Do Cape Buffalo (*Syncerus caffer caffer*) Browse When Given The Opportunity?

Katie Levasseur and Nicole Kasper

Abstract

Five African Cape buffalo (*Syncerus caffer*) from the Great Fish River Reserve bomas were observed for a three week period. They were given the option of hay and six species of specific browsing material from the bush clump thicket. These species included *Acacia karroo, Euclea undulata, Grewia robusta, Olea europaea, Plumbago auriculata, and Portulacaria afra.* Each evening branches of the six species were weighed and hung in a random order at the same height along the boma wall to allow the buffalo access to the material. This was done overnight to prevent mass altering evaporation of the branch. In the morning, branches were observed for evidence of buffalo feeding and reweighed. Although direct observation indicated that the buffalo tried each type of plant, the trials indicated that they preferred *Portulacaria afra* and *Olea europaea* over the other species. Conclusively these buffalo, usually considered grazers, will browse certain plant species when given the opportunity.

INTRODUCTION

The African or Cape buffalo is the most recent and advanced ruminant to evolve within the last seven million years (Estes). *Syncerus caffer caffer* have an average life expectancy from 15-20 years. It is closely related to the American bison. It has a strong, massive build with short, powerful legs. Full grown females get up to 600kg and have a shoulder height of 1.4m, while males reach 800kg and 1.5m. These buffalo have large, bulky horns that reflect their age and sex (Estes). They also have large heads and wide necks. *S. caffer* have short and course hair; males have black or grey fur, while females and youth are reddish (internet Wayne).

S. caffer has poor senses of hearing and sight, but have a good sense of smell. A herd is made up of mostly females and their offspring. The males live in age dependent bachelor herds, but often become independent of others when they get old (internet American). Cape Buffalo are herbivores that need an abundance of grass, water, and shade. Shade and water are critical because of their poor ability to regulate body temperature. This forces them to stay near a constant water source and remain in the shade

during the heat of the day. *S. caffer* feed mostly during the night (internet American). They are most commonly found in low rainfall areas. This is surprising because they are very susceptible to weight loss without an adequate amount of fresh, green vegetation (internet Wayne). By eating long, coarse grasses, *S. caffer* plays an important role in allowing smaller animals to access more palatable grasses (internet Animals). Their adaptations to eat these harsh grasses include a broad incisor row, large cheek teeth, and a prehensile tongue that allows them to grab, pull together, and eat bundles of grass (Estes). As they get older, their teeth condition declines as does their weight and body condition (internet American). Their physiological state affects the amount of food they eat, as does the quality and abundance of food (Brunsting 2002).

Typically, the African buffalo graze in savannas, but there are times when they will browse. Kerley and Landman researched this and concluded that *S. caffer* is a specialized grazer that will browse, but cannot solely depend on browsing for survival. They eat 2.2 percent of their body weight daily which consists of 5 percent herbs and browse foliage (internet American).

Great Fish River Reserve

This study site was located in the Central part of the Eastern Cape in South Africa. The Sam Knott Nature Reserve, Double Drift Game Reserve, and Andries Vosloo Kudu Reserve composed the 45,000 ha Great Fish River Reserve. The dominant vegetation type is the thicket biome. The five thicket types identified are Dune Thicket, Valley Thicket, Xeric Succulent Thicket, Mesic Succulent Thicket, and Spekboom Succulent Thicket. The study site closely resembled the Valley Thicket (Estes). The thicket biome contains little grassy under story. The low rainfall is not able to support forest type vegetation. Plants common to this area include mostly short evergreen and deciduous trees, shrubs, and succulents, such as: *Acacia karroo, Euclea undulata, Grewia robusta, Olea europaea, Plumbago auriculata,* and *Portulacaria afra*.

Acacia karroo

Acacia karroo is known for its distinctive white, paired, long, straight thorns. It is a small to medium size deciduous tree that can withstand drought. The quickly growing main stem of *A. karroo* has branches that are low to the ground with a spreading rounded crown. The bark is rough and dark; the leaves occur in singly or in tufts. Certain species of ants find shelter within thorns that reach up to 70mm in length. During the summer, these trees form golden yellow flower clusters at the end of their branches. Dark brown, sickle-shaped pods

are formed in clusters in late summer and early fall. *A. karroo* is an indicator of sweet veld, therefore, it is also referred to as Sweet Thorn (internet Gardening) (Pooley 1993).

Euclea undulata

Also known as Common Gwarri, *Euclea undulata* can be identified by its distinctive undulated leave margins. It is a non-thorny 3-6m shrub or small tree that is found in the bushveld, rocky outcrops, and arid areas. *E. undulata* can have many stems covered in grey bark with longitudinal fishers. The wood is strong and durable. The branches are vertically straight with slightly rolled under and wavy leaves that are found in sub-opposite whirls. The small, white, and sweetly scented flowers of *E. undulata* bloom in the summer. Red to purplish black, round fruit grow from February to September (Pooley 1993).

Grewia robusta

Grewia robusta is a shrub that flowers in the winter, showing its tiny pinkish purple star shaped flowers through its tangled dry, winding branches. There are often other bushes entangled in it. It is common to see lichen hanging from this plant. This plant is more likely to grow broader than high. *G. robusta* has smooth, oval, tiny leaves. This plant has tan bark with grey growth covering most of its surface area. It is a commonly browsed shrub by larger herbivores. *G. robusta* is a scrambling shrub or small tree that can get up to 3m in height. It's reddish-brown to purple, four lobbed fruit are eaten by many types of birds which disperse its seeds, while butterflies and skippers eat the leaves with three distinct veins (internet *Grewia*).

Olea europaea

Olea europaea is a 5-10m shrub or medium tree. It is most commonly found on forest margins, bushveld, rocky hillsides, and near water. The stem of *O. europaea* is gnarled with a widely spreading crown. This non-thorny plant is hearty and quick growing. The long, thin, shiny, leathery, drooping leaves have sharp tips. These leaves re-grow smaller when heavily browsed. *O. europaea* braches start off square with four ridges and eventually become smooth branches. Small greenish-white flowers bloom in early summer; purplish blue, round fruit can be found in the winter (Pooley 1993).

Plumbago auriculata

Plumbago auriculata is a non-thorny, durable, scrambling shrub that grows to 3m by 3m. New growth is bright green, contrasting with darker green old growth. This evergreen can withstand frost. The main flowering is between November and May, where you can find pale blue, sticky flowers. *P. auriculata* have ear shaped leaf bases, from where they get their species name. The height of the plant depends on the browsing pressure (internet *Plumbago*) (Manning 1996).

Portulacaria afra

Portulacaria afra is also referred to as Spekboom. It is heavily grazed by game and domestic stock. It is an evergreen, succulent bush or small tree that can grow up to 5m in height. *P. afra* leaves are small, round, and juicy and protrude from reddish stems. They grow in hot, dry river valleys in the Eastern Cape, Transkei, Natal, and Transvaal. The thick, arching, non-thorny branches are full of tightly packed leaves. Clumps of small, star-like, pink flowers bloom late winter to spring; seeds in winged fruit appear from August to September. *P. afra* is helpful in preventing soil erosion. It is beneficial when tall herbivores, like elephants, browse top to bottom. This allows the plant to re-grow horizontally at ground level. When plants are browsed bottom to top, seed dispersal is necessary for plant survival (internet *Portulacaria*) (Pooley 1993).

Objectives

1. To determine if *Syncerus caffer caffer* consumes browse material while a primary diet of hay is consistently available.
2. To establish which browse species *S. c. caffer* prefer: *Acacia karroo, Euclea undulata, Grewia robusta, Olea europaea, Plumbago auriculata,* or *Portulacaria afra*. .
3. To examine the weather conditions' affect on the amount of Cape buffalo browse intake by analyzing the weathers' affect on branch mass.

Hypothesis

Buffalo will consume browsable material when given the regular diet of hay. Due to the immense competition in the thicket biome for limited graze materials, grazers, such as Cape buffalo, will turn to other vegetation we predict.

Acacia karroo, being thorny, was predicted to be ignored by *Syncerus caffer caffer*. Our hypothesis is that *Portulacaria afra, Grewia robusta,* and *Olea europaea* would be eaten by the buffalo. Consumed by elephants, rhinos, humans, and others, we predict that Cape buffalo will eat succulent *Portulacaria afra*. Observations by Derek Brown indicated that Cape Buffalo eat *Olea Europaea*. As a part of many species diets, *Grewia robusta* could logically be a part of the Cape buffalo food intake as well. *Plumbago auriculata* and *Euclea undulata* were abundant in the location of the study site, therefore were added to the test group.

The Cape buffalo's browse intake will not differ from rainy to clear weather conditions. In some cases, however, the data will need to take into account the natural branch mass changes. Branch mass will be affected by weather. Given rain, dew, or mist, the exposed branch will increase in mass over time.

Methods And Materials

The sample group of Cape buffalo included 3 young females and 2 young males captured from the Great Fish River Reserve. They were kept in a boma at the Basil Kent Research and Conservation Center in the Andries Vosloo Kudu Reserve part of the Complex where their food intake and behaviors could be easily observed. They were given a shaded area, a constant supply of water, and five bails of hay each day. In addition to the grazing material, they were given a choice of browsing material.

When determining what type of browsing vegetation to offer the buffalo, the characteristics of availability, abundance, and thorniness were taken into account. The group of browse materials offered include: *Acacia karroo, Euclea undulata, Grewia robusta, Olea europaea, Plumbago auriculata, and Portulacaria afra.*

For each trial, a similar sized bundle of branches from each species was cut with a billhook. These bundles were chosen to have equivalent amounts of leaves. They were collected from different sites for every trial each evening before sunset. This time of day was chosen for two reasons. Buffalo prefer to eat during the night and rest in the shade during the day to avoid overheating. Night was also chosen to minimize evaporative waste loss by the branches. Evaporation from these branches would decrease the final weight, giving an incorrect reading of buffalo consumption. These branches were individually weighed with a spring balance and hung with bailing twine on the inside of the enclosure wall. Randomly across the wall, each was placed at equal distances of three meters apart at a standard height of one meter. The species were hung each night in a random fashion to prevent bias of the animals preferring a certain area. They were hung far enough away so that they would not influence the buffalo's decision to try the next one. The height of these branches were kept at buffalo eye level so that they would be in their browsing zone. In the morning, the branch biomass was rechecked; this amount was compared to the night before to determine the mass of each species eaten. Once it had been shown that Cape buffalo ate browse material, their preference was tested. Each trial was repeated 10 times.

We compared the corresponding weather conditions to its trial date's plant mass intake by carrying out test trials that showed the fate of the cut branches without animal browsing. This showed the amount of water loss or gain that took place without plant

material being consumed. The percentage of natural change in mass of the control samples was subtracted from the change in mass of each trial sample to account for environmental effects. This gave us a more accurate reading for how much *S. caffer* ate.

The initial branch mass was subtracted from the final branch mass {$Mass_{Final}$-$Mass_{Initial}$= $Mass_{Change}$}; this gave the amount the branch mass changed over night. This over night mass change included the moisture added or decreased from the buffalo intake. In order to calculate the amount of vegetation the buffalo actually ate, the average percentage of natural branch mass increase was found by diving the mass change of the test trial sample by the initial mass of the test trial sample {(M_F-M_I) / M_I = % Moisture Increase}. This percent of change due to environmental conditions was used to alter the data to give a more accurate reading of how much the Cape buffalo ate. The percentage specific species' natural mass increase was multiplied by the initial mass of each trial in order to account for the amount of vegetation eaten that was offset by branch moisture increase { (%MI)*(MI) + Raw Calculation of Mass Consumed = Branch Mass Consumed }. To calculate the percentage of each species consumed relative to the total vegetation biomass of all the species, we divided the species mass consumed by the total mass of all the species eaten {$BMC_{species}$ / BMC_{total}}.

Results

Syncerus caffer caffer did consume browse material while hay was available. The amount consumed by the Cape buffalo from the greatest to the least were: *P. afra* (1066g), *O. europaea* 1 (587g), *O. europaea* 2 (174g), *P. auriculata* (145g), *E. undulata* (130g), *G. robusta* (41g), and finally *A. karroo* (25g). Table 1 shows the plant mass difference and average of all the species each day for a ten trial period. Table 2 shows the amount of species vegetation eaten using daily percentages. Taking into account the natural overnight mass change, the percentage of each plant consumed out of the total plant biomass eaten. Table 3 shows the percentage of the actual branch *S. caffer* consumed each night. This shows how heavily the branch was browsed. Figure 1 and 2 are visualizations of Table 1 and 2 respectively.

There was no distinct correlation between the weather conditions and the amount the Cape buffalo consumed. In Table 4, you can see these weather conditions on the ten trial days. However, the moisture increases branch mass overnight without browsing. Therefore, environmental conditions effect the branch mass. There was no evidence of evaporative water loss for A. karroo and E. undulata overnight. P. afra increased 2.8%, G.

robusta increased 3.5%, O. europaea 2 increased 4%, P. auriculata increased 7.8%, and O. europaea 1 increased 15.4% according to our data as your can see in Table 2.

Discussion

The mass of browse types eaten was used to infer preferred browsing material eaten by the five individuals of *S. caffer*. Initially, three non-thorny and three thorny plants were going to be used. We decided that one thorny species would be sufficient because it seemed unlikely that this large herbivore could feed on leaves between the thorns of these types of plants.

The sample population was limited due to the fact that only five buffalo were used and these five were all relatively young animals. The sample group could have been larger and encompassed a greater diversity of age, genes, and home range. The bomas also are not exact replicas of their natural habitat, which could have affected their feeding behavior. Exposure to humans was common and occurred where food was presented, which also could have affected their behavior.

The quality, quantity, and location of the collected plant species have an effect on the desirability of the vegetation. Although some branches had great quality, others were overgrazed. For example, *Olea europaea*, when overgrazed had smaller leaves that were located lower to the ground; these branches looked bare. The overgrazed *O. europaea* was neglected by the buffalo compared to non-grazed, high quality *O. europaea* found higher in the tree.

When collecting branches, some species grew differently from others making it difficult to gather one full branch of desired leave mass. Some species, like *P. auriculata*, needed multiple stems to obtain a large enough vegetation sample. Others like *O. europaea* or *E. undulata* had an adequate sample size with one branch. Species isolated in particular areas presented a problem with finding a variety of sample locations. The study site is where most of the plant material was collected. When possible, different locations in the study site were chosen.

When hanging the vegetation on the boma wall, a predetermined standard height was used. It was done this way to replicate a shrub of browsing material. Instead of using only one side of the boma, every side could have been experimented with to see if the results differed.

When calculating data, human error, wind, and inconsistent scale use could have altered the data collected. The hang scale used was sensitive to wind, therefore there were attempts to block the wind. An alternate hang scale was used for two of the trail dates due

to a misplacement of the regular equipment. This alternate scale was marked to 1.00 kg instead of 10.0 kg, which altered the way the branches were measured and the accuracy. To be consistent, one person was designated reader of the scale and one was the recorder. In addition, the measurements might have also been skewed from the process of the buffalo feeding. Branches and leaves had to be collected from the ground inside the boma and added to the final branch weight to ensure the most accurate readings possible.

Avoiding feeding during the day prevented the problem of evaporation but also uncovered a different problem with the overnight dew. It was deceiving when calculating the amount consumed because the moisture change overnight was not incorporated. Sample branches were prepared and isolated from the buffalo to determine the percent moisture mass increase that occurred overnight. The amount consumed by the buffalo was then adjusted to incorporate the moisture mass increase that occurred naturally.

We suspect that mostly *P. afra* was consumed due to its succulent nature. *O. europaea* 1 was consumed over *O. europaea* 2 due to full braches. *A. karroo* was not enjoyed probably due to the thorns.

Conclusions

This study indicated that the Cape Buffalo, Syncerus caffer caffer, prefer to browse on non-grazed *Olea Europaea* (O_1) and *Portulacaria afra* over *Acacia karroo*, *Euclea undulata*, *Grewia robusta*, overgrazed *Olea Europaea* (O_2), and *Plumbago auriculata*. The percentage of natural environmental mass change was calculated and factored into the amount of vegetation eaten. These animals will eat browse material in addition to their typical diet of graze material. The weather did not affect the eating habits of the buffalo, however, in this study, moisture mass increase was an important factor.

Literature Cited

American Wildlife Foundation: '*Wildlives: African Animals*'- <http://www.awf.org/wildlives/64>

Animals: African Cape Buffalo- <http://www.rhinorally.com/english/static/subsections/animals/buffalo.htm>

Brunsting, A. M. H. and Smallegange, Isabel M. 2002. Food supply and demand, a simulation model of the functional response of grazing ruminants. *Ecological-Modeling* 149 (1-2): 179-192.

CAPE BUFFALOSyncerus caffer- <http://www.nature-wildlife.com/buftxt.htm>

Estes, R. D. African or Cape Buffalo: *Syncerus caffer. Safari Companion.* Chelsea Green Publishing Company. 158-163.

Gardening: Trees- <http://gardening.worldonline.co.za/0029.htm>

Grewia occidentalis L.- <http://www.plantzafrica.com/plantefg/grewiaoccident.htm>

Manning, J. 1966. *Eastern Cape: South African Wild Flower Guide II.* Capetown: NB/Paarl Print.

Plumbago auriculata Lam.- <http://www.plantzafrica.com/plantnop/plumbago.htm>

Pooley, E. 1993. *The Complete Field Guide to Trees of Natal, Zululand and Transkei*. Durban: Natal Flora Publications Trust.

Portulacaria afra Jacq.- <http://www.plantzafrica.com/plantnop/portulacarafra.htm>

Wayne Wagner: Safaris- <http://www.wagnersafaris.com/capebuffalo.htm>

Table 1: *Plant Mass Difference in grams over a 10 Trial Period*

Species/ PM Trial Dates	**1** 5/24	**2** 5/25	**3** 5/26	**4** 5/29	**5** 5/30	**6** 5/31	**7** 6/3	**8** 6/4	**9** 6/5	**10** 6/7	Daily Avg.
A. karroo	100	20	110	-50	-50	-20	20	40	0	80	**25**
E. undulata	80	160	40	250	150	100	240	20	80	180	**130**
G. robusta	80	100	50	50	-140	-200	60	-50	80	40	**7**
O. europaea 1	N/A	N/A	N/A	1000	400	N/A	320	350	200	360	**438**
O. europaea 2	280	120	100	0	250	200	130	100	110	90	**138**
P. auriculata	230	250	90	200	150	30	60	-65	20	0	**97**
P. afra	440	700	1300	1250	1900	600	610	1150	990	980	**992**

Table 2: *Amount Species Vegetation Eaten*

Plant species	BMD	%NOBA	AC (g)	% T
A. karroo	25	0	25	1.15
E. undulata	130	0	130	6.00
G. robusta	7	3.5	41.37	1.91
O. europaea 1	438	15.4	587.38	27.09*
O. europaea 2	138	4	173.72	8.01
P. auriculata	97	7.8	144.54	6.67
P. afra	992	2.8	1066.24	49.18

BMD= average daily branch mass difference
NOBA= natural overnight branch alteration
AC= amount amount consumed per day
%T= percent of total amount consumed by average daily weight

**Olea europaea* 1 was calculated on a 6 day trial period only.

Table 3: *Percentage of Branch Consumed*

Species / Trials (%)	**1** 5/24	**2** 5/25	**3** 5/26	**4** 5/29	**5** 5/30	**6** 5/31	**7** 6/3	**8** 6/4	**9** 6/5	**10** 6/7	**Raw avg**	**AVG**
A. karroo	8.7	4.8	10.4	8.3	N/A	N/A	6.1	5.3	0	15.1	**7.3**	**7.3**
E. undulata	7.3	20.5	6.8	17.9	23.1	8.7	25.3	3.8	11.6	30.0	**15.5**	**15.5**
G. robusta	6.5	13.3	8.3	3.7	N/A	N/A	7.1	N/A	9.1	6.2	**7.7**	**11.2**
O. euro 1	N/A	N/A	N/A	51.3	32.0	N/A	40.0	47.9	48.7	52.9	**45.5**	**60.9**
O. euro 2	23.3	14.6	10.0	0	17.2	13.8	17.3	12.5	35.5	15.0	**15.9**	**19.9**
P.auriculata	27.7	35.7	14.8	20.0	17.6	3.8	15.0	N/A	6.3	0	**15.7**	**23.5**
P. afra	22.1	32.6	48.1	40.3	55.1	20.7	27.4	51.2	58.2	24.7	**38.0**	**40.8**

Table 4: *Trial Weather Conditions*

Trial	TIME OF DAY	Temp. (*C)	Wind?	Rain?	Fog?	Clouds?
1	*PM*	*15*	*NO*	*NO*	*NO*	*YES*
1	*AM*	*10*	*YES*	*NO*	*YES*	*YES*
2	*PM*	*15.6*	*NO*	*NO*	*NO*	*NO*
2	*AM*	*10*	*YES*	*NO*	*NO*	*YES*
3	*PM*	*16*	*NO*	*NO*	*NO*	*YES*
3	*AM*	*8*	*YES*	*YES*	*YES*	*YES*
4	*PM*	*12*	*YES*	*NO*	*NO*	*NO*
4	*AM*	*10*	*NO*	*NO*	*YES*	*YES*
5	*PM*	*14*	*NO*	*NO*	*n/a*	*n/a*
5	*AM*	*11*	*NO*	*NO*	*YES*	*YES*
6	*PM*	*12*	*NO*	*NO*	*NO*	*NO*
6	*AM*	*11*	*NO*	*NO*	*NO*	*NO*
7	*PM*	*13*	*YES*	*NO*	*NO*	*NO*
7	*AM*	*7*	*NO*	*NO*	*NO*	*YES*
8	*PM*	*9*	*NO*	*YES*	*YES*	*YES*
8	*AM*	*4*	*YES*	*NO*	*YES*	*YES*
9	*PM*	*7*	*YES*	*NO*	*NO*	*NO*
9	*AM*	*6*	*YES*	*NO*	*NO*	*NO*
10	*PM*	*12*	*NO*	*NO*	*NO*	*NO*
10	*AM*	*6*	*NO*	*NO*	*NO*	*NO*

Table 5: *Branch observations*

Species	*Comments*
A. karroo	*There were attempts to eat it two of the days.* *There were few bite marks on the tip of some branches.*
E. undulata	*Branches were ripped off and on the ground many of times.* *However, they did not consume much of this plant.* *There were obvious attempts.*
G. robusta	*Parts of branches were found cracked on occasion.* *Some leaves were found on the ground.* *Most of the time, it was left untouched.*
O. europaea 1	*Some days had up to 90% leaves eaten.* *Branches demolished.* *Some leaves found on ground, but most consumed.* *Did not eat berries.*
O. europaea 2	*Nibbling on branches.* *Evidence of eating by bite marks and some leaves on ground.* *Overgrazing obviously affects the quality and desirability..*
P. auriculata	*Few attempts.* *Some leaves on ground.* *Little evidence of bite marks.*
P. afra	*Ate as much as available to a certain extent.* *Branch tips gnawed off.* *Whole branches were ripped off.* *Demolished this plant.*

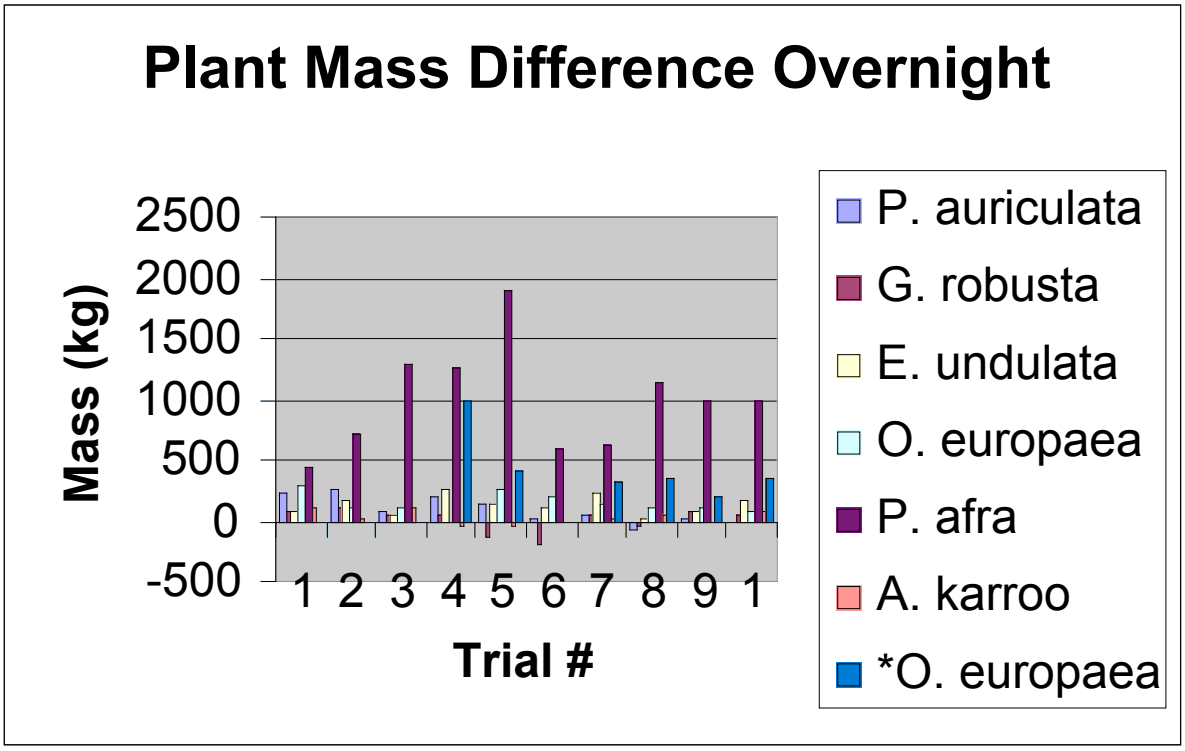

Figure 1: *Plant Mass Difference Overnight (*mass is in grams not kilograms)

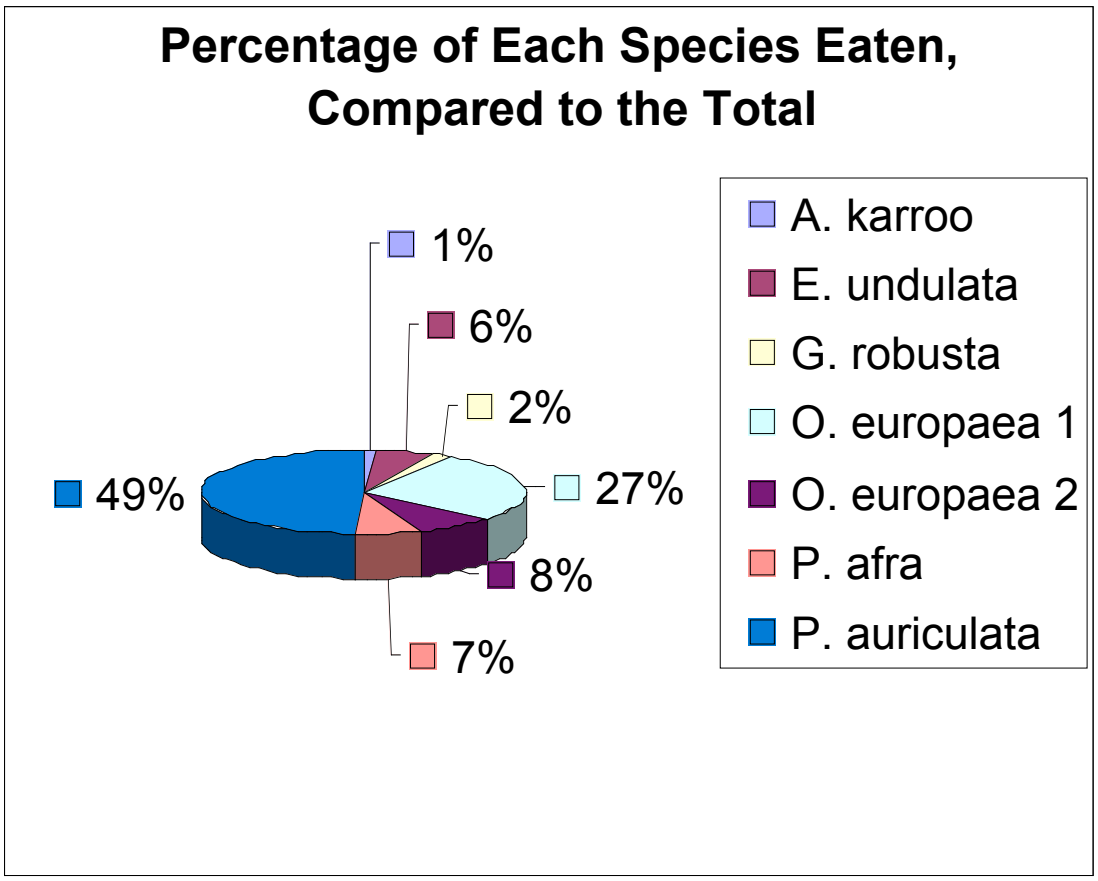

Figure 2: *Each Species' Percentage of Total*