestandsdichte die Infektion vieler Tiere ermöglicht. Und zwar um so eher, wenn diese durch Nahrungsmangel bereits geschwächt sind.”)*
- Probably several factors together result in the deterioration of the general health of an animal population. A population, which has grown above the habitat carrying capacity, eats up its own food resources and even destroys its cover, or the animals have to move into unsuitable habitats. Social stress is believed to add to the poor health of individuals. If natural mortality factors like predators (lion, wild dog and spotted hyena in the case of the Kudu) are removed or drought mortalities are countered by artificial water supply and artificial feeding, epidemics surely will be nature’s remedy to keep natural balance intact.
- All animal populations are subject to regular fluctuations. These occur during the year. In our case the density of the populations of most species are highest during the rainy season when the young are born. As the year progresses death takes its toll in many forms (predation, drought, old age) until densities are lowest at the end of the dry season.
- There furthermore are irregular fluctuations, which ultimately keep the natural balance intact if populations have outgrown the habitat capacity. This is what happened with our kudu population in the early 1980ies, when the population collapsed.

- One of nature's fundamental laws is that, to maintain natural balance, there has to be mortality. If a certain natural mortality factor is removed, it will be replaced by another mortality factor. Typical natural mortality factors – apart from old age – are predation and climate factors. If they are removed, diseases will replace them; if one disease is removed, it will be replaced by another disease.
- However animal populations build up very rapidly again, even from very few individuals.

Number End of	Adult	Juvenile	Total
First Year	2	8	10
Second Year	10	40	50
Third Year	50	200	250
Fourth Year	250	1000	1250
Fifth Year	1250	5000	6250
Sixth Year	6250	25000	31250

*Adopted from "Die Sache mit der Jagd" by H. Kalchreuther*

**Table 1:** Theoretical Population growth of Helmeted Guinea Fowl at average growth rate.

Clutch size 6-19 eggs = average of 12 eggs (ca. 8 young hatch)



- In the very unlikely event that on a specific farm only 3 Kudu would have survived the 1980ies rabies, in theory the population could have developed like this:

Number End of	Adult - male+female (fertile+young)	Juvenile	Total
Year 1	1+2	2	5
Year 2	2+3(2+1)	2	7
Year 3	3+4(3+1)	3	10
Year 4	4+6(4+2)	4	14
Year 5	6+8(6+2)	6	20
Year 7	9+11(8+3)	8	28
Year 8	13+15(11+4)	11	39
Year 9	19+20(15+5)	15	54
Year 10	26+28(20+8)	20	74
Year 11	36+38(28+10)	28	102
Year 12	50+52(38+14)	38	140
Year 13	69+71(52+19)	52	192
Year 14	95+97(71+26)	71	263
Year 15	131+132(97+35)	97	360

*Adopted from "Die Sache mit der Jagd" by H. Kalchreuther.*

**Table 2:** Theoretical Kudu Population growth.

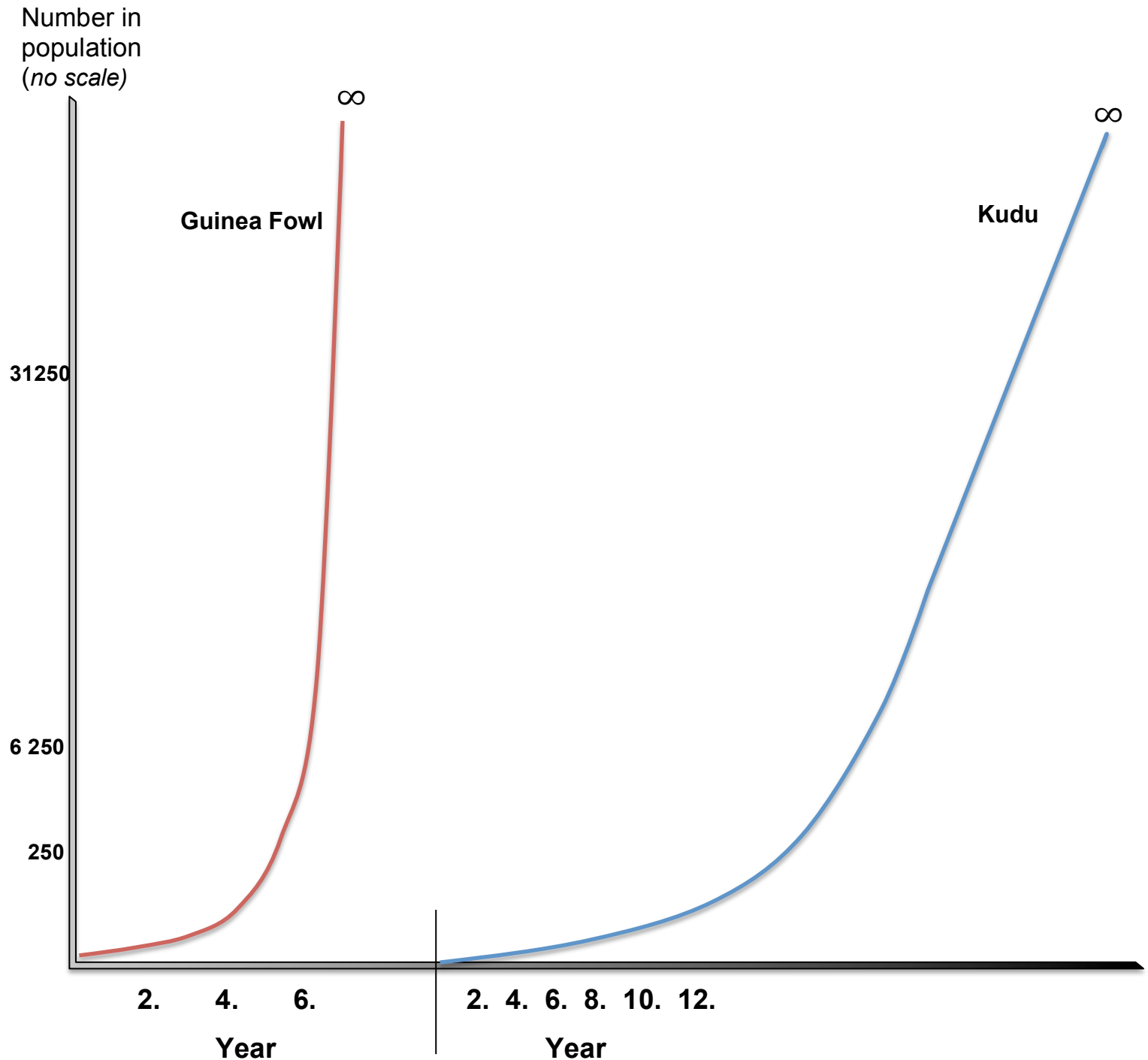
Starting Population = 1 male + 2 females

*In Brackets: Number of fertile female + number of young female from previous year*

- However, it is estimated that approximately 70 % of the population died during the 1980ies rabies epizootic. If, just to give a figure, on a 5000Ha farm there had been 100 kudus (and most likely there would have been much more) before the rabies outbreak, 30 of these would have survived. Now imagine from the above table how rapidly the population would have build up again.

- We can thus summarize that animal populations very quickly recover and irrespective of old age related mortalities can grow into infinity.

**Figure 1:** Exponential population growth curve for Helmeted Guinea Fowl and Greater Kudu

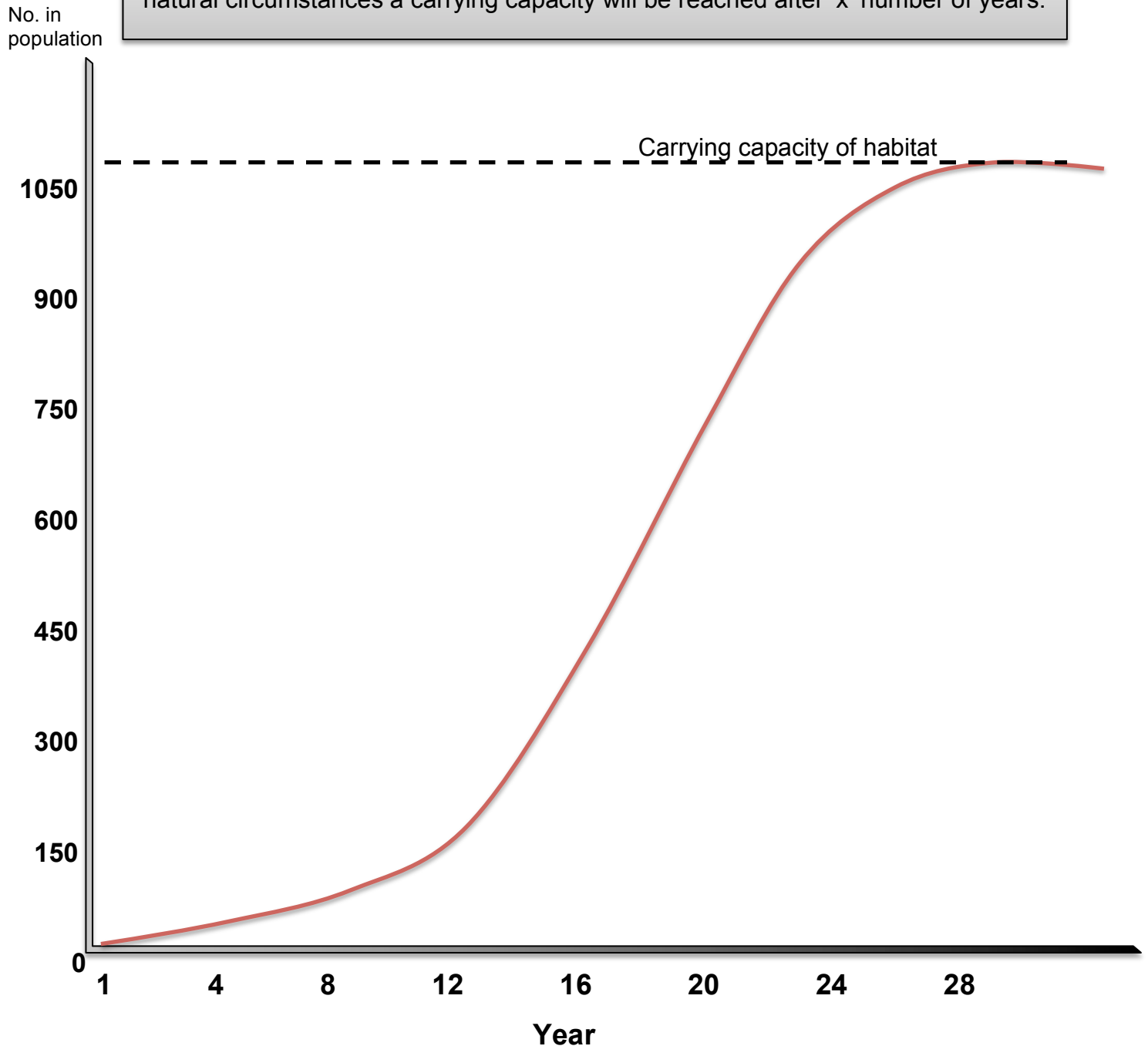


*Adopted from "Die Sache mit der Jagd" by H. Kalchreuther.*

- At first any animal population very rapidly grows and fills the available habitat. As it nears the habitat carrying capacity, growth slows down because sufficient food and cover becomes scarce and predators take their toll. This is called the s-curve.

### Figure 2: The 'S'-curve

The 'S'-curve showing how a species (Kudu) populates a new habitat. Under natural circumstances a carrying capacity will be reached after 'x' number of years.



*Adopted from "Die Sache mit der Jagd" by H. Kalchreuther.*

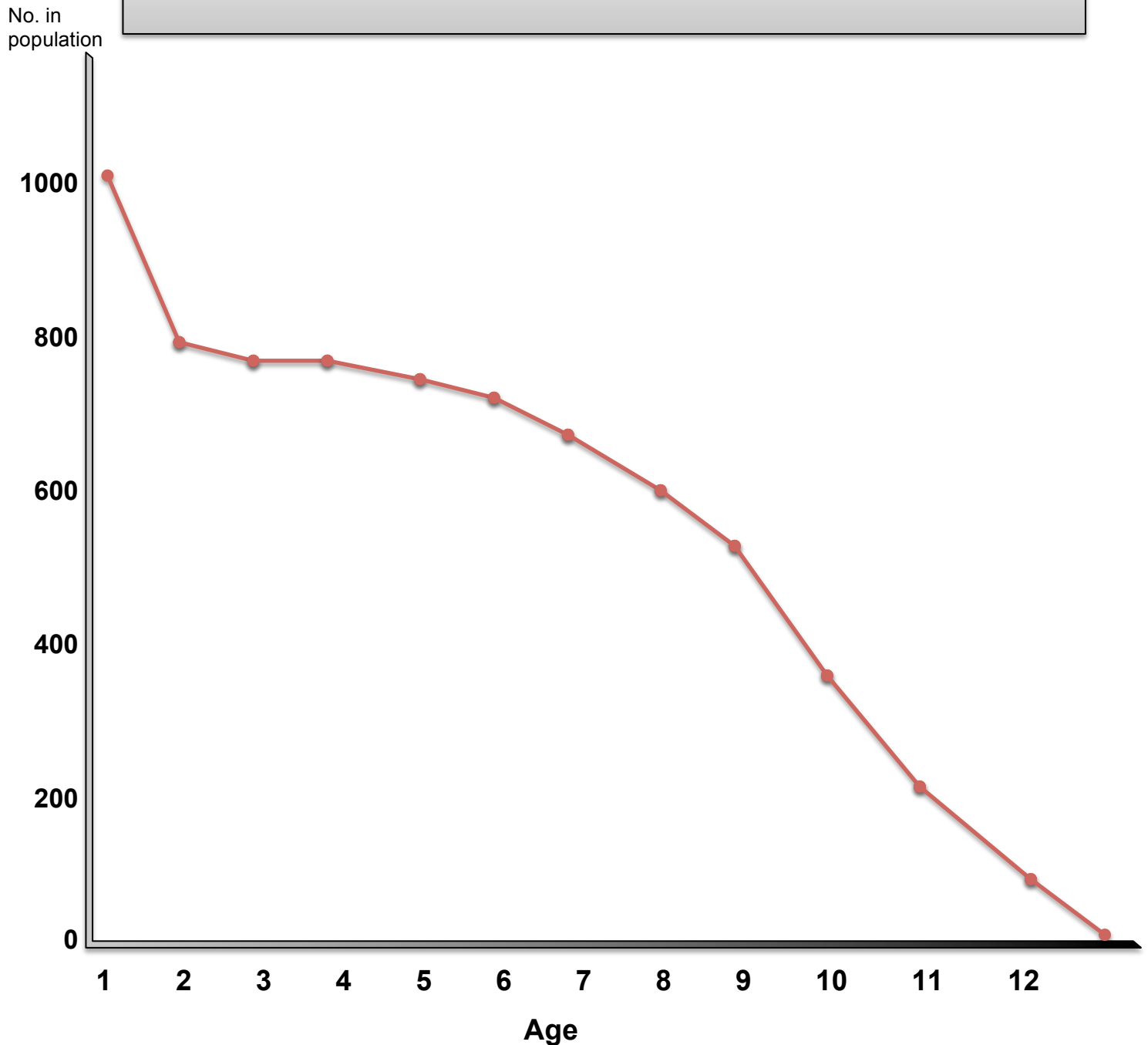
- If for some reason the population drastically outgrows the carrying capacity, irregular fluctuations are nature's remedy to maintain natural balance.

## Kudu Specific Population Dynamics in Namibia

- Being a browser and largely water dependant, the drought mortality factor (together with predation by large carnivores) is the most important “population limiting factor” to keep the natural balance intact.

**Figure 3:** Mortality curve for Greater Kudu.

After the first 24 months mortality rate is low and only gets higher towards end of life.

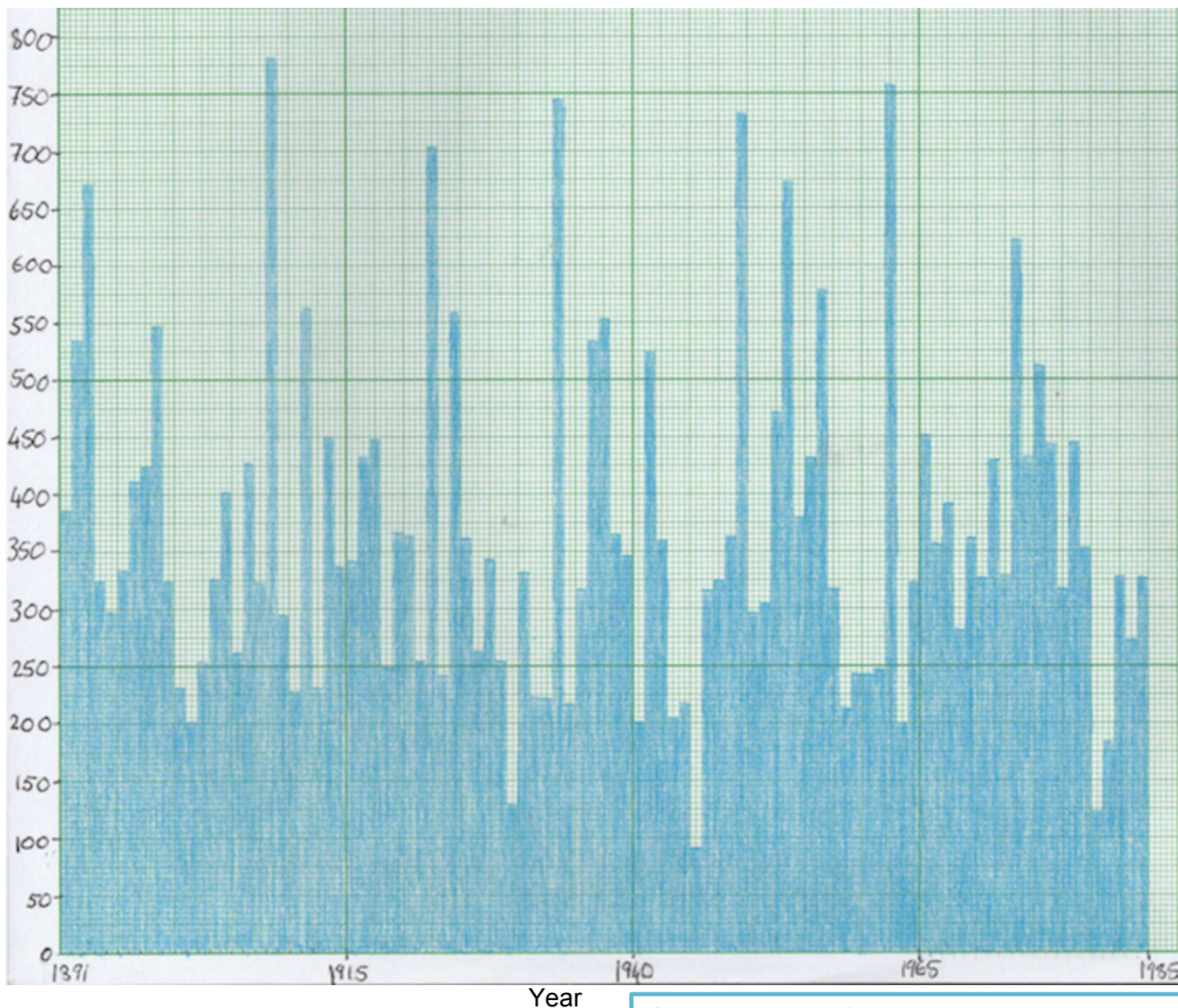


*Adopted from “Die Sache mit der Jagd” by H. Kalchreuther.*

- Starting out from the understanding that typical kudu female herd size under natural conditions averages between 2 – 6 animals and that male:female birth ratio is 1:1, moreover that males leave the herd in most cases at two years age, the following conclusions are made: A herd of two females within 3 years has reached the number of six females. From now on the herd grows quicker as the first female offspring starts to calve as well. It is clear that the population grows very quickly if mortality factors do not step in and the habitat capacity is reached soon.
- There are two major mortality factors under normal conditions which seem to balance in such a way that optimal herd size of 2 – 6 animals is maintained: Drought and predators.

**Figure 4: Rainfall Statistics for Windhoek, Namibia from 1891-1985**

Rainfall in  
mm



Statistics acquired from Namibia Weather (2015)  
[Online] – see bibliography.  
Graph prepared by Katrin Denker.



- From these rainfall statistics over a period of nearly 100 years it becomes apparent that in intervals of 5 – 7 years there is a drought in Namibia, reducing kudu numbers to habitat capacity. In longer intervals of approximately 20 years there are severe droughts, which reduce kudu populations to relatively low levels, securing the principle of the survival of the fittest and a phase of rejuvenation and maintaining the general good health of the kudu population.
- At least since the 1950s wild dog were severely persecuted in central Namibia, lion and spotted hyena even earlier. Since the late 1960ies, in the wake of ownership of wildlife, kudus were effectively protected on private land and at the same time numerous artificial water points where developed. Since the 1980ies artificial feeding of wildlife during the dry season may have added to reducing natural mortality very significantly.
- This leads to a situation where kudu over-utilize their habitat, especially during drought times and even more so if high numbers of competitive browsers like eland and impala have to utilize the same habitats. High numbers result in insufficient cover with unsatisfactory spacing between individual groups. Kudu have to wander off and live in inferior habitat (open country), all of which contribute to social stress, which subsequently result in the deterioration of the general health and makes the species susceptible to disease, which due to high numbers reaches epidemic proportions.
- This is what happened for the first time in the early 1980ies in spite of the severe drought of 1981 and again in the early 2000s.



## Kudu Population Densities in Namibia at the Example of Farm Schlucht in the Erongo Mountains

### Background:

- It seems that there are differences of opinion as to the size of the kudu population, some people even believe that Namibia's kudu population is endangered. NAPHA has received suggestions from members to request MET to place kudu under "protected status".
- Because of this we have decided to get some clarity on the situation. The first step was a very basic estimate done by Mrs van Avezaart and Ernst Scholz. With this study, Hagen and I tried to further deepen the knowledge on the situation.

### Background on kudu rabies in the area:

- According to information from farmers in the area, the area was severely affected by the first rabies outbreak in the early 1980ies, kudu numbers heavily reduced within a short time.
- I am in the area since 1991. The kudu numbers seemed relatively low (or normal!) at the beginning, rising towards the late 1990ies when a disease, locally called "Erongo Räude" appeared increasingly in the population. This is a skin disease from which kudus eventually die, but the disease is very slow, affected animals loose condition over a long period of time until the fatal end.
- Around 2005 a second rabies outbreak appeared, fluctuating in intensity, being most intense during the rutting seasons of 2011, 2012 and 2013. There was one dead bull in good condition found in 2014, the cause uncertain.
- There were no recorded rabies cases in 2015.

### Description of study area:

- The size of the Farm is 10500ha. The terrain is very mountainous; altitude varies from 1100m to 2100m. The habitat offers a lot of cover with different ecotones from riverine thickets to hillsides and mountains with very varied plant life and can be described as ideal kudu habitat. We must add that the terrain is so broken and cover is such that by driving through the farm very few kudus are seen.

### Method of counting:

- Intense glassing for long periods from high vantage point. Immature bulls younger than 2 years in herd were counted as part of "female herd size".

### Results:

<b>Study v. Avezaart</b>	<b>Females</b>	<b>Males</b>	<b>Total</b>
1. Outing	6	0	<b>6</b>
2. Outing	0	0	<b>0</b>
<b>Total</b>	<b>6</b>	<b>0</b>	<b>6</b>
<b>Conclusion – it seems that kudu numbers are very low</b>			

**Table 3:** Counting for study by Jannemieke and Ernst in Early March 2015

- During three different kudu safaris, deliberately searching for an old bull, Hagen and I have kept meticulous record of all kudu sightings. It has to be borne in mind that,

because of the habitat, the group size at times could not be ascertained beyond doubt. Thus the numbers given are the minimum seen, in many case there must have been more animals.

- An old bull was eventually taken after 9, 8 and 9 days respectively.

<b>Safari 1</b>	Females	Males	<b>Total</b>
1. Day	0	2	<b>2</b>
2. Day	6	0	<b>6</b>
9. Day	4	3	<b>7</b>
<b>Total</b>	<b>10</b>	<b>5</b>	<b>15</b>
<b>Conclusion – numbers indeed seem to be low</b>			

**Table 4:** Safari 1, end March / beginning April 2015

<b>Safari 2</b>	Females (+ separates groups)	Males (+ separates groups)	<b>Total</b>
1. Day	6	1 + 1 + 3	<b>11</b>
2. Day	3 + 2	1 + 1	<b>7</b>
3. Day	3	1 + 3	<b>7</b>
4. Day	3	3 + 1 + 1 + 2 + 1	<b>11</b>
5. Day	2	1 + 1	<b>4</b>
7. Day	0	1	<b>1</b>
8. Day	0	3 + 1	<b>4</b>
<b>Total</b>	<b>19</b>	<b>26</b>	<b>45</b>
<b>Conclusion – numbers are not that low at all</b>			

**Table 5:** Safari 2, August 2015

<b>Safari 3</b>	Females (+ separates groups)	Males (+ separates groups)	<b>Total</b>
1. Day	5 + 6 + 5	2 + 1	<b>19</b>
2. Day	3	0	<b>3</b>
3. Day	4 + 3	1	<b>8</b>
4. Day	6 + 7 + 10	2 + 3 + 3 + 2	<b>33</b>
5. Day	3 + 4 + 4 + 1	1 + 3	<b>16</b>
6. Day	3	1	<b>4</b>
7. Day	0	5 + 2	<b>7</b>
8. Day	0	4 + 1 + 2 + 1	<b>8</b>
9. Day	10 + 4 + 5 + 4	2 + 1 + 1	<b>27</b>
<b>Total</b>	<b>87</b>	<b>38</b>	<b>125</b>

**Conclusion - numbers were grossly underestimated before; population density appears high; social stress is clearly visible, head-butting between females of different groups at waterholes and saltlicks; only two years after last rabies outbreak it appears that another outbreak is imminent.**

**Table 6:** Safari 3, October 2015

<b>Overview</b>	Number of Kudu sighted
Study v Avezaart <i>Early March 2015</i>	6
Safari 1 <i>March/April 2015</i>	15
Safari 2 <i>August 2015</i>	45
Safari 3 <i>October 2015</i>	125

**Table 7:** Overview of Kudu sightings

- Habitat capacity of 10500ha, based on 1000 ha home range of female groups (which ideally should not overlap) and healthy average group size of 6 animals, moreover sex ratio 1:1 = 63 Female, 63 Males **Total 126** (= presumable carrying capacity)
- Estimation of population according to the observation during the year: minimum 150 animals = Overpopulation
- Interesting observation: While habitat capacity seems reached, female group size is around 5 – 6 animals
- Kudu sightings were recorded throughout the year, the given numbers reflect the trend of how sightings increased over the year as visibility becomes better in the dry season and kudus have to move more to fulfil their food and water needs

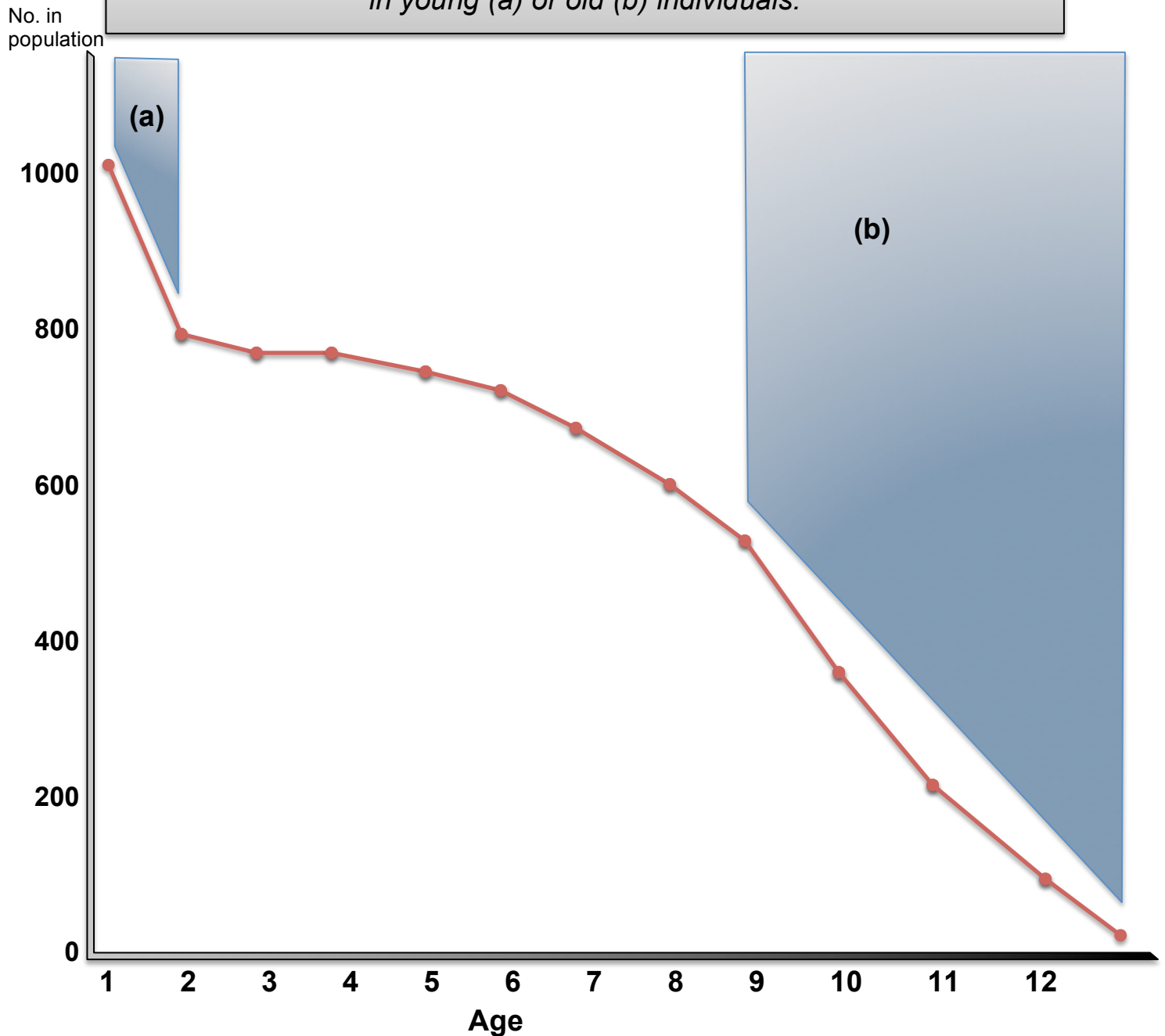
## **Conclusions**

- Kudu numbers seem to be much higher than generally believed, which we think is generally the case in Namibia
- Kudu certainly are not endangered, nor is there danger of genetic impoverishment; diseases are nature's remedy to maintain a natural balance
- Rabies however has a negative effect on Trophy Hunting, as prime bulls are prone to infection during the rut and only few bulls become old enough to represent the ideal trophy animal
- Management measures should accompany vaccination

## Suggestions for Management

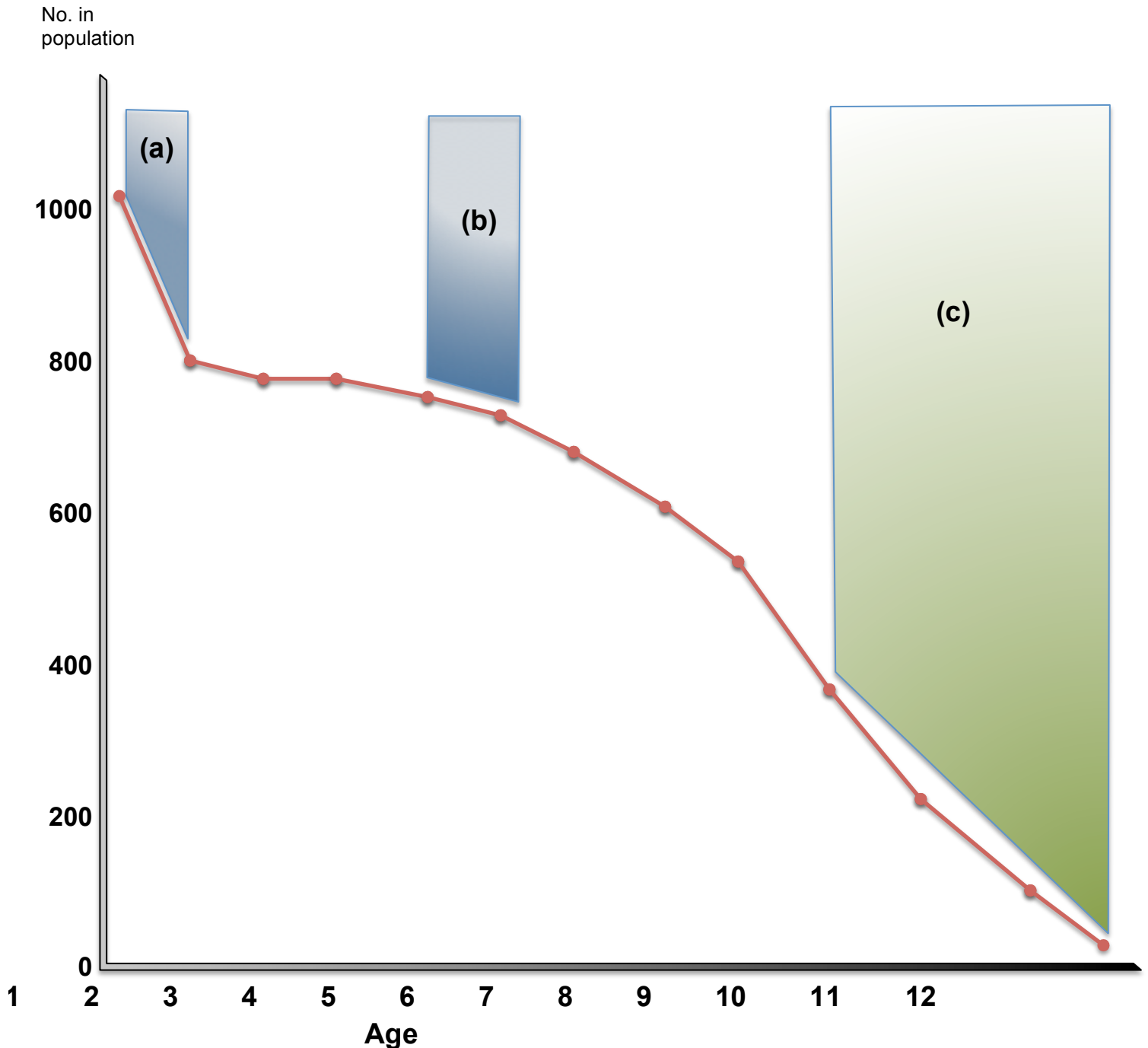
- To maintain healthy habitat and kudu population, increased off-take is urgently necessary
- Female herd size of more than 6 is indication of overpopulation
- Higher off-take of kudu, in particular females
- Suggestion for female off-take; preferably reduce herds of more than six animals, take out calves in first year (M & F) and old cows, keep healthy middle-aged animals

**Figure 5: Management Proposal for Female Kudu Population.**  
*Sustainable off-take from population when natural mortality rate is high in young (a) or old (b) individuals.*



*Adopted from "Die Sache mit der Jagd" by H. Kalchreuther.*

**Figure 6: Management Proposal for Male Kudu Population.**  
*Sustainable off-take from population when natural mortality rate is high in young bulls (a); sustainable off-take in non-trophy bulls (b); and sustainable off-take in trophy bulls (c), when natural mortality rate is higher again*



*Adopted from "Die Sache mit der Jagd" by H. Kalchreuther.*

- Suggestion for male off-take; preferably take out middle aged bulls of inferior trophy quality to reduce social stress amongst bulls, keep good trophy animals to reach old age and use as ideal trophy animal to enhance status of Namibia as kudu country *par excellence*



## **Suggestions for PR work**

- We are missing out on a golden opportunity to make a very important point in support of sustainable utilisation.
- It is not a case of hunters saving the kudu so that in future they can still be hunted. This attitude is very dangerous, as apart from vaccination, animal rightist may suggest that instead of killing, population should be managed by “anti baby pill” and other suchlike unnatural measures.
- We have to point out that death is a normal occurrence in nature. It can occur in the form of predation (including hunting), drought mortality factors, disease, etc.
- In the special case of central Namibia increased off-take is inevitable to keep numbers at healthy levels.
- Sustainable hunting only pre-empts natural mortalities in the form of starvation, old age and horrible diseases

And there he is, emerging from the thick bush in late afternoon; shy, elusive – and magnificent.

This is our animal, none is more beautiful and majestic – there is much fuzz about the sable; for what reason has never become clear to me.

Let us manage and hunt him well.

And an appeal to the younger generation of PH's: Specialize in hunting kudu – this is Namibia's most noble species. It requires extreme skill, it allows for extremely atmospheric encounters and it requires that the hunter, like his quarry, truly melts into the surroundings.



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