

Transforming wild African herbivores into edible meat for local communities. Sustainable use of impala (*Aepyceros melampus*) in the CAMPFIRE Program, Zimbabwe

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Key words

Aepyceros melampus - Wild animal - Game meat - Sustainability - Mobile unit - Zimbabwe.

Summary

For a long time, African wildlife has been considered a potential source of animal protein for human populations. However, projects aiming at producing bush meat have often been hindered by major constraints such as public health concerns and their cost. The goal of the Nyama project, operating within the CAMPFIRE program in Zimbabwe, had been to supply the people of Omay Communal Land (Nyaminyami District) with affordable impala (*Aepyceros melampus*) meat on a regular basis and in accordance with the national law on public health. This paper describes the technical innovations (mobile butchery and meat distribution points), the procedure followed during the cropping operations and a financial summary of these activities during the initial phase of the project. In 1996, the production system was handed over to the Nyaminyami District Council, who has since been running the project independently.

INTRODUCTION

Wild African herbivores have, for a long time, been considered as a potential source of substantial amounts of nutritional protein (4, 6, 10). Plans to harvest the considerable animal diversity of the African savannahs have been numerous, but only few have succeeded in the sustained transformation of wild biomass into edible meat (5, 9). Public health precautions necessary for the organized production of large amounts of meat, added to the technical requirements of harvesting free-ranging non-domesticated animals, have more often than not rendered such operations economically or politically not viable.

When it takes place, meat production from wild animals is often a side activity of the ecological control of prolific species. Notable exceptions are the exemplary cases of the ongoing supply of antelope meat as a quality product to high paying markets: springbok (*Antidorcas marsupialis*) meat exported from South Africa and Namibia to Europe, meat of various herbivores sold to restaurants in Kenya, the elephant (*Loxodonta africana*) and buffalo (*Syncerus caffer*) abattoir and canning factory in Skukuza (Krüger Park, South Africa) that supplied the local market, the cropping of buffalo in the Zambezi delta in the late seventies, the culling of hippopotamus (*Hippopotamus amphibius*) in the Luangwa River (Zambia) for the benefit of local communities, the sustained harvesting of a variety of herbivores in the Nazinga Ranch (Burkina Faso) for the benefit of local communities, and the cropping of impala (*Aepyceros melampus*) and Thomson's gazelle (*Gazella thomsoni*) in Kenya (1).

In 1990, the Nyaminyami District Council, one of the pioneers of the CAMPFIRE Program, sought to optimize its impala meat producing operations to supply the local market. Improvements were necessary in the fields of public health, involvement of the local population, building of local capacity to manage the

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operations independently from outside assistance, reduction of meat export outside District limits, economic viability, and overall increased output. This led to the implementation by the CAMPFIRE Association and Cirad-emvt of the so-called "Nyama Project" ("Meat Project") financed by the French Embassy in Zimbabwe for the benefit of the Nyaminyami Rural District Council to optimize the use of impala. A combined system of purpose-designed mobile abattoir and fixed meat retail facilities utilizing appropriate technologies and local manpower was experimented in 1994 and 1995. The system was deemed satisfactory and its components were approved by the competent authorities. Responsibility for the operations and production means were gradually transferred to the local authority (Nyaminyami District Council) through a capacity building process that was completed in 1996 when outside assistance had ended.

The purpose of this article (based on cropping operations in 1994-1995) was to describe the different stages from animal cropping to meat distribution to the local population, as well as technical innovations which allowed to meet the initial expectations.

MATERIALS AND METHODS

Background

At the onset of the CAMPFIRE Program in the Nyaminyami District of Zimbabwe in 1989 (figure 1), considerable thought was given to the possibility of harvesting the large impala population

on the shore of Lake Kariba by and for the benefit of the local population (7, 11). As efforts focused on safari hunting because of large financial profits it generated to be shared among the population by the local district council, meat production activities were limited to professional safari hunters supplying villages with the meat of hunted buffaloes and, more importantly, culling surplus impala three times a year (12).

An investigation of these operations concluded that the possible public health hazards from infectious pathogens and parasites were negligible, but that the sequence of events from the death of the animal to the sale to the consumer was suboptimal: 1) it did not meet the minimum national public standards (no bleeding, extensive contamination of carcasses and very late evisceration) (2); 2) products of culled animals were not completely used (heads and offal were purchased by the local crocodile farm) (12); 3) the operation was not economically viable when subsidies were included in the analysis (11); 4) supplied products could not be stored (sun drying, the preferred local technique, was difficult when carcasses had not been bled) and greater control of meat wastage was required (11); 5) substantial amounts of meat, considered a primary benefit from wildlife by the local population and a potential threat to animal health outside the Foot and Mouth Disease infected District, "escaped" from the District through uncontrolled dealings.

Strategies

The project had to develop a system that would provide meat and offal supply that met legally acceptable standards (i.e. fit for consumption and contamination free) to the local population

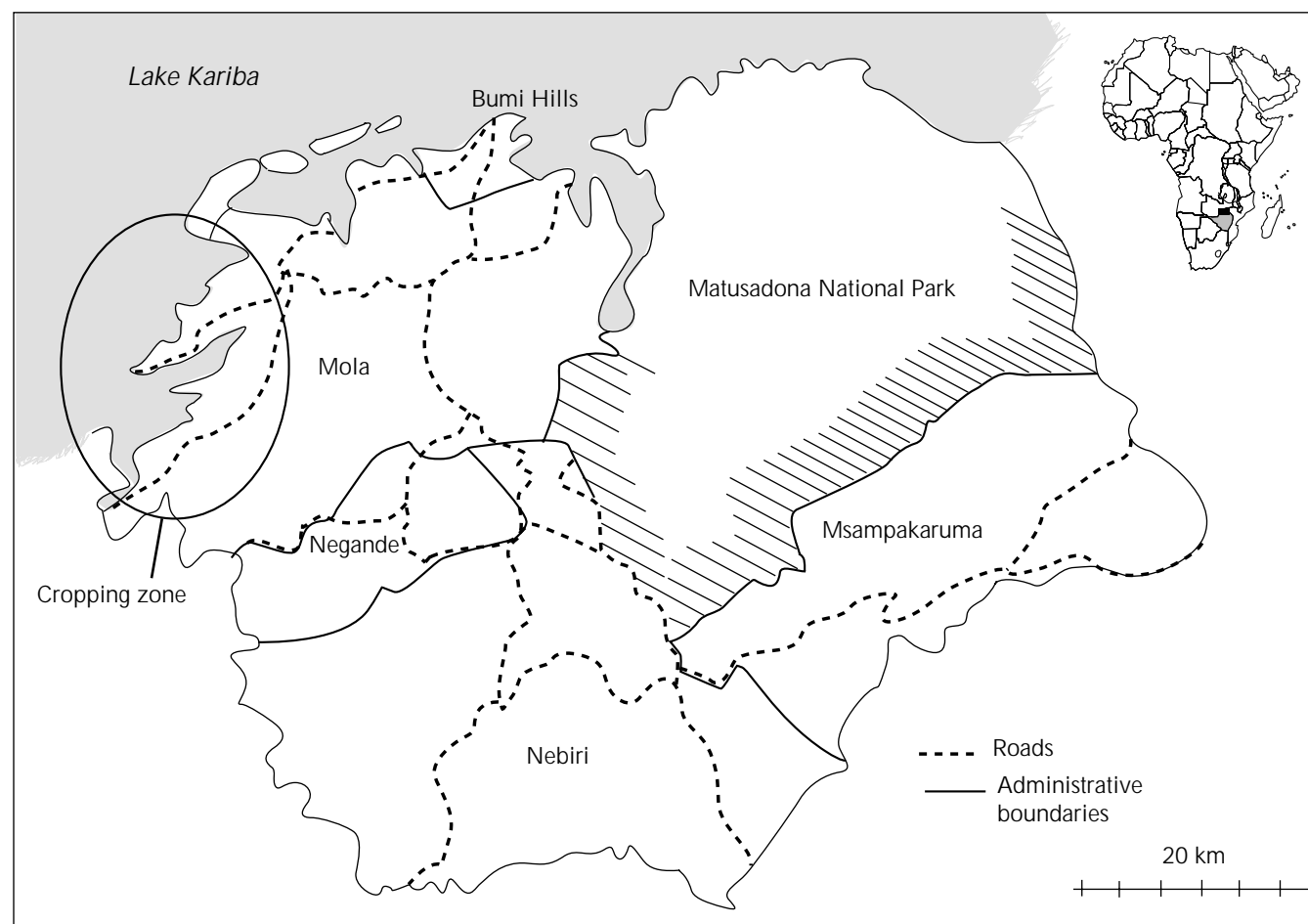


Figure 1: Map of Nyaminyami District. Cropping zone and administrative boundaries.

scattered in ten administrative village areas, some located as far as 80 km from the main impala habitats, use as much local manpower as possible, be versatile enough to crop animals in remote places where only small groups of animals were to be found, make it as difficult as possible for people from outside the protein poor district to purchase large quantities of meat, and be economically viable.

To achieve this, it was decided to work along the possibility of providing small quantities of fresh meat and offal to designated distribution points at frequent intervals. The buyers would then be free to process on their own the product into biltong (sun-dried and spiced meat). This would avoid dealing with the complicated issue of cold storage in places where there is no electricity and, besides, refrigerators would be a health hazard. Moreover, this choice would restrict the public health responsibility of the district council to the rather manageable scope of selling fresh meat within twelve hours of animals' death.

The goal in using impala was to produce retail meat. To accomplish it, considerable awareness on meat management and production issues was needed at all levels of local wildlife management authorities. New skills had to be acquired by the local staff in charge of shooting and management had to integrate this new approach for the operation to be successful.

Materials

Following literature review on comparable activities, it was decided to experiment an adaptation of the procedure used in Australia to cull kangaroos, i.e. a four-wheel drive pick-up vehicle carrying all the equipment and staff necessary to crop the animals, process and inspect the carcasses, and deliver the product. In addition, pre-designated points would be equipped with a receiving and retail structure, the meat distribution point (MA) to be developed, installed and run with the participation of the benefiting communities.

The mobile abattoir

The mobile abattoir (MA) (figure 2) was carefully developed in collaboration with the District Wildlife Management Committee and the District Public Health Services and was officially approved. The result of numerous experiments was a structure adapted to its purpose in the local conditions. It consisted of locally available flat iron bars and tubes assembled by electric welding that could be repaired at the local district council's workshop which was equipped with a generator. The final structure was fitted to a Toyota Land Cruiser 4 x 4 (6-cylinder diesel) equipped with a conventional hunters' roll bar and bull bar. It was easily detachable from the vehicle by a team of six people in no more than ten minutes.

Important additional equipment comprised racks with iron rollers, on their extremities, and chromed mobile hooks, PVC water containers with brass taps fitted to the sides of the structure, spotlights for work at night and a roof rack to store equipment. Debates over the necessity to keep dust away from the meat led to experiment a PVC cover for the whole structure. Results were poor in that more dust was being drawn into the back of the car by the air vortices. The PVC cover was used only in case of rain. Keeping the load into open air led to negligible contamination by dust on the poorly frequented road of the District during the night.

The mobile abattoir could accommodate more than 20 carcasses with 25 considered an operational maximum. The overall cost of building such a structure (without the initial development and experiment costs) was around Z\$ 15,000 (US\$ 1 = Z\$ 8 approx. in 1995).

A similar structure was fitted to a reconditioned Land Rover (Series III, gasoline) provided by the District Council. The arrangement (in this case, the structure was fitted directly and permanently to the vehicle's chassis) proved far less durable and only fit for smaller cropping operations and deliveries within a limited range as long as the area roads remained in very poor condition.

The meat distribution point

The MDP structure (figure 3) was developed in collaboration with the District Wildlife Management Committee, the District Public Health Services and the Public Health Branch of the Department of Veterinary Services, and was officially approved. It consisted of a bolted assembly of pre-constructed iron grills, cast in a concrete platform built by the benefiting community with a wide opening loading gate, a galvanized corrugated iron roof, a sale latch with a galvanized iron plate and various hanging racks and basins for the temporary storage of water and cut pieces. Once erected, the whole structure was wrapped in a synthetic fly mesh to keep insects out. The MDP could be locked with a key. The overall cost of building an MDP (without the initial development and experiment costs) was around Z\$ 20,000.

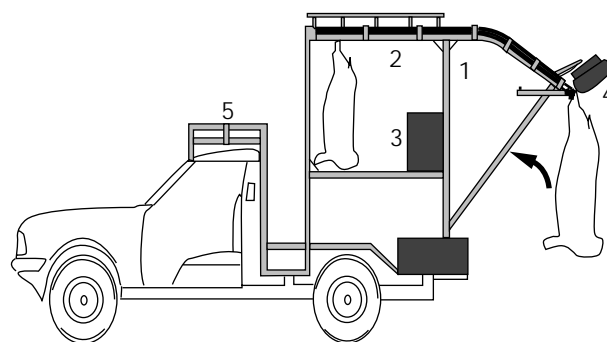


Figure 2: Mobile butchery. Detachable metal structure fitted to a pick-up vehicle - 1) flat iron bars; 2) racks with mobile hooks and iron rollers; 3) PVC water containers; 4) spotlight; 5) roof racks.

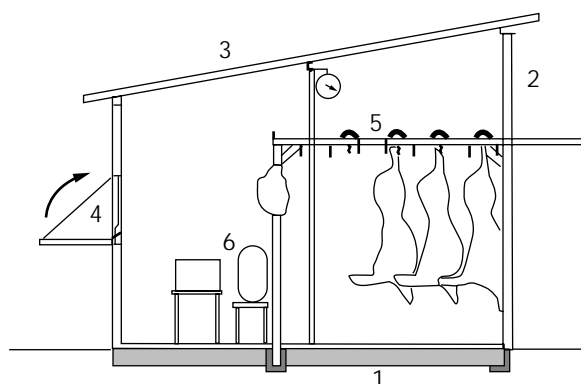


Figure 3: Meat distribution point - 1) concrete platform; 2) iron grills; 3) corrugated iron roof; 4) sale latch; 5) hanging racks; 6) basins for water and temporary storage of cut pieces.

Training

■ Hunters

The fourteen game guards employed by the District Council had to be trained in order to undertake the cropping exercise in a professional manner and ensure that the whole process would eventually be controlled by local authorities. Their initial training on weaponry when joining the Wildlife Management Unit had been limited to handling, cleaning and storage of firearms. Shooting had not been considered relevant to their tasks (law enforcement and problem animal control). Also, unlike other African countries where informal hunters developed some skills through the use of hand-crafted rifles, there was little or no rural tradition of rifle hunting in Zimbabwe and most game guards required basic training.

A training program was initiated to provide the Wildlife Management Unit with a satisfactory proportion of reasonably skilled marksmen, able to perform precision shots in night conditions on a regular basis. Specific paper targets were developed and one of the Council's .22 rifle with scope and silencer was used with ammunition provided by the project. The training was to become an ongoing exercise with weekly sessions leading to the selection of the most appropriate staff for the following cropping exercise.

■ Butchers

The early large scale impala culling exercise had trained around one hundred villagers in the techniques of skinning for the purpose of providing good quality hides to the purchasing tannery. The local authorities initially selected five young men from the target villages who would undergo training in the fields of bleeding, carcass dressing, offal cleaning, equipment maintenance and general hygiene. Training was offered by the small ruminants abattoir in the capital, Harare, 400 km away, and took place during full moon weeks (no cropping). Twelve villagers were to be trained in order to provide each village with at least one individual who could supervise meat retail at the MDPs.

Methods

Preparation

It consisted in selecting dates and sites for cropping, choosing members of the cropping team among the District' game guards and ensure that the trained butchers were present. Full moon nights were systematically avoided as the efficiency of a spotlight on the impala was then reduced. A cropping team was composed of a leader/driver, one or two hunters (local council game guards trained for that purpose) and three to five butchers. The necessary equipment was assembled: vehicle equipped with the dressing and hanging structure, weapons (.222 and .22 caliber rifles with silencers and scopes, .223 with scope), ammunition ("soft nose"), first-aid kit, mobile spotlights (2 x 100-watt spots), butchery equipment (knives, containers, etc.), water containers (up to 80 l) and sundries.

During the preparation, the meat distribution sites had to be agreed upon if the distribution schedule was not followed, and appropriate information had to be sent to the villages by the District Council.

Cropping sites

Several hunting sites have been selected in the District, most of them contiguous and located in the area around Lake Kariba

shores (figure 1). The two main sites represented an area of about 1500 ha each, constituted mainly of savannah woodland (*Brachystegia* spp.), open Mopane (*Colophospermum mopane*) woodland and savannah grassland along the lake shore.

Cropping procedure

Departure from the administrative center of the district was at around 17h00 to reach the cropping sites two hours later after having adjusted the scopes. The sides of the roads or paths were swept with the beam of the spotlight. The animals were spotted by the reflection of the light from their eyes and usually showed little reaction (7). The visibility zone varied from a few meters in undergrowth to a little over 100 m on grassy plains depending on night light and vegetation abundance and type. When a group of animals was spotted, the vehicle stopped or tried to get within shooting distance. The final part of the approach to the animals could be on foot if necessary (although this was avoided whenever possible) when the vegetation was too dense and visibility poor. Targets were chosen based on animals' position and mobility. The marksman generally aimed at an animal which was immobile and clearly visible. If there were two hunters, the first shot was generally fired by the bearer of the smaller caliber rifle, i.e. .22 if distance allowed, or .222.

Based on the annual quota fixed by the Department of National Parks and Wildlife (750 males and 750 females) (12), and although the need to conduct economically and financially profitable operations was kept in mind, the criteria of choice of animals to shoot was fairly variable. Males in bachelor herds were chosen in priority. Females (adults and subadults) were shot when they were not with young, and juvenile males and females were the last choice.

The shot should bring about immediate death of the animal in order to avoid stress, suffering and disappearance of the animal into the vegetation. To achieve this, neck and head were prime targets. It was anticipated that hunters would progressively acquire the necessary skills to increase the proportion of animals killed after one round fired. Between 1 and 3 animals were cropped during one stop; 5 animals maximum were kept in one stop in order to avoid abattoir overloading, which would lead to delays in evisceration.

Abattoir and slaughtering

The animals were collected and transported to the vehicle by the butchers immediately after shooting. Collection of wounded animals was sometimes difficult when it was not clear where the animal had fallen or moved to.

Bleeding was done as soon as possible after shooting, usually within five minutes. The animal was then hanged, head down, to a hook on the side or rear of the vehicle.

Initially, the carcasses were skinned in the field, before evisceration. This allowed considerable cooling and superficial drying of the carcasses. It also allowed some contamination to occur. Experience showed that keeping the skins on for up to 10 h after death did not make skinning more difficult. This option was then adopted as routine in order to save time in the field.

When three to five animals had been hung from the work rack at the back of the vehicle the working lights at the rear of the vehicle were switched on, the engine turned off, and the slaughtering process would start. The operations were made in the following order:

- removal of the four hooves (discarded)

- removal of the head (stored in the vehicle) and preparation of the trachea
- incision of the abdominal cavity
- removal of the small intestine, large intestine and uterus (testicles and penis were removed before the incision of the abdominal cavity)
- removal, cleaning and inspection of the liver
- storage of liver in plastic basin 1
- removal, emptying and cleaning of the rumen
- storage of rumen in plastic basin 2
- removal of the heart and lungs
- storage of heart and lungs in plastic basin 2
- inspection of the carcass and removal of parts contaminated by hemorrhage
- rinsing of the inside of the carcass if needed
- checking the butcher's work and hygiene standards
- storage of the carcass holding rack in the front part of the slaughter structure
- loading of basins
- cleaning of equipment.

The whole rack-plus-suspended-animals with skins on was pushed to the front of the vehicle for storage. This element and the next racks (up to five in one night) would not be tampered with until the morning after at the selling point. Offal and heads were collected for sale. This allowed residual blood to drip from the carcasses, "shaken" during the ferrying of the load.

The stomachs were stored separately in plastic containers after cleaning. Livers and lungs with parasites or in doubtful condition were discarded. Those deemed fit for consumption were washed and stored.

Simple hygiene was considered very important since the District Council responsibility was engaged in case of a public health alert and the main hazard was considered to be meat contamination by polluting agents. During carcass preparation the butchers had to follow a set procedure to limit carcass contamination:

- wash hands and knife before the operation
- wash the knife after incision into the skin
- wash hands and knife after evisceration before continuing preparation
- rinse the inside if there were traces of contamination (e.g. small hemorrhages).

An inspection chart for the carcasses, hygiene during operations and hide quality had been devised to motivate the butchers to respect hygiene procedures and to perform up to standard. The work of individual butchers was graded, and bonuses were used as incentives.

Meat and offal delivery

After slaughter and evisceration of the last animals, the carcasses were transported in the cropping vehicle, directly from the hunting area to the selling point. Transportation took between twenty minutes and two hours depending on the selling point and road conditions. After arrival at the MDP, usually around eight o'clock in the morning, the carcasses were skinned and cut up.

The carcasses were offloaded (the reverse of the loading operation) and transferred to the storage racks inside the MDP. Skinning began immediately. They were cut up on the rack to avoid additional handling. The grade of the skin was estimated according to fixed codes (Grades A to C).

Carcass weights, number of livers, stomachs, etc. delivered to the MDP were recorded. One or two selling points were supplied per cropping night. The MDP manager (chosen by the community) then organized the sale of the products. He was also in charge of informing villagers about meat delivery dates and preparing equipment for the MDP (water tank, containers, etc.).

In 1996, three MDPs had been setup, and seven more were planned in selected areas chosen by the District Council and wards' representatives.

Retail

Retail began immediately after skinning. The MDP manager and one or two assistants took charge of cutting up, weighing and selling meat and offal. Depending on the MDP 5 to 25 carcasses could be sold in a day. In 1995, the price of the meat was Z\$ 2 per kilogram, much lower than that of beef.

All people in the village had access to the meat. Sales of products had to take place the same day, if possible during the morning, since there was no way to store or transform them at the MDPs.

The skins were preserved by salting (performed by the butchers) then sold to a commercial tannery.

■ RESULTS AND DISCUSSION

Catches

In 1995, seventy-seven cropping operations were carried out at regular intervals from the end of March to the end of November, during which 1382 impala were cropped (574 males, 759 females and 49 whose sex was not recorded). In a sample of 46 cropping operations, for which the carcass weight of the animals cropped was accurately recorded, variations in carcass weight were calculated by age groups (determined by National Parks' guards based on animal size and horn curvature for males) and sex (table I).

Table I

Average carcass weight (kg) by age and sex of impala cropped in 1994-1995

Group	Num. Measured	Average	Std. dev.	Minimum	Maximum
Adult male	191	25.5	4.26	14.2	39
Adult female	355	20.4	2.94	12.0	31
Subadult male	74	18.4	3.27	9.0	26
Subadult female	42	16.5	3.57	11.0	24
Juvenile male	78	13.4	2.25	6.0	19
Juvenile female	63	13.4	2.82	6.0	22

To test the influence of age and sex on carcass weight, a non parametric analysis of variance (Kruskall-Wallis, Logithec software) was carried out, as the variances were not homogenous for the different classes, and it showed a significant effect ($p < 0.001$).

Paired comparisons of carcass weights were significantly different between the different age and sex classes ($p < 0.01$), except between male and female juveniles ($p > 0.05$) and between juvenile and subadult females ($p > 0.05$). These results illustrate the sexual dimorphism of impala (subadult and adult), and might also highlight the difficulties of separating juvenile and subadult females, without horn criteria (3).

On one occasion, carcass yields were determined on 14 impala and ranked between 51 and 61% according to age and sex. These results, which compare with those obtained during more detailed studies (3), confirm the high carcass yield of impala. This, combined with the impala gregarious behavior and ability to use various types of pastures (mixed feeder), makes it an adequate butchery animal.

Meat supplies

In 1995, more than 26,700 kg of meat (plus 973 livers, 1294 clean offal and 1303 heads) were delivered to the local community (92 points distributed for 77 cropping operations). Each ward received meat about once a month. Quantities of meat left at each selling point were variable. Depending on the selling point 5 to 25 animals could be left for sale. The products (heads, offal, etc.) sold per ward are shown in table II.

Economics

To calculate the operation cost an account was kept of the following charges: vehicle expenses (gasoline, maintenance and depreciation of the vehicle), salaries and bonuses (guards, driver and butchers) and ammunitions.

During this period, the average cost of a cropping outing was Z\$ 1015.2 ($s = 32.6$) but this cost varied from Z\$ 387.4 to Z\$ 1809.5 and the cost distribution was as follows (figure 4):

- vehicle 59.4% (i.e. Z\$ 603)
- ammunition 29.2% (i.e. Z\$ 296)
- butchers 8.1% (i.e. Z\$ 82)

- wildlife guards 2.2% (i.e. Z\$ 22)
- driver 1.1% (i.e. Z\$11).

Inputs relating to staff varied little between hunts. Ammunition and vehicle were the most variable factors. In particular, as shown in table III, the average total cost increased with the distance between the shooting place and selling point, the cost being the lowest in Mola wards situated close to the cropping zone and the highest in Msampa (figure 1).

It was clear that the cost of ferrying the meat to a place located far away from the cropping site substantially increased the cost of the operation.

CONCLUSION

The mechanism experimented, developed and handed over to the local authorities, makes it possible to regularly supply the local market with impala meat in good hygienic condition under the control of appropriate institutions. The production system, managed by the local authorities with local employees, insures a maximum involvement of the local population. The production costs and the structures put in place (mobile butchery and meat distribution points) are covered by the meat selling price, although the program obviously requires a substantial initial investment. These operations could be adapted for other areas or animal species.

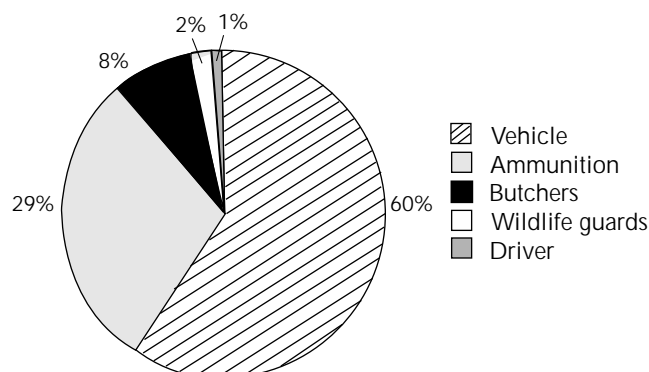


Figure 4: Average cost distribution per cropping outing in 1994-1995.

Table II

Distribution of meat and coproducts per ward in 1995
(64 cropping operations included in the table for a total of 77 completed in 1995)

Name of ward	Num. of distributions	Total meat (kg)	Num. of lungs/hearts	Num. of stomachs	Num. of heads	Population/ward
Mola A	8	3197.9	138	130	140	3995
Mola B	8	2607.0	126	134	133	3381
Negande A	5	2438.6	74	69	76	2331
Negande B	4	767.5	64	76	86	1073
Nebiri A	14	5731.6	223	238	245	1038
Nebiri B	4	1677.8	69	68	71	2541
Msampa A	8	4483.4	144	140	159	1513
Msampa B	6	1861.2	102	111	121	1447
Others	7	1788.3	17	21	20	-
Total	64	24,553.3	957	987	1051	17,319

Table III

Total cost of a cropping outing (Z\$)
according to the meat distribution place in 1995

Selling point	Average cost	Minimum	Maximum
Mola A	889.4	730	1176
Mola B	840.5	511	1113
Msampakaruma A	1271.1	942	1809
Msampakaruma B	1239.4	1081	1531
Nebiri A	925.8	387	1379
Nebiri B	1057.4	804	1268
Negande A	973.8	761	1199
Negande B	1088.9	991	1151
Miscellaneous	1125.1	1002.2	1248
Total	1015.2	387	1809

Close collaboration with the Department of National Parks and other organizations involved in wildlife conservation is essential for a sustainable use of the target animal populations. A study on the impact of off-takes on the dynamics of hunted species populations and periodic counts are advisable to ensure the viability of the animal populations utilized. Simple monitoring methods implemented by the local populations would strengthen their involvement and contribute to the sustainable production of game meat by local populations for themselves.

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Résumé

Féron E., Tafira J.K., Belemsobgo U., Blomme S., De Garine-Wichatitsky M. Transformation des herbivores sauvages africains en viande propre à la consommation pour les communautés locales. Utilisation durable de l'impala (*Aepyceros melampus*) dans le cadre du programme CAMPFIRE, Zimbabwe

La faune sauvage africaine a depuis longtemps été considérée comme une source potentielle de protéines animales pour les populations humaines. Mais les projets visant à la fourniture de viande de brousse se sont souvent heurtés à des contraintes majeures, notamment des problèmes liés à l'hygiène de la viande produite et au coût des mesures de santé publique. Le projet Nyama, qui opère dans le cadre du programme CAMPFIRE au Zimbabwe, avait pour but la fourniture régulière aux populations locales de la zone communale d'Omay (district de Nyaminyami, Zimbabwe) de viande d'impala (*Aepyceros melampus*) dans des conditions d'hygiène satisfaisant la réglementation nationale sur la santé publique. Le présent article décrit les innovations techniques (boucherie mobile et points de distribution de vente), la procédure suivie lors de l'abattage et de la préparation des carcasses et présente un bilan financier de ces activités durant la période de mise au point. En 1996, les moyens de production ont été transférés au Conseil du District qui assure depuis la continuité du projet.

Mots-clés : *Aepyceros melampus* - Animal sauvage - Viande de gibier - Durabilité - Unité mobile - Zimbabwe.

Resumen

Féron E., Tafira J.K., Belemsobgo U., Blomme S., De Garine-Wichatitsky M. Transformación de los herbívoros salvajes africanos en carne comestible para comunidades locales. Uso sostenible del impala (*Aepyceros melampus*) dentro del programa CAMPFIRE, Zimbabwe

Durante mucho tiempo, la vida silvestre africana se ha considerado como una fuente potencial de proteína animal para las poblaciones humanas. Sin embargo, los proyectos con objetivos de producción de carne silvestre han sido a menudo impedidos por obstáculos mayores, como salud pública y costo. El fin del proyecto Nyama, operando dentro del programa CAMPFIRE en Zimbabwe, ha sido el de suplementar a la población de la Tierra Comunal de Omay (distrito de Nyaminyami) con carne de impala (*Aepyceros melampus*), en una forma regular y de acuerdo con la ley nacional de salud pública. El presente artículo describe las innovaciones técnicas (carnicería móvil y puntos de distribución de carne), el procedimiento seguido durante las operaciones de recolección y el resumen financiero de estas actividades, durante la fase inicial del proyecto. En 1996, el sistema de producción fue traspasado al Consejo del Distrito de Nyaminyami, quien ha seguido con el proyecto en forma independiente.

Palabras clave: *Aepyceros melampus* - Animal salvaje - Carne de animal de caza - Sostenibilidad - Unidad móvil - Zimbabwe.