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A Case and Comparative Study of Citizen Hunting in the Charara/Makuti Study Area: Allocating Zimbabwe's Protected Area Resources Efficiently and Equitably

Alex R. Hartner

Submitted in partial fulfilment of the requirements for the degree of Master of Science by coursework and dissertation in the Department of Environmental and Geographical Science

September 1993

Title page:
A hunting scene from Chiseme cave in Mutoko communal land, Zimbabwe. The rock-art at this single site is rich in hunting scenes and unusually portrayed human and animal figures.
(Map reference: 1732 A4: 394.835)
Photo: R. Hangartner

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To my parents, Jennifer and Rolf,
for their support and encouragement,
and their devotion to things wild

"In scientific analysis there is much data and little action, whereas in everyday thinking there is much action but little data. Action is the main purpose of everyday thinking. It is not a matter of accumulating as much knowledge as possible but of coming up with just enough knowledge to tell you what to do next."

De Bono (1971): 37.

Preface

This dissertation complements the coursework for the degree of Master of Science in Environmental Science. The research project involved a five month period of individual field work in Zimbabwe and subsequent analysis and preparation. The project's aim was to demonstrate practical application of theoretical concepts to a real life issue in the context of a developing country, for use by the Department of National Parks and Wild Life Management (DNPWLM). The present document presents a synthesis of the approach, the methods used, the results, and recommendations for the DNPWLM to take these results forward. Included in the appendices are additional data, for the purposes of documentation and future research.

The idea to study the licensing system used for citizen hunting in the Charara/Makuti area, and to consider alternative licensing systems, originated from discussions with Rowan Martin in the DNPWLM. For this opportunity and challenge, I am extremely grateful to him. In addition, I am indebted to the Department's Director, Willi Nduku, and Deputy Director, George Pangetti, for their permission to undertake this research in the Parks and Wild Life Estate in Zimbabwe. It is hoped that this research combines an appropriate mixture of scientific and practical thinking to stimulate decision-making and action.

Many people inside and outside the Department were consulted during the study. They are listed separately in the acknowledgements (page 250). Information, when available, was always willingly supplied. The cooperation of all persons is greatly appreciated, for no research of this kind may be concluded successfully without it.

I wish to extend my sincere thanks to the following persons for their generous, and often personal, contributions during the course of this research:

Lindsay McNiell for the statistical consultancy and programming.

Tony Leiman, Trudy Hartzenberg, Tim Dunn and Heather Cambell for their respective expertise and valuable advice. Andy Vinnicombe for his cartographic skills.

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John and Sheina Butler, Charles and Margi Grobbelaar and their families for the hospitality of C-camp in the Rifa hunting area.

Michael Chimbangu who acted as a spontaneous and invaluable guide in the Charara Safari Area, and whose knowledge of roads and terrain made two-wheel progress by road at all possible.

My mother for her patience and time in transcribing hunter's preferences.

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Niklaus Maurhofer, Jane Froggart, and Rob Austin for their patience, and their solutions to endless computer mysteries, and members of the ITS team for their splendid support.

Use of Gender

When referring to hunters, hunting, and hunting activities the generic "he" is used throughout this report. This use of gender reflects historical evidence that there have been few women subsistence hunters (Ardrey, 1976; Coon, 1971; Lee and De Vore, 1968), and more recent results of a survey by Reilly (1987), where fewer than 1% of sport hunters who responded were women.

Format

The Harvard method of citation used in this report was based mainly on the guide by Thurabian (1982). Where deviations from this convention were necessary, the author opted for consistency and accuracy. For example, page numbers are sometimes included for exact referencing after the date, as in Rae, *et al.*, 1981: 64-67. Printing was done in postscript 12.5 point Times Roman typeface. To improve readability, all figures, maps, tables and appendices are cross-referenced by their page number, in addition to their consecutive numeric number, as in Figure 2.1, page 18.

Abstract

The research was undertaken to determine first, how well the hunting resources were allocated by a lottery to Zimbabwe citizen hunters in the Charara/Makuti study area. A second investigation determined whether the opportunity costs of this allocation method could be justified in the context of Zimbabwe's current socio-economic development priorities. The Department of National Parks and Wild Life Management (DNPWLM) is the government agency responsible for the management of Zimbabwe's protected areas and wildlife.

In a first assessment, the lottery allocation was investigated at the microeconomic level (individual persons). The efficiency with which all hunts were allocated to hunting applicants was assessed assuming that resource managers aimed to allocate all hunts available in the Charara/Makuti study area in an equitable manner. The findings were, that: in 1991 the lottery was very inefficient; only 55 percent of available hunts were allocated successfully; after a second re-allocation using a first-come-first-served method, the DNPWLM succeeded in allocating a further 12 percent of available hunts successfully; and by the end of the hunting season, 67 percent of all available hunts had benefitted some citizen hunters. The DNPWLM and applicants incurred considerable costs due to this inefficient allocation method. It was concluded that lack of personal choice for applicants due to the design of the lottery system was the single major cause for these results.

The equality, or fairness, of the lottery allocation was then investigated. It was assumed that the lottery allocation was intended to be random for all applicants. Each applicant's probability of winning a hunting opportunity in the Charara/Makuti study area was simulated. The findings were, that: in 1991 the lottery allocation was very inequitable; it allocated hunts to those applicants with the greatest willingness to pay, rather than randomly with the same probability of winning for all applicants; an arbitrary allocation rule was applied by the DNPWLM to determine which specific hunt each lottery winner won. This (impersonal) allocation rule was a major cause for dissatisfaction and for lack of commitment on the part of hunters to take their hunts up. It was concluded that lottery systems did exist that were more equitable and could accommodate applicant's personal hunting preferences. Such lotteries are complex and costly to administer. In view of these opportunity costs alone, the question was posed whether a lottery allocation method was justified for the Charara/Makuti study area in the name of equality for very few Zimbabwe citizen hunters.

The second assessment investigated opportunity costs of the lottery system at the macroeconomic level of Zimbabwe's economy. The lottery allocation was compared to other systems that allocate sport hunting in Zimbabwe. Findings for the lottery system in the Charara/Makuti study area were, that: the lottery system had the lowest prices; the lottery system had the least numbers of people who benefitted directly from the hunting activities; that it incurred significant additional opportunity costs in the form of foregone revenue in

Zimbabwe dollars and foregone foreign exchange revenue; by forgoing foreign exchange revenue significant multiplier effects for the Zimbabwe economy of this valuable economic resource were foregone, amounting to 4 Zimbabwe dollars activity for every Zimbabwe dollar of foreign exchange foregone. Further, it was concluded that: by not returning any revenue from sport hunting in protected areas to the DNPWLM, the present institutional arrangements exacerbate the opportunity costs; this revenue is thus not invested in conservation in the Charara/Makuti area, or in the DNPWLM to promote conservation. Jobs are not created, and bio-diversity and park management goals are severely restricted. Instead, all revenue at present is delivered to central treasury in the Zimbabwe Government.

By determining the value of foreign exchange, it was concluded that even if Zimbabwe citizen hunters were allocated hunting using an auction at market prices (in Zimbabwe dollars) in competition with foreign hunters and safari operators, Zimbabwe citizens are directly subsidized by about 65 percent at the macroeconomic level by the state at 1991 prices and exchange rates. The Zimbabwe dollar's weakness versus foreign currencies is a major factor for these economic costs. Significant economic activity and job-creation opportunities (multiplier effects) would, in this case, be forgone indirectly as well.

The advantages of using a competitive auction system to allocate sport hunting at market-determined prices to all participants (citizen hunters, foreign hunters, safari operators) are many, including: that the market price determines the proportion of hunting resources allocated to foreign and citizen hunters; that the opportunities for participants in the safari hunting industry to obtain big game - a factor limiting profitability, growth and new entrants into the industry - are increased; that the safari hunting industry will become more competitive.

The main recommendations for action indicated by the research include:

- The DNPWLM should clarify basic allocation principles for land-use in protected areas. Conflicts between principles of resource allocation that apply inside (non-economic) and those that apply outside protected areas (economic) should be removed.
- Unqualified intentions to subsidize Zimbabweans should be avoided, and the cost of such actions quantified and put in relation to foregone benefits from alternatives.
- Policy on citizen hunting should be reviewed. The policy for the Charara/Makuti hunting area should be reviewed, objectives should drawn up in terms of a park plan, and particular emphasis should be placed on financial sustainability of actions. Pending removal of the tsetse-control fence could alter land-use patterns and conservation management for the area after 1994.
- Non-consumptive uses of the Charara/Makuti study area should be especially emphasized, and sport hunting of quality trophy animals integrated. Consumptive and non-consumptive land-uses should be integrated to benefit the region surrounding Charara/Makuti study area. Multiple land-use options would more fully utilize the inherent recreational value of the resources in the area.

- Contractual partnerships together with the private sector could enhance facilities and services for the hunting and non-hunting public, without posing any additional financial burden on the state.
- Collaborative and creative ways need to be found to free the DNPWLM from institutional arrangements that restrict the agency from fulfilling its responsibilities to adequately protect, research, and secure the country's best conservation and development benefits with the bio-diversity resources the agency is entrusted with.
- As a matter of priority, present institutional arrangements between central government and the DNPWLM are inimical to wise resource use, to the promotion of conservation and development in the Charara/Makuti study area; the arrangements should be altered. As a basic principle, all revenue from protected areas should be returned to the DNPWLM as the management agency. The agency can then account for the full cost of activities in each protected area with a view to achieving ecological and financial sustainability of development and conservation actions as soon as possible.

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Glossary

Any Hunt: Term indicating that hunting applicants could not choose any characteristics of the hunts they were applying for, due to the way the allocation system was designed (DNPWLM lottery system). Applicants applied for an option to hunt an undefined hunting opportunity. Compare *First Hunt Preference* and *Next Hunt Preference*.

Assessment: The process of collecting, organizing and analysing, interpreting and communicating data that are relevant to some decision. Compare *evaluation*.

Big game: The mature male species hunted by sport hunters as the classic "big five" safari for their trophy value: elephant, rhinoceros[1], lion, leopard and buffalo. Can also include hippopotamus, and crocodile[2]. Also termed "hard-skinned animals". Compare *plains game*.

Citizen hunting: A type of sport hunting. The licensed hunting by Zimbabwean citizens of plain and big game species for a combination of their trophy, meat, and recreational values associated with the hunting trip. Shooting an animal is only one part of the whole recreational experience. Compare *citizen/safari hunting* and *safari hunting*.

Citizen/Safari hunting: A type of sport hunting which includes aspects of citizen hunting and safari hunting. Includes Zimbabwean and foreign hunters who hunt big game and plains game mainly for their trophy value. Compare *citizen hunting* and *safari hunting*.

Commercial hunting: Any hunting activities which are run on a commercial basis, usually on a large scale, which serve mainly formal markets for venison meat. Takes place mainly in centrally planned economies of Europe.

Consumptive utilization: Forms of wildlife use that depend on harvesting by some means to generate value. Hunting, population reduction for ecological reasons (culling), and game farming are the main forms. Compare *non-consumptive utilization*.

Dangerous game: Refers specifically to three species of big game hunted for their trophy value: elephant, lion and buffalo[3].

Economic good: Any service or material item that gives people satisfaction and whose present or ultimate supply is limited.

Economic needs: Types and amounts of certain economic goods (eg. food, clothing, water, oxygen, shelter) that each of us must have to survive and stay healthy. Compare *economic wants*.

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[1] Black and White Rhinoceros are a specially protected species at present, and are not on quota for sport hunting in Zimbabwe.

[2] The common and scientific names for species are listed in Appendix 1, page A3.

[3] As defined by the Zimbabwe Professional Hunter's and Guides Association of Zimbabwe. Safari Operators' Association of Zimbabwe (1988).

Economic resource: A natural, human, or financial resource used in an economy to produce material goods and services. See *natural resource*.

Economic wants: Economic goods that go beyond the basic economic needs. These wants are influenced by the customs and conventions of the society we live in and by our level of affluence. Compare *economic needs*.

Efficiency: In economic terms, as first defined by Pareto, an allocation of resources is efficient if there is no other feasible allocation that will make someone better off, whilst making no one else worse off, under conditions of perfect competition (Arrow, 1983; Samuelson, 1973).

Equality: (or Equity) A theoretical, political, and practical problem of distributing resources and their benefits amongst people in society according to some rule. Each rule involves giving benefits to some individuals deemed to be deserving, at the expense of other individuals. Willingness to pay (wealth) is challenged as the rule for benefit distribution (Rae, *et al.*, 1981).

Evaluation: The process of weighing information. The act of including individual's subjective value judgements in order to weigh choices make a decision. Compare *assessment*.

First Hunt Preference: Term indicating that hunting applicants could choose the hunt characteristics they were applying for by ranking their preferred hunts according to their personal preferences. The allocation system (Wyoming lottery system) was designed to consider each applicant's first hunt preference, then each applicant's second hunt preference, etc. Compare *Any Hunt* and *Next Hunt Preference*.

Foreign exchange: Includes all currencies other than the Zimbabwe dollar (Z$).

Hunting bag: A quota of animals, identified on a licence issued to a sport hunter by species, sex and number, which may be shot during a number of hunting days between set dates in the hunting season. The species in the hunting bag, eg. *big game* or *plains game*, and the total bag size influence the duration of the hunt, which in turn both affect the bag's value for the hunter.

Institutional arrangements: Financial and administrative relationship between central government and its agencies. Closely linked to how much autonomy the agency (eg. DNPWLM) has in budget and management decisions from the controlling authority (eg. central Government).

Licensing system: Defined as an integrated administrative system to regulate hunting by allocating scarce resources (the supply of hunting bags) amongst hunters competing for an opportunity to hunt. It performs three main functions: pricing the hunting bags on offer, limiting the number of hunters demanding a hunting bag to the number available in each hunting area, and determining the distribution of revenue and benefits from hunting amongst people.

Multiplier effect: Economic activity which is added to the size of the local, regional, or national economies from a project or institution. Arises from the re-spending effects of factors such as wages spent on consumables,

or from services purchased from local suppliers (eg. transport) due to the project or institution (see Vorhies, 1992).

Natural resource: The earth's solid surface, nutrients and minerals in the soil and deeper layers of the earth's crust, water, wild and domesticated plants and animals, air, and other resources produced by natural processes.

Next Hunt Preference: Term indicating that hunting applicants could choose the hunt characteristics they were applying for, and rank (value) their choices according to their personal preferences. The allocation system (ZHA lottery system) was designed to consider all preferences of each winner, ignoring the hunt's preference ranking during the allocation. Compare *Any Hunt* and *Next Hunt Preference*.

Non-consumptive utilization: Forms of wildlife use that do not rely on harvesting to generate value. Such forms include photographic safaris, walking safaris, game viewing and other recreational and tourist activities closely associated with, and dependent on, wildlife populations and their habitats.

Plains game: Various antelope species hunted by sport hunters. The more valuable trophy animals are the rarer species, eg. sable, wildebeest, kudu, eland. The less valuable, more common species are impala, springbok, duiker and grysbok. Also termed "soft-skinned animals". Compare *big game*.

Professional hunter: A hunter who has attended and passed a practical and written test, is registered with the Department of National Parks and Wild Life Management in Zimbabwe, and is qualified to accompany foreign hunters when hunting game for remuneration.

Safari operator: A professional hunter who has attended and passed additional tests to become an operator, is registered with the Department of National Parks and Wild Life Management in Zimbabwe. Qualified to offer hunting expeditions to foreigners commercially and to employ other professional hunters.

Safari hunting: A type of sport hunting. The licensed hunting mainly by foreigners who visit Zimbabwe to hunt mainly big game and valuable plains game species for their trophy. Often undertaken as the fee-paying client of a safari operator, or with the services of a professional hunter. Compare *citizen hunting* and *citizen/safari hunting*.

Sport hunting: A category of licensed hunting activities which includes *citizen hunting*, *citizen/safari hunting*, and *safari hunting*. Sport hunting serves the economic wants of persons hunting for trophies, venison, and recreational benefits. Sport hunters follow a sound ethical code of conduct in the pursuit of their sport. Often termed "recreational hunting"; a practice not followed here. Compare *subsistence hunting*.

Subsistence hunting: A category of unlicensed hunting activities which serves the economic needs of local communities in rural areas.

Trophy: Any part of an animal that is retained by the hunter as a sign or memento of hunting success, excluding the venison as meat.

Abbreviations

CAMPFIRE	An acronym for a community based rural development programme in Zimbabwe, called the *C*ommunal *A*reas *M*anagement *P*rogramme *F*or *I*ndigenous *RE*sources. The indigenous resource base includes wildlife, grazing, water and wood, but at present emphasizes wildlife, the economically most valuable resource.
DNPWLM	Department of National Parks and Wild Life Management. Also referred to as the "agency". Responsible for Zimbabwe's protected areas and wild life.
ESAP	An acronym for a policy programme adopted by the Zimbabwe Government, called the *E*conomic *S*tructural *A*djustment *P*rogramme. It aims to revitalize Zimbabwe's economic and social development by promoting a market economy with the support of the World Bank and other institutions (Zimbabwe Government, 1990c; Zimbabwe Government, 1991b).
NPB	Natal Parks Board. Responsible for protected areas and wildlife in Natal, South Africa.
Rand	South African rand currency unit.
US$	United States dollar currency unit.
WWF	World Wide Fund for Nature (formerly World Wild Life Fund)
Z$	Zimbabwe dollar currency unit.
ZHA	Zimbabwe Hunters' Association.

Major exchange rates for the Zimbabwe dollar

Exchange rate in Zimbabwe dollars per unit of:		Foreign currency
3.07	(31.5.91)	United States dollar (US$)
1.53	(31.5.91)	German mark (DM)
4.55	(31.5.91)	British pound sterling (£)
1.84	(31.12.91)	South African rand (Rand)

Source: Reserve Bank of Zimbabwe (1991)

CHAPTER 1
INTRODUCTION

1.1. Introduction

Regulated sport hunting in Zimbabwe started as early as 1924, when the conservation agency made hunting of valuable African big game species available to Zimbabwe citizens and foreigners (see Beira, Mashonaland and Rhodesia Railways, 1924). Then, as now, Zimbabwe citizens paid less than foreigners to go sport hunting. One apparent reason for maintaining preferential access to sport hunting for Zimbabwe citizens was the controlled foreign exchange market, which led to big game hunting being marketed and sold to safari hunters in foreign exchange currencies by safari operators, effectively excluding local hunters. Another reason may be due to the legacy that conservation agencies have treated wildlife and protected areas as open access resources and attempted to make them accessible to a broad mass of people. The Zimbabwean's right to enjoy cheaper, exclusive, access to their country's natural resources for sport hunting has therefore been accepted. The resource allocation problem was seen in terms of how sport hunters - as opposed to subsistence hunters[1] - could be supplied with suitable land and wildlife quotas for hunting.

This approach to resource allocation is not an economic one, but a politically sanctioned and bureaucratically managed choice based on the assumption that resource allocations for this activity are "the right thing to do". The government conservation agency was automatically responsible for making sport hunting opportunities available on state land, and incurred the costs. The economics of such government decisions, that is the costs and benefits of this resource allocation, were not raised in the past. This dual system of preferential hunting areas for Zimbabweans and areas for foreign hunters has persisted right up to the present day.

Since the advent of hunting trips organised for foreign hunters in Zimbabwe's first protected areas declared for this purpose early in the 1960s (Cumming, 1988), demand for big game hunting resources has increased, as has the supply of land devoted to wildlife utilization and sport hunting (Cumming, 1988; Bowler, 1992).

A significant break with past state policy and approaches to wildlife and the conservation of natural areas was made during the 1960's, which was formalized in the Parks and Wild Life Act in 1975. The previously sole state responsibility and control for wildlife was devolved

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[1] Sport hunting, the category of licensed hunting activities on which the dissertation focuses, serves the economic wants of persons hunting for trophies, venison, and recreational benefits. Subsistence hunting, also known as traditional hunting, is defined as a category of unlicensed hunting activities which serves the economic needs of local communities in rural areas (see Glossary, page xxi).

to individual landowners on whose property wildlife resources existed.[1] State policy officially endorsed economic incentives and market principles to promote conservation, utilization and development of wildlife by all landowners in Zimbabwe. With this policy, all categories of land in Zimbabwe (including protected areas that allow sport hunting) were potentially available for wildlife utilization and sport hunting. Landowners on all categories of land - except protected areas - were now able to derive the full range of economic and conservation benefits from wildlife management on their land.

The considerable growth of safari hunting as a commercially viable form of land-use is well documented (see Child, B., 1988; Bigalke, 1986). Safari hunting is recognized as an ecologically sustainable form of land-use. Moreover, this particular activity is also financially sustainable - indeed highly profitable. Sport hunting gave landowners on private and communal land the initial impetus to conserve and use their wildlife resources wisely, and is now increasingly being complemented with a broad spectrum of tourist related land-uses that add further ecologically and financially sustainable tiers of value (Child, B., 1988) to land and wildlife.

More recently, the state also offered sport hunting to Zimbabweans at fixed prices using a form of lottery in the hunting areas of Charara/Makuti, the study area. Decision-makers intended that citizen hunting in the Charara/Makuti study area should be accessible to "all Zimbabweans in the middle-income bracket". The prices used to value big game hunts in this area are fixed, are the lowest in Zimbabwe, and are significantly lower than market prices for big game species.

Against this background, and in contra-distinction to the safari hunting industry, the allocation of valuable big game hunting resources to Zimbabweans - defined as citizen hunting in this dissertation - is not based on economic principles. Whilst wildlife conservation and sport hunting in Zimbabwe is officially based on market principles (eg. Child and Heath, 1990), high resource values, and market prices to allocate resources in the most efficient manner, citizen hunting is valued at fixed prices far below market prices, giving resources low values, and allocated using different forms of lottery systems. Lottery systems were rationalized politically and administratively using non-economic principles such as "fairness", "equal access", "equal opportunity" and "a fair chance". However, available policies have failed to define these principles sufficiently for them to be tested objectively. The lottery methods employed are neither officially documented, nor are their aims and objectives clear. The allocation process and results of non-market lottery methods have not previously been analyzed according to their economic costs and benefits.

Another policy conflict became apparent in the preliminary stages of this research concerning the lottery system used to allocate citizen hunting in the Charara/Makuti study area. Although

[1] Landowners were not given ownership in the legal sense, but the full usury rights for wildlife on their land, including the right to benefit financially from wildlife on their property.

the lottery system should, in principle, allocate hunts based on some probability of being drawn, the particular design of the lottery system in the Charara/Makuti study area allowed applicants to influence their own probability of winning by purchasing unlimited numbers of lottery tickets (similar to many state-run lottery systems held for charity or welfare in many countries). The allocation by lottery appeared to be based on applicants' willingness to pay, not on luck. Once again this form of allocating resources differed with policy makers' stated intentions.

At this point of the research, it became clear that certain basic questions were not being addressed in policy and management concerning the allocation of resources for Zimbabwe citizen hunters, probably for historical reasons, but also due to their wide-ranging implications and political nature. For example:

a) What are the arguments for giving Zimbabwean sport hunters preferential (exclusive) access over foreigners?

b) What does sport hunting by Zimbabwe citizens involve? Which citizens go to hunt, and which persons could potentially afford to hunt in this manner?

c) Since big game sport hunting resources in Zimbabwe are very scarce, and a limiting factor for the safari hunting industry, their allocation for citizen hunting on any category of land involves opportunity costs for that landowner. Why should the DNPWLM allocate land and big game resources in protected areas for citizen hunting using the DNPWLM budget and so bear the opportunity costs, when big game resources and all other land categories are being managed by their respective land authorities for maximum economic return?

d) Why should Zimbabwe citizens be allocated big game hunting opportunities - recognized as the most valuable sport hunting resource - at fixed government prices using a lottery system, rather than at market determined prices using an auction system?

e) Since land in protected areas used for citizen hunting can principally be used for a wide range of alternatives instead (such as safari hunting and non-consumptive activities), and the size of hunting area determines the quota of animals available and therefore the number of hunters, what proportion of the big game hunting resources (quota) and the protected areas (land) should be allocated exclusively for Zimbabwe citizen hunting? In other words, how large must the supply of hunting opportunities for Zimbabwe citizens be compared to the demand for such opportunities?

f) What quality and variety of hunting experiences and facilities should be supplied, and at what price?

g) What financial, human, technical, and other resources of the DNPWLM budget for protected area management are to be allocated to supply citizen hunting?

h) What additional benefits should be provided in the hunting area outside the hunting season to neighbouring communities, to non-hunters, to the regional and national economies?

No previous work has attempted to apply economic principles of resource allocation to citizen hunting on protected areas in Zimbabwe. This research addresses this lack of data and documentation. Existing policy and allocation methods in Zimbabwe are documented. The scope of this dissertation is limited to sport hunting resources that are available on state land designated as Zimbabwe's protected areas (Parks and Wild Life Estate).

The lottery system in the Charara/Makuti hunting areas was suggested as the study area by R. Martin of the Department of National Parks and Wild Life Management (DNPWLM). The purpose of this allocation system is to give Zimbabwe citizens an "equal opportunity" to participate in big game sport hunting. The first question asked at this operational level of analysis was:

- How well did the DNPWLM lottery system allocate resources for citizen hunting in Charara/Makuti according to the DNPWLM policy objectives?

The opportunity costs of achieving objectives of so-called equal access using a fix-priced lottery system for citizen hunting in Zimbabwe are hitherto undocumented. A second comparative assessment investigates these opportunity costs for hunting resources in the study area. The principle question asked at the level of Zimbabwe's national economy, and in relation to objectives for sustainable development was:

- What are the opportunity costs of using the present non-market and fix-priced lottery system in the Charara/Makuti study area to allocate resources in terms of Zimbabwe's national policy objectives and sustainable conservation and development?

An aspect of particular importance concerns the possibility of earning foreign exchange from the hunting resources. With recent moves instituted by the Reserve Bank and the Government of Zimbabwe to liberalize the foreign exchange market, the opportunity costs of earning Zimbabwe dollar revenue from sport hunting rather than foreign exchange revenue can be estimated.

This comparative analysis is of particular note for protected area resource managers and policy makers seeking to take decisions that are to be in tune with Zimbabwe's economic and social development priorities. Documents announcing Zimbabwe's economic structural adjustment programme (ESAP) (Zimbabwe Government, 1991b; Zimbabwe Government, 1990c) clearly outline key areas for action, which are: earning foreign exchange by promoting export activity and economic investment; creating employment; reducing the Zimbabwe Government's budget deficit and the national debt; reducing Zimbabwe's balance of payments deficit and the national foreign debt; promoting a dynamic market-oriented economy, with less government involvement. The documents emphasise that economic development priorities must take place within the limits of natural resource sustainability.

The positive implications of a well-managed wildlife and natural resource base are important from an ecological, social and economic viewpoint in any country, but especially so in Zimbabwe. As a developing country with a fast growing population, Zimbabwe relies heavily on its natural, rather than its capital or human resource base, to sustain economic and social development into the new century.

1.2. Aims and objectives of the study

The main purpose of licensing systems is to allocate resources for quality sport hunting to sport hunters. To achieve this for the Charara/Makuti hunting area, the following questions served as general aims to guide the study:

1. **What** type of hunting needs to be provided to hunters?
2. **For whom** should the type of hunting be provided?
3. **What** are the **alternatives** to provide the type of hunting required? Specifically:
   - Where are the alternative land areas situated?
   - By whom are the alternatives to be administered and managed?
4. **How** can the type of hunting be provided using the alternatives available? Specifically:
   - What licensing system should be used? (price or non-price system)
   - What additional services should be provided?
5. **What** are the **opportunity costs** of these allocation decisions?

The research centred around questions four and five.

The study's objectives were formulated as follows:

1.2.1. To assess the efficiency of hunt allocation to hunters by the lottery system in the hunting areas of Charara/Makuti for 1991. (Chapter 4, section 4.2.)

1.2.2. To assess the equality of hunt allocation to hunters by the lottery system in the hunting areas of Charara/Makuti for 1991. (Chapter 4, section 4.3.)

1.2.3. To assess comparatively the efficiency of generating revenue with price and non-price licensing system alternatives in Zimbabwe with wildlife and time (the hunting season) as the limiting factors of production. (See Chapter 5, section 5.2.)

1.2.4. To assess comparatively the equality of benefit distribution of hunting revenue from price and non-price licensing system alternatives in Zimbabwe. (See Chapter 5, section 5.3.)

1.2.5. To place the present allocation system used by the DNPWLM in the Charara/Makuti hunting areas in the context of Zimbabwe's economic and social development, in order to draw conclusions and recommend suitable actions on the suitability of this system and available alternatives for the DNPWLM, Zimbabwe's protected area management authority.

1.3. Approach used

An economic approach was chosen, based on market principles. The following approach was adopted for this research:

- To document of the policies, resource allocation methods and conflicting practices that may exist concerning citizen hunting in Zimbabwe. (This may serve as a basis for decision-making, and further research.)
- To consider alternative licensing systems used for allocating hunting in Zimbabwe. To assess each systems' principal features (advantages and disadvantages). A central question is how each system addresses the trade-off of equality against efficiency.
- To motivate criteria to make the theoretical concepts of efficiency and equality operational for the assessment of licensing systems.
- To first assess the resource allocation achieved by the lottery system in the study area. This assessment viewed the lottery system as though it involved no opportunity costs. The assessment forms the case study of the of the DNPWLM lottery system for the Charara/Makuti study area. The resource allocation problem is analyzed from the perspective of the individual hunter (a microeconomic analysis).
- To then compare the lottery system in the study area with alternative licensing systems that allocate sport hunting resources in Zimbabwe in a comparative study. The perspective of analysis for the resource allocation problem is altered to a national level of Zimbabwe (a macroeconomic analysis).
- To draw conclusions for decision-makers based on the research, and recommend actions to be taken based on the data presented.
- To adopt a holistic approach to the resource allocation problem, and not limit analysis, conclusions, or recommendations to the present system used in the study area. Once the assessments at the microeconomic level and at the macroeconomic level have been concluded, overall conclusions and recommendations focus on the resource allocation problem in the Charara/Makuti study area, although some conclusions are broader and apply to the management of Zimbabwe's protected area resources in general.

1.4. Sources of reference

The investigation required the collection of both quantitative and qualitative data on the demand for hunting, the supply and allocation of hunting, socio-economic data, policy documents, personal experiences of hunters and non-hunters. Often personal interviews with past and present members of the DNPWLM proved to be the only source of data on many current and past management practices.

The variety of methods and sources used reflects this lack of documentation:

- Personal interviews, with:
  - Hunting administrators, park wardens, and staff of the DNPWLM in Harare and Chinhoyi, and at the DNPWLM offices Marongora and Kariba;
  - Hunting administrators of the Zimbabwe Hunters' Association;
  - Selected hunters and selected urban employees in Harare.
- Archive research and primary data collection, from:
  - Licensing offices of the DNPWLM in Harare, Marongora and Kariba for hunting licences;
  - Research centres, Centre for Applied Social Studies, at the University of Zimbabwe and the WWF-Multispecies Project, Harare;
  - Auctioneers of the Zambezi valley hunts, ABC Auctions.
- Archive research and secondary data collection, from:
  - Government departments (Ministry of Finance, Department of Veterinary Services, Central Statistics Office, Reserve Bank of Zimbabwe);
  - Other institutions (World Bank, Standard Chartered Bank, Zimbabwe Trust, local government in Kariba, Zimbabwe Republic Army);
  - Department of Forestry at the University of Stellenbosch, South Africa.
- Correspondence with managers of wildlife resources in various countries for comparative information on licensing systems and the management of wildlife for hunting purposes. Major sources included:
  - U.S. Fish and Game Department
  - NPB, Pietermaritzburg, South Africa;
  - Ciskei Safaris, Queenstown, Ciskei, Southern Africa.
  - Pilanesberg National Park, Mogwase, Boputhatswana, Southern Africa.
- Personal observations of hunting activities made:
  - On a field trip of 4 days in the company of hunters to C-Camp in Rifa hunting area during August 1991;
  - On a field trip of 1 week to Marongora, Kariba and the Charara Safari Area during August 1991;
- Literature review.

Individual research methods are described and referenced in the relevant sections of the report. Persons consulted for personal communications, data, or critical comments are listed in the acknowledgements, page 250. Data were corroborated from different sources, where possible. Permit data were processed using spreadsheet analysis, part of which was used in the computer simulation of the DNPWLM lottery system for the Charara/Makuti study area.

1.5. Assumptions underlying this research

This study is based on the following assumptions:

1.5.1. Individual persons are in a better position to make efficient and equitable choices for themselves than government can ever hope to be, through lack of information.

1.5.2. Efficient use of economic and natural resources is a principle that can, and should, be applied to government activities (Crowe, 1987; Kernaghan and Dwivedi, 1983).

1.5.3. Efficiency of government is necessary and important for sustaining activities with scarce public finances.[1] This implies that the DNPWLM should be responsible for a balanced budget, ie. for revenue as well as expenditure, from all activities in Zimbabwe's protected areas. At present, this is not the case.

1.5.4. Equality (or equity) is understood as a theoretical concept that requires political definition to translate it from theory to practice. Equality is seen as a particular way of distributing resources amongst people (a distribution pattern). In reality, there are many equalities possible, not merely one absolute equality of resource distribution (Rae, *et al.*, 1981).

1.5.5. There is currently little incentive for the DNPWLM to use revenue from profitable activities to subsidize other activities on the land for which it is responsible, but from which it does not receive the revenue (see assumption 1.5.3).

1.5.6. All hunts that have been planned for a specific hunting area must be sold, once the area's quota has been decided on. Unsold hunts have ecological, economic and social opportunity costs, especially in the longer term (eg. habitat degradation, culling requirements, poor trophy quality, foregone revenue for conservation and development, restricted access and benefits for people).

1.5.7. A quantitative increase in the number of hunter-days offered in an area (more hunting campsites, more hunters per hunt, shorter hunting periods) ultimately affects the hunt quality; economic, ecological, and environmental factors further limit such increases. The exact nature and influence of these factors for resource management are still poorly understood and researched in African environments (Bothma, 1989: 325).

1.5.8. "For the most part, detailed information on population size, structure and dynamics [for Zimbabwe's protected areas] is lacking" (Cumming, 1988: 163). For Charara/Makuti study area in particular, the ecology and animal populations and dynamics are not documented, and are inadequately researched (Robertson-Magnus, personal communication).

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[1] This is the main thrust of the Economic Structural Adjustment Programme (ESAP), adopted by the Zimbabwe Government in conjunction with the World Bank (Zimbabwe Government, 1990c; Zimbabwe Government, 1991b).

1.5.9. Variety, understood as the potential for individual persons to make free choices amongst alternatives according to their personal preferences, has a positive value.[1] If an individual hunter is given a wider range of choice (eg. of hunt types), he will be better off; if his available choice is limited, his satisfaction and welfare are diminished.[2]

1.6. Report structure

Following this introduction, **Chapter 2** provides a conceptual, theoretical, and socio-economic background to the study. First, hunting terminology used in this dissertation is defined and put into context with existing literature and usage. A framework is introduced to structure licensing systems for administering (allocating) sport hunting. The theoretical concepts of efficiency and equality are explained, and the theoretical and practical trade-off problems associated with these terms are highlighted. Resource allocation is conceptualized for hunting and licensing systems using a market approach. A one-hunt model of the hunting market is sketched to clarify the economic problem of allocating sport hunting resources. Market and non-market approaches to solve these allocation functions are interpreted for licensing systems. Both approaches seek to balance the supply of hunts with the number of applicants demanding a right buy a hunt at some price.

Next, sport hunting practice in Zimbabwe is described. The organisation of land for wildlife in Zimbabwe is outlined. The wildlife policy and organisation of sport hunting on land categories in Zimbabwe are described. Protected areas used for sport hunting activities are mapped. Land-use areas are quantified. An overview of the market for citizen hunting in Zimbabwe's protected areas is given. Demand for and the supply of hunting opportunities for Zimbabwe citizens is documented to put the resource allocation problem into an overall context within the country. An estimate of potential demand for sport hunting by Zimbabwe citizens is made, based on income distribution data. Finally, key socio-economic indicators are tabulated, showing Zimbabwe's current development status.

Chapter 3 serves as a background for analysis in chapters 4 and 5, where descriptive detail has been kept to a minimum. The chapter provides a detailed technical review of alternative licensing systems in two parts. The first part describes licensing systems that allocate sport hunting in Zimbabwe. Four different systems are used (lottery systems, tender systems, auction systems and safari operator marketing systems) in seven different hunting areas. The systems are administered directly by the DNPWLM, by the ZHA, or by the safari operator. The second part describes three foreign systems (lottery systems and a first-come-first-served

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[1] On variety, see Lancaster (1979), especially pages 5-6. On free choice, as in the sense of personal, rather than a chance, event, see Boyle, Grisez and Tollefsen (1976): 11.

[2] This is a central postulate of welfare economics and of consumer theory, where it is known as *consumer sovereignty*. In separate contexts, both Lancaster, and Krutilla and Fisher, see variety as enhancing the opportunity for individual choice and, consequently, welfare. See Lancaster (1979): 5-6 and Krutilla and Fisher (1975): 43.

system). Emphasis is placed on relevant differences between these system and the Zimbabwean systems. The chapter concludes with a summary of Zimbabwean licensing system's main points.

Chapter 4 sets the scope of analysis at the level of the individual applicant and hunter for the Charara/Makuti study area (microeconomic). The concepts of efficiency and equality are applied to the hunt allocation procedure for the DNPWLM lottery system as a case study assessment. Were all hunts allocated to applicants? Did the lottery allocation procedure match standards of fairness (in terms of equal probability) expected of a lottery?

Chapter 5 sets the scope of analysis at the national level of Zimbabwe's economy (macroeconomic). A comparative study of the DNPWLM lottery system is made to determine the opportunity costs of this system in relation to other Zimbabwean licensing systems. The concepts of efficiency and equality are defined to make all Zimbabwean licensing systems comparable. The opportunity costs of the DNPWLM lottery system for the Charara/Makuti study area are quantified; efficiency of generating hunting revenue and other conservation benefits generated from revenue are measured; revenue foregone in foreign exchange is valued at market exchange rates; the results are interpreted in terms of Zimbabwe's socio-economic development priorities.

Chapter 6 summarizes the major results of the study from all previous chapters for the fix-priced lottery system in the study area. Conclusions are drawn for the DNPWLM and decision-makers that integrate these results. Recommendations are made for action based on this research. Strategies and actions are recommended to supply citizen hunting in the Charara/Makuti study area in the short term (by the year 1994). Strategies and actions for allocating resources in the Charara/Makuti study area more efficiently in the medium term (between the years 1994-2000) follow which require a longer lead-time to action, due to their institutional and political nature.

CHAPTER 2
A CONCEPTUAL AND SOCIO-ECONOMIC BACKGROUND TO THE STUDY

2.1. Terminology

2.1.1. What is a Zimbabwe citizen hunt?

In Zimbabwe, a citizen hunt involves: *licensing*[1] a *hunting party* to access and hunt a *hunting bag* in a *protected area*. Each hunt has a specific *hunt duration* and takes place at a certain time of the year between set *hunting dates*. The hunter pays a price to hunt, normally termed the *trophy fee*, for each species in the hunting bag. All hunting is done accompanied by a staff member (game scout or tracker) of the protected areas management agency, known as the Department of National Parks and Wild Life Management (DNPWLM). Hunters are based at a *hunting campsite*, surrounded by a no-hunting zone of up to two kilometres, within the protected area. Key hunting terms are now explained further, in the above order. Readers are also referred to the glossary, on page xxi.

The *licensing system* procedure, that is the procedures for allocating and administering the licence issue to a particular hunter and his hunting party, is undertaken by hunting administrators. They may be the DNPWLM, the Zimbabwe Hunters' Association (ZHA) who are allowed to use certain protected areas for hunting activities, or the safari operator who leases a protected area for exclusive hunting rights (see section 2.2.2, page 22, for a framework of licensing systems).

A *hunting party* may be between 1 and 30 members, and include:

- The hunter, in whose name the hunting licence has been issued;
- Co-hunters, between one and three in number, who are permitted to actively assist the hunter by shooting;
- Non-hunting visitors, of varying numbers, who are usually family or friends, including children;
- Members of staff, employed by hunters to help with duties at the hunting campsite, such as the preparation of hunting trophies and venison.
- A member of the DNPWLM (game scout or tracker) armed with a rifle, whose function is to control the hunting activities, help tracking game, and support hunters in incidents involving wounded animals or dangerous game.

[1] A note on grammar (The Oxford English Dictionary). The document authorizing a hunter to hunt is a licence (noun); licensing is the process or action of issuing the document (verb). A licensing system thus licenses hunters.

A *hunting bag* includes a limited quota of African big game and plains game, specified by species, sex, and number of animals, and sometimes by tusk size (eg. for elephant).

The *protected area* is spatially delimited for hunting the hunting bag (quota of animals) and hunting activities. Hunting parties are not, however, limited to exclusive hunting areas, except in the case of foreign clients who hunt in areas of a park leased by the DNPWLM to a safari operator for his exclusive use. This means that a number of hunting parties enter the same hunting area at any point in time, and each party of hunters has access to the whole area for the entire hunt duration.

The *hunt duration* specified for hunts by hunting administrators is currently between 6 and 14 days in Zimbabwe's protected areas, but may be longer for foreign client safari hunts, where standard hunting periods of 5, 10, 15 or 21 days are used to market certain types of hunts with buffalo, lion or leopard and the big four, which includes elephant but excludes rhinoceros in the case of Zimbabwe.

The *hunting dates* are dates specified during the hunting season by hunting administrators, before and after which no hunting by the licence holder or members of his hunting party may take place.

The *trophy fee* for each species in the hunting bag is set according to the type of system used to price hunting resources (eg. market-priced or fix-priced systems). The trophy fee only values the hunt's consumptive resources, that means the quota of animals. Table 2.1 shows trophy fees for selected species set by the government schedule for citizen hunting.

Table 2.1 Government scheduled trophy fees of selected species for citizen hunting: 1991

Species[1]	1991 Government Trophy Fee Z$	
Big and dangerous game:		
Elephant, bull	7'500	
Buffalo, bull	600	
Lion, male	1'500	
Leopard	1'000	
Plains game and other:		
Kudu, male	300	
Warthog	75	
Impala, male	60	
Guinea Fowl	5	
For comparison: Government legislated minimum wage for agricultural workers in Zimbabwe	Z$2'200	per annum

1 See Appendix 1, page A3 for scientific names of species.

Source: DNPWLM licensing office. Full schedule in Appendix 8, page A77.

Often, a hunt includes a daily hunting fee (the daily rate) that is determined according to the type of hunt being sold to the hunter (big game hunt, plains game hunt), so that the total hunt price varies depending on both the composition and species in the hunting bag and the duration of the hunt.

The *hunting campsite* is usually located at or near water in scenically attractive settings. In some areas, hunt and campsite allocations are linked. Facilities provided at these hunting campsites vary greatly in quality. Safari operators usually establish temporary luxury tented campsites, the ZHA uses built campsites with certain permanent facilities, whilst facilities at others are fairly basic.

The *costs of a hunting trip* are substantial, involving the purchase of a hunting bag, transport to and within the hunting area which is located in remote parts of Zimbabwe, food for the hunting party (hunters, visitors and staff), wages for staff, camping equipment that may include refrigeration facilities, lighting equipment, four-wheel drive vehicles, as well as appropriate hunting rifles and ammunition depending on the type of species on quota in the hunting bag. Excluding the purchase of the hunting bag, the costs of undertaking a 10-day hunting trip have been estimated at Z$10'000 (Appendix 18, page A110), or about US$3'000 calculated at 1991 foreign exchange rates. Hunting bags offered to Zimbabwe citizens in 1991 ranged from about Z$18'000 to Z$1'000, depending on the species in the bag and the pricing system. Total costs for a Zimbabwe citizen hunting trip thus ranged between Z$11'000 and Z$28'000. These costs compare with government controlled minimum wages of about Z$2'200 per annum for agricultural workers in the same year. By these standards alone, it may be concluded that citizen hunting is an expensive sport, which only rich people in Zimbabwe can afford; citizen hunting has nothing to do with subsistence hunting activities carried out for survival (see Glossary, page xxi, for definition of subsistence hunting).

In addition to going hunting, members of a citizen hunting party (hunters and non-hunters) make good use of the recreational opportunities offered by the hunter's right of access to some of Zimbabwe's prime wildlife resource areas (used as hunting areas) within the protected area system. Activities undertaken include fishing, which is popular, but mainly the diversity of non-consumptive recreations possible within each area, such as bird watching, tree identification, walking, boating, photography.

2.1.2. A hunt - A bundle of hunt characteristics

Lancaster (1966) developed a novel way to view goods as comprising a bundle of physical characteristics or properties whose specific combinations consumers valued (eg. sit-down meal with a hamburger), but which consumers would quite easily substitute for a good possessing the same characteristics, but combined slightly differently (eg. steak and chips in an expensive restaurant). Conventional economic theory on consumer behaviour and choice had hitherto assumed all goods to be completely homogenous, and being valued equally by all persons. Lancaster's marketing and psychological approach categorizes goods with similar characteristics, and helps to explain for instance why personal service or the atmosphere in a restaurant make the same calorific meal valuable to different persons.

Applying Lancaster's characteristics approach to "a hunt" as an economic good, it becomes clear that a "hunt" has firstly a complex set of characteristics, and secondly that allocating or selling a "hunt" consists of significantly more than killing a number of animals on quota. Resource administrators who sell a "hunt" are packaging a whole range of resources and characteristics into a hunting opportunity, many of which are available in other hunts offered in the same or similar hunting areas. Lancaster's approach also explains why "going hunting" can mean very different things to individual persons, and why a hunter is motivated by more than the desire to shoot an animal - especially in the case of citizen hunting in Zimbabwe - since not all members of a hunting party are hunters and actually hunt.

The complex motives for going hunting and the many benefits enjoyed from the activity are noted by Giles (1978) and Bigalke (1986), and were confirmed in the southern African context for Transvaal game hunters by Reilly (1987). For Zimbabwe, the author's personal observations in the company of citizen hunters (C-camp in Rifa hunting area, 1991) confirmed that a hunting trip gives many persons the possibility of a bush-related experience in the company of friends and family members. The harvest motive, which includes the actual kill and products of the wildlife species, eg. venison, biltong, skin, and trophy, is de-emphasized by both Giles (1978) and Bigalke (1986) in their identification of motives for sport hunting in the American context. The Transvaal hunters also indicated that the harvest motive was the least important motive for sport hunting (Reilly, 1987: 25).

Thus, a hunter does not desire a hunting opportunity for the sake of owning the right to hunt and access to a hunting area, but for the hunt characteristics which make it useful, give him and other members of the party benefits (the trophy, venison or African bush experience) and enjoyment. Consequently, for a hunter to perceive that a particular hunt is preferred the most, and will give him the greatest use and value, the hunter must know its characteristics and those of available alternative hunting options.

A specific mixture of the following *hunt characteristics* are part of a typical hunt:

- The species in the hunting bag (eg. elephant, buffalo, nyala, impala, grysbok). These determine whether, for example, the hunt on offer is a classic big game hunt, a cat hunt (lion or leopard), a buffalo hunt, or an impala hunt;
- The quality of animal in the hunting bag (trophy bearing (male), non-trophy bearing (male or female), and possibly trophy limits on tusk size);
- The number of animals in the hunting bag;
- The hunting period (eg. 1-day, 7-day, or 21-day hunt);
- The hunting dates (eg. during the school holidays, leave or working holidays, or the cool-dry as opposed to the hot-dry season);
- The price of the hunting package (only if fixed prices are used for valuation).

The hunting bag quality and quantity of animals together determine the hunt type offered, that is whether a trophy or non-trophy hunt is offered, and whether a big game hunt or plains game hunt is offered. It should be noted, that if a hunter pays a higher price for certain hunts due to their variety or quality of the hunting characteristics, he is not as a consequence

necessarily worse off, but quite possibly better off - quality and choice would not be available if all prices were low.[1]

2.1.3. Motives for hunting

Three basic hunting motives were identified in the course of this research: the trophy motive; the venison motive; and the recreational motive which includes all non-consumptive experiences that may be enjoyed.

2.1.4. The hunt's resources

The scarce resources involved in a hunt are the quota, or consumptive resource, and the access time (hunt duration) to the particular hunting area. The access time principally allows all members of the hunting party to enjoy recreational activities based on non-consumptive resources that are largely unlimited, eg. a beautiful view. In addition, administrative and human resources are invested in supplying hunting, in particular the official DNPWLM employee who accompanies the hunting party for the duration of the hunting trip.

2.1.5. The importance of hunter's personal preferences and choice

2.1.6. The need for informed personal choice by the hunter

To apply for a hunting opportunity and make an informed choice about which hunt he prefers, a prospective hunter must be fully informed of the hunt's basic characteristics (see listed items, page 14). A hunter's personal preferences (eg. traditional customs and beliefs associated with specific animals), or a particular hunter's dislike at hunting certain species, (eg. elephant or other dangerous game) can greatly influence the value he places on any particular hunt. For Zimbabwe citizen hunters, it is also apparent that the primary hunting motive is important for the type of hunt a hunter chooses. A trophy hunter may emphasize the hunt characteristics of trophy quality, the number of species in the hunting bag and the price of the hunt. A venison hunter, by contrast, might emphasize the meat, available recreational facilities and opportunities, and perhaps the wilderness experience.

The hunter may also wish to know:

- The statistics of exceptional trophy animals recorded by hunters in the past for a particular hunting area;
- The hunting area's features (eg. topography, vegetation, location, diversity of experiences) and wilderness value;
- The location of the hunter's campsite (eg. with water frontage), and facilities included in the hunt price (eg. accommodation, slaughter block, meat drying racks).

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[1] The author is grateful to A. Leiman for this point, and the examples to illustrate it. See: Gallini, 1988: 57-66 and Salvatore, 1986: 114-116.

2.1.7. Hunting terminology

Citizen hunting is now defined and related to other key hunting terms for this dissertation. Important differences are to be found between citizen hunting and safari hunting in the composition of the hunting party, the activities of hunters and non-hunting members of the hunting party, and their hunting motives. Due to the present organisation of citizen hunting in Zimbabwe, a systematic definition of the two terms was further complicated. Although citizen hunting, in principle, is allocated exclusively to Zimbabwe citizens, and safari hunting is only available to foreign hunters because it is sold in foreign exchange currencies, the DNPWLM uses one particular system that makes hunting available to both foreign and Zimbabwe citizen hunters because it is sold in the local Zimbabwe dollar currency. This mixture is defined as citizen/safari hunting.

2.1.7.1. A variety of hunting terms in literature and practice

A confusing variety of hunting terms is in use in policy, literature and practice on hunting. Table 2.2, page 16, lists some terms used in DNPWLM policy documents (see also section 2.3, page 37).

Table 2.2 Sport hunting terms used in DNPWLM policy documents

Hunting Term	Section	Reference
Sport hunting	Sections 8, 12 and 16. Section 5.4	Zimbabwe Government (1990b) Zimbabwe Government (1992)
Recreational hunting	Section 2.3.2 and 5 (preamble)	Zimbabwe Government (1992)
Hunting for indigenous Zimbabweans	Section 2.3.2	Zimbabwe Government (1992)
Hunting opportunities for citizens	Section 16. Section 5.4	Zimbabwe Government (1990b) Zimbabwe Government (1992)
Sport hunting industry	Section 5 (preamble)	Zimbabwe Government (1992)
Quality trophy hunting of male animals	Section 5 (preamble)	Zimbabwe Government (1992)

Apart from the last term, quality trophy hunting of male animals, the documents do not further define or relate the hunting terms. For Botswana, Cumming and Taylor use citizen hunting to mean "hunting undertaken by affluent citizens (those who own vehicles and guns)" (in Botswana Government, 1989: 15) sold at subsidized (ie. non-market) prices by government, as does Barnes (in Botswana Government, 1988). Cumming and Taylor refer to safari hunting as synonymous with recreational hunting (page 14), and to safari hunting as synonymous with trophy hunting one page later. The authors also refer to sport hunting by citizens (Botswana Government, 1989: 22).

Hudson (1988a) attempts to systematize hunting terminology in the context of diverse wildlife production systems from around the world, with systems graduating from extensive

unmanaged wild populations to intensive farming of tamed wild animals. The authors define the category of sport hunting, and propose in addition commercial hunting and subsistence hunting as two further categories. In later chapters, however, the authors are inconsistent by referring to sport hunting and commercial hunting synonymously as recreational hunting.

According to Hudson (1988a), the category of sport hunting includes: licensed hunting, safari hunting, fee hunting and revier hunting (traditional European hunting systems). Unfortunately the authors do not base their definitions on a set of explicit and common criteria. In the context of Zimbabwe's sport hunting practice, the terms licensed hunting, fee hunting, safari hunting and commercial hunting used by Hudson were found to be ambiguous and overlap. For example, all sport hunting in Zimbabwe's protected areas is licensed as well as priced. All safari hunting is priced as well as commercial. The sub-category "fee hunting" erroneously implies that an alternative such as "free hunting" exists.

Describing wildlife production systems with plains game for South Africa, Berry (1986) introduces the terms trophy hunting and non-trophy recreational hunting. With trophy hunting he refers to mature male animals hunted for their trophies (eg. horns or tusks) whilst with non-trophy hunting he refers to the hunting of larger quotas of less mature animals of both sexes. In Zimbabwe, only certain hunting areas and quotas are devoted exclusively to trophy hunting. These so called hunting safaris[1] are organised by safari operators and sold to foreign clients at high prices as complete hunting packages to include professional hunting services. Quotas in other hunting areas of Zimbabwe do not only comprise strictly only male trophy animals, but also include considerable numbers of non-trophy female animals (eg. female buffalo and female impala in Charara/Makuti hunting quotas, see Appendix 2.1, page A5, and female impala in Dandawa hunting quotas, see Appendix 2.6, page A19). The hunting motives and activities of Zimbabwe citizen hunters reflect this mixture of hunting for quality trophies, for venison, and for recreation.

Table 2.2, page 18 presents the results of a review of terminology used by various authors in the context of sport hunting.

[1] *Safari* is from the Swahili language, and means to undertake an extensive journey, or to travel to a far off place for some days. A hunting safari is thus a hunting trip involving considerable preparation and travel. The Zimbabwean place name for the study area *Charara*, or *Chalala* similarly means a hunting trip in local dialects.

Hunting Terminology	Literature Reference and Usage	Author's Interpretation or Synonym
Sport Hunting	Martin and Thomas (1991); Zimbabwe Government (1992); Wright (1990); Martin (1990); Cumming (1988). "Premium quality trophy hunting for foreign and Zimbabwean hunters". Bigalke (1986); "America: "Game as a sport hunting resource". Anderson (n.d.); "Trophy hunting". Hudson (1988a); "Practised mainly for recreational reasons".	Super-Category implies trophy hunting
Subsistence Hunting	Martin and Thomas (1991); "Non-trophy cropping for meat, hides and products for community". Hudson (1988a); informal harvesting for meat and subsistence".	Super-Category
Traditional Hunting	Campbell (1990); "Batswana ivory hunting". Hudson (1988a); "Practised by a hunter-gatherer societies".	Subsistence hunting
Safari Hunting	Barnes (1990); Cumming (1988); Martin and Thomas (1991); Bigalke (1986); "Trophy hunting for foreign clients". Hudson (1988a); "Guiding and outfitting".	Sub-Category, Big game hunting, trophy hunting
Commercial Hunting	Campbell (1990); Cumming (1988); "White Hunter African ivory trade". Wright (1990); Barnes (1990); "High income from few animals sold to safari operators for foreign clients". Hudson (1988a); "Serves formal (meat) markets by cropping".	hunting as an enterprise and profession
Citizen Hunting	Sinvula (1990); "Batswana elephant hunting for commercial re-sale of hide and tusks, not meat". Martin and Thomas (1991); "Zimbabwe citizen and resident trophy hunting"	Sub-Category, Big game hunting, plains game hunting, trophy and non-trophy hunting; compare safari hunting
Recreational Hunting	Zimbabwe Government (1992); "Sport hunting of trophies".	? all types of hunting except subsistence hunting (for a livelihood)
Trophy Hunting	Wright (1990); "Sport hunting". Martin (1990); "Male trophy animals for sport hunting (elephant)". Cumming (1988); Safari hunting with low off-take and high trophy quality". Zimbabwe Government (1992); "Sport hunting". Campbell (1990); "Sport hunting for trophies (size and weight of tusks or horns)". Anderson (n.d.); "Sport hunting". Berry (1986); "Non-trophy recreational hunting".	compare venison hunting, non-trophy hunting
Non-Trophy Hunting	Zimbabwe Government (1992); "Culling quotas are larger than trophy quotas". Berry (1986);	compare trophy hunting, venison hunting
Venison Hunting	Ciskei Safaris and Natal Parks Board (personal communication.); "plains game non-trophy bearing animals".	non-trophy hunting, biltong hunting, meat hunting
Meat Hunting	colloquial usage in southern Africa (personal observation).	venison hunting, biltong hunting, non-trophy hunting
Biltong Hunting	colloquial usage in southern Africa (personal observation).	venison hunting, non-trophy hunting
Big Game Hunting	Cumming (1988); "Zimbabwe: types of trophy hunts sold by safari operators".	compare plains game hunting, "no big five"
Plains game Hunting	Cumming (1988); "Zimbabwe: types of trophy hunts sold by safari operators".	compare big game hunting
Ranch Hunting	Cumming (1988); "Zimbabwe: types of trophy hunts sold by safari operators on private ranch land".	implies plains game hunting on ranch with cattle
Licensed Hunting	Hudson (1988a); "Simplest way of organised sport hunting".	as opposed to "unlicensed hunting"?
Fee Hunting	Hudson (1988a); "Private landowners charge fees to organise sport hunting".	as opposed to "gratis hunting"?
Revier Hunting	Hudson (1988a); Bubenik (1988); "Continental European organisation of sport hunting with landowner and hunter involvement".	

Figure 2.1 Review of hunting terminology in literature

2.1.7.2. Defining sport hunting systematically for Zimbabwe

A systematic definition of sport hunting for Zimbabwe is proposed in Figure 2.2, page 20. This dissertation focuses on sport hunting (the hunting for sport and enjoyment) as opposed to subsistence hunting (the hunting for food as a basic human need).

Sport hunting is defined as category of licensed hunting activities practised for sport, that includes three types of hunting: citizen hunting, safari hunting and citizen/safari hunting. Differentiating sport hunting primarily according to the citizenship of the hunter (Zimbabwe citizen or foreigner) and then accommodating the mixed participation of both citizens and foreigners in one system (the DNPWLM auction system for Nyakasanga/Sapi hunting areas), the following definitions for the three types of sport hunting activities are proposed.

Citizen hunting is a type of sport hunting. It includes the licensed hunting by Zimbabwe citizens of plains and big game species for a combination of their trophy values, their meat values, and the recreational value associated with the hunting trip. Shooting an animal is only one part of the whole recreational experience. By intent, the hunter may be a trophy hunter, a venison hunter, or a combination of both. Citizen hunting presently takes place in hunting areas reserved exclusively for Zimbabwe citizens[1] within Zimbabwe's parks system, and on private land. Hunting is priced using fixed prices and allocated to citizens in the Zimbabwe dollar currency using lottery or tender allocation systems.

Safari hunting is a type of sport hunting. It is undertaken exclusively by foreign hunters visiting Zimbabwe. Together with a safari operator and the services of a professional hunter, foreign hunters hunt big game and valuable plains game species mainly for their trophy. Usually a safari operator with exclusive rights to hunt in big game hunting areas markets hunting packages at internationally competitive market prices to foreign clients who pay in foreign exchange currencies (mainly the US$). Safari operators frequently combine big game quotas on state land with plains game quotas on private ranch land.

Safari hunters pay high prices for their hunting package, which are calculated and sold using a daily rate for each day's hunting. In the limited time available, safari hunters thus pursue their prime objective of securing quality trophies. This means that foreign hunters spend little time in the pursuit of non-hunting recreational activities, in comparison to most citizen hunters.

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[1] To qualify as a citizen of Zimbabwe under the Citizenship Act (Act No. 23 of 1984), a person must be a citizen by birth, by registration, or a permanent resident of Zimbabwe. Foreigners and temporary residents are thus excluded from participating in citizen hunting.

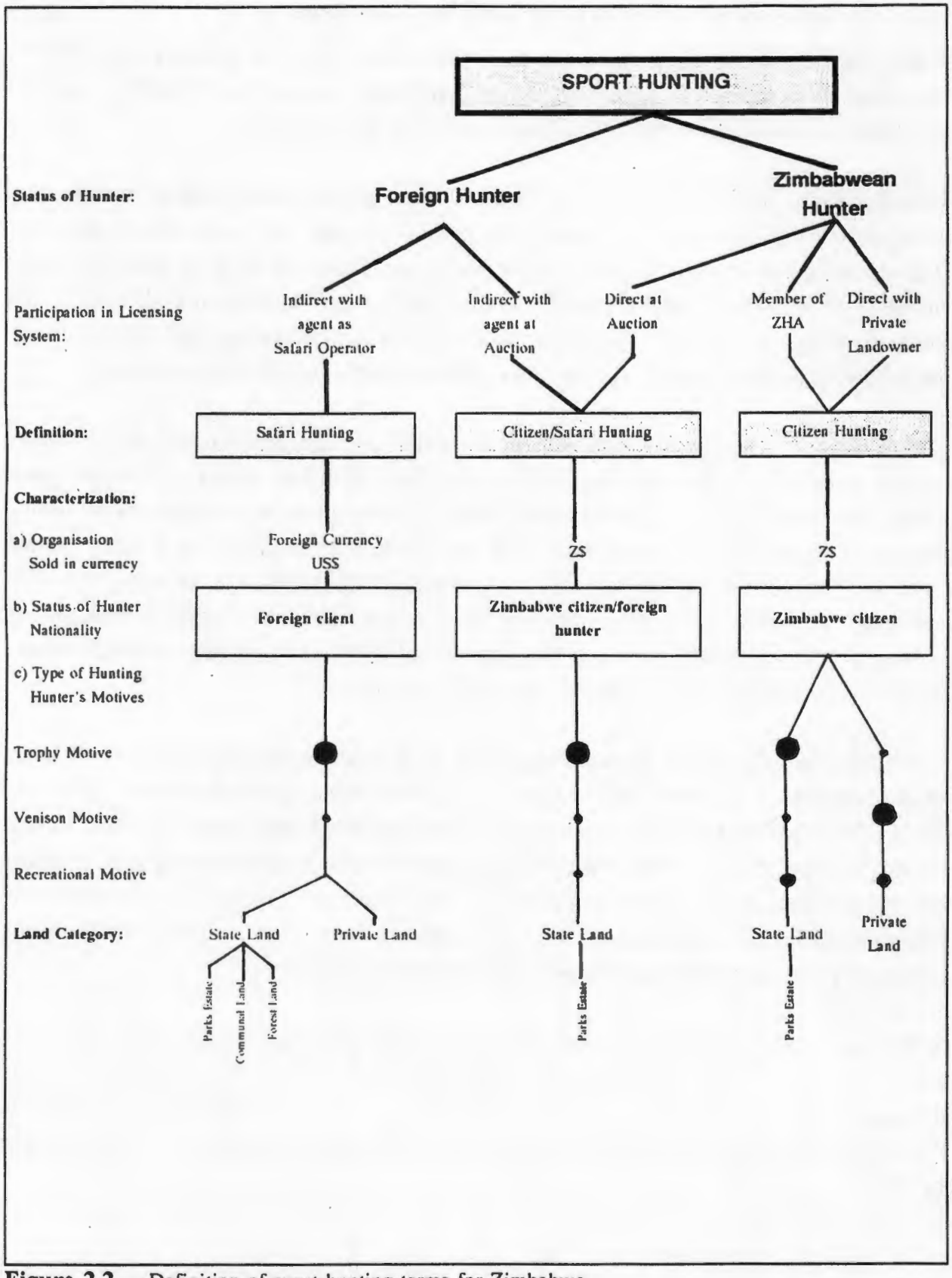

Figure 2.2 Definition of sport hunting terms for Zimbabwe

Citizen/Safari Hunting is a type of sport hunting that includes aspects of citizen hunting and safari hunting. Zimbabwe citizens, foreign hunters or their Zimbabwe agents representing them and safari operators all have access to this type of hunting, because it is sold in Zimbabwe dollars. The hunting of big game and plains game offered in two hunting areas in the parks system is mainly for the trophy value. Hunting is allocated using a public auction system and priced at the highest auction price in Zimbabwe dollars.

Figure 2.2 on page 20 emphasizes that because the personal motivation of individual hunters may differ, an important and necessary distinction should be drawn between hunters according to their primary motive for hunting. Major differences in emphasis of hunting motive between citizen hunters and safari hunters are shown using three sizes of dot for the trophy, venison and recreational motives respectively.

A safari hunter's main motive is to secure a quality big game or plains game trophy. A citizen hunter's main motive may either be to secure a quality trophy, or the venison, whilst emphasizing the recreational experience. A citizen/safari hunter's main motive is to secure a quality big game or plains game trophy.

It is evident from the above and Figure 2.2 that although similar motives underlie both citizen hunting and safari hunting activities, the importance of each motive for individual hunters may be quite different, and depend on the hunter's personal preferences and income.

Data confirming the difference in primary hunting motivation between foreign hunting clients and some Zimbabwe citizen hunters was obtained from personal observations in hunting areas and discussions with professional safari hunters. In South Africa, the Natal Parks Board (NPB) and Ciskei Safaris offer hunting bags that differentiate between the hunting quota and price at which trophy hunting, and non-trophy hunting for venison or recreation, are sold. For an example of the hunts offered, see Appendix 15.1, page A105 for NPB; and Appendix 15.2, page A107 for Ciskei Safaris.

2.2. Concepts and theory of resource allocation systems for sport hunting

2.2.1. Introduction

The purpose of this section is to relate licensing systems used to allocate sport hunting to economic theory, since the problem of allocating hunting is a problem of scarcity, with too many people wanting to hunt the available big game resources. First, a conceptual framework to structure licensing systems is introduced, then a theoretical model of allocation based on price mechanisms, markets and people's behaviour is sketched. The economic issues of allocation are stated, and the systems available to solve them are outlined for the theoretical model (at zero-prices) and are then adapted to Zimbabwe's real life situation, where resources are all, to some extent, priced in monetary terms. These models serve to analyze and review licensing systems for sport hunting in Chapter 3.

Finally in this conceptual section, the theoretical concepts of efficiency and equality are reviewed and brief working definitions as used in this dissertation are given. These concepts are at the centre of the controversy between the efficient economic production and distribution of resources (or benefits), and their politically desired and enforced (or non-economic) distribution.[1] The controversy underlies much of the literature on the productive and distributive allocation of resources, where the frequency with which authors use the terms "equity", "fairness" and "equitable distribution" is often matched by the authors' omission to define this difficult, but nevertheless practical, highly political and important idea.

2.2.2. Licensing systems: A framework to allocate sport hunting

A *licensing system* is defined as an integrated administrative system to allocate resources, particularly hunting resources consisting of sustainable quotas of wild animals, access time, and space, to hunters in hunting areas. Its purpose is limit and control the hunting activity to within ecologically sustainable limits inside an ecological resource area (hunting area).

The overall objective of licensing systems is to supply a certain combination of the hunting characteristics to satisfy the demands of a particular sport hunting community.
Other possible objectives of hunting licensing systems are suggested, such as:

- Maximizing revenue (defined in foreign exchange, or in Z$);
- Allowing hunters access to hunting benefits, by licensing them;
- Providing maximum benefits from access and revenue to the public from protected areas and their natural resources;
- Enhancing the conservation of bio-diversity.

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[1] See, for example, Okun's classic essay "Equality and efficiency", Okun (1975); and Samuelson (1973): 801-822.

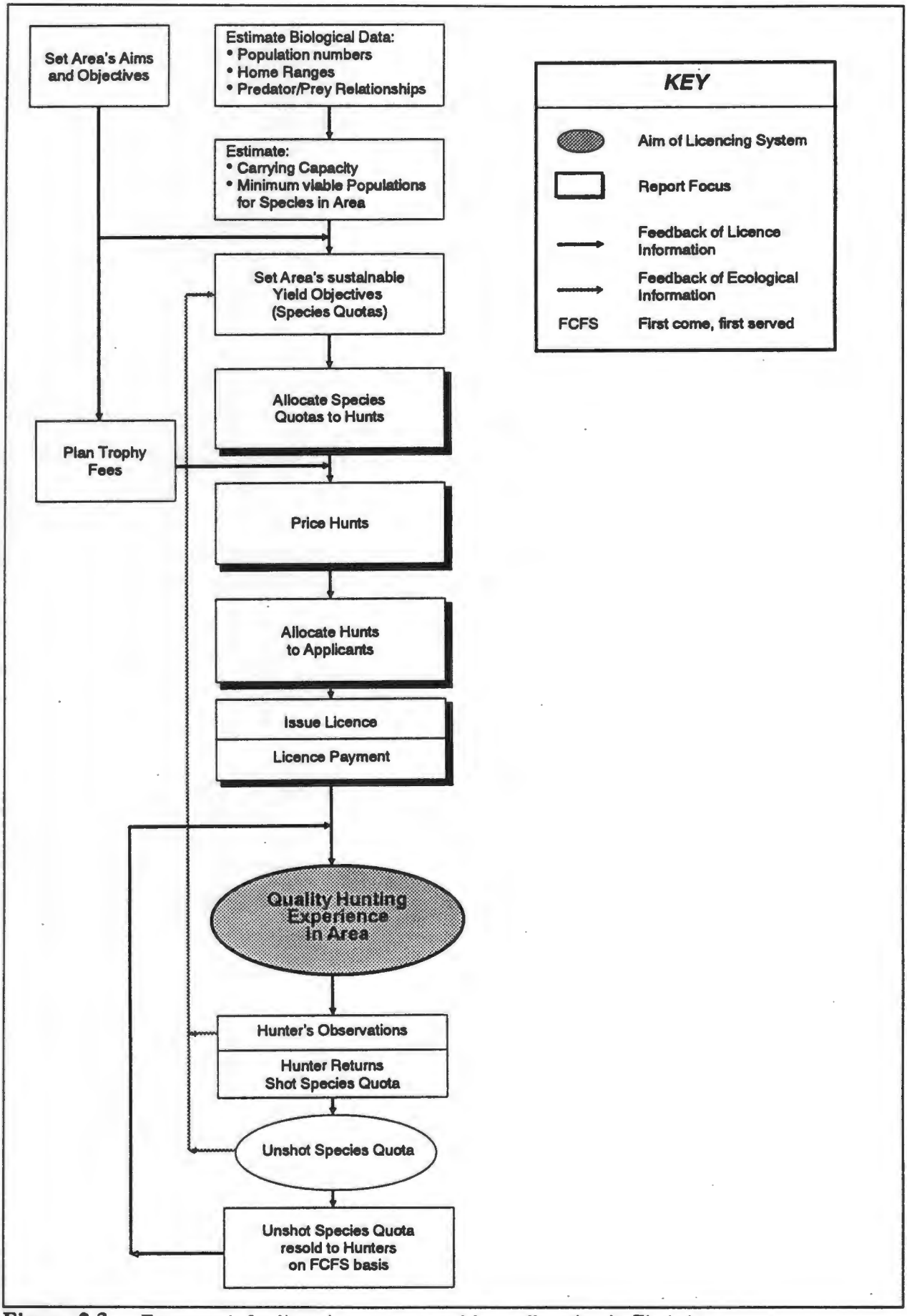

Figure 2.3 Framework for licensing systems and hunt allocation in Zimbabwe

Desktop publishing assistance by J. King is gratefully acknowledged.

Figure 2.3, page 23 shows a framework for the allocation of sport hunting in Zimbabwe. The framework shows the sequence of steps involved to license sport hunters. The framework is general, in that it shows the steps used to allocate a fixed number of licences amongst a number of applicants to allow the controlled use of a resource. The framework is based on descriptions of hunting administration given by Crowe (1987), Cumming (1988), Giles (1978), and also on the review of licensing systems used in Zimbabwe, South Africa andd Wyoming as detailed in Chapter 3.

The allocation functions of major importance in the framework (see Figure 2.3, page 23) are now briefly described, taking a fix-priced lottery system, such as that used in the Charara/Makuti study area, as an example.

A licensing system involving a lottery allocation procedure begins with the policy, resource assessment, and planning of the quota allocation to hunts. These hunts are then allocated by a particular system, which involves advertising, receiving applications for hunts, conducting the lottery draw procedure and determining who wins (is allocated) a particular hunt, issuing the licence and receiving payment. For the appointed hunting dates, the hunter and his hunting party then book-in at the DNPWLM control office in the hunting area, collect DNPWLM trackers who are to accompany the hunters throughout their hunting trip, set up the hunting camp at the designated site. After completing their hunt with the tracker, hunters then officially book out at the DNPWLM control office, return their hunting licence indicating their hunting success (animals killed and wounded) and undertake the return journey carrying any hunting trophies or prepared venison.

- **Policy:**

Policy and land-use for each protected area must be specified in a park plan. For the Charara/Makuti study area no park plan exists, and available policy documents are either not specific enough, or contain conflicting statements concerning the implementation of a licensing system. For details on sport hunting policy in Zimbabwe, see section 2.3, page 37.

- **Quota allocation to hunts:**

In each hunting area, the *species' quotas* are packaged into a number of individual hunting bags and assigned to a number of hunts. The function of allocating the quota to individual hunting bags determines the hunt's specific characteristics. This *quota allocation to hunts* is done by hunting administrators of each system for every hunting area, according to the *type of hunting* that is to take place. The type of hunt, its potential value to hunters, and the revenue potential of this hunt type are determined at this stage of planning the actual licensing system.

Hunt types include: *trophy hunts*, containing male trophy-bearing animals; *Non-trophy hunts*, containing other animals with value for venison and the hunting experience; *Big game hunts*, containing dangerous or big game species such as elephant, buffalo, lion, leopard and

hippopotamus; *Plains game hunts* containing a wide variety of antelope species, some of which are common on much land in Zimbabwe, such as impala, kudu, grysbok, and others which are rarer and valued for their trophy or hide by sport hunters, such as eland, sable antelope, nyala and zebra.

All the above hunt types provide recreational value to the hunter whilst, at the same time, providing trophy and venison value from the activity of hunting as a sport. The term "recreational hunting", though frequently used by many writers, ignores the primary consumptive motives that are the reason for the limiting the harvest to sustainable levels in the first place, these being the trophy and venison motives.

This differentiation of consumptive motives is necessary, if the resources associated with a hunt are to be priced correctly. A hunter is under no obligation to actually kill the animals on quota. During the time he is in the hunting area, the hunter still benefits from the experience, in which case he has enjoyed privileged access to the whole hunting area accompanied by a DNPWLM member of staff - which makes the hunter an exclusive visitor. If the hunter is not prepared to pay more than an exclusive tourist for the non-consumptive resource of access and space in the hunting area, then there are opportunity costs associated with allocating space and access to hunters instead of visitors. The fact that a hunter benefits additionally by hunting the consumptive resource of a hunting bag means that by purchasing a hunt, he enjoys two completely different types of resources and benefits with one and the same licence.

A further point is important for resource managers. The recreational quality of hunting and non-hunting activities that derive from access to the protected area, since access is not limited or consumed by any one person, can only be enhanced if facilities or personalized services are offered to the visitor.

- **Hunt allocation to applicants:**

Once a certain number and type of hunts have been determined, hunting administrators must solve the following economic problems of resource allocation:

- Who gets how many hunts?
- Who gets which particular hunt or hunts?
- What price is to be paid by each hunter for the hunt and its associated resources?

A critical question in terms of resource allocation is: How are personal valuations and preferences to be measured and compared by individuals for the hunts on offer, and between individuals when choosing which persons to allocate resources to?

This question is taken up further in two sections. First, in the market model of resource allocation (section 2.2.3), then in the section introducing efficiency and equality as antagonistic principles of resource valuation and allocation (section 2.2.5).

- **Pricing the hunt:**

Hunt prices are determined by the type of allocation system used. Fix-priced systems (lotteries) use controlled trophy fee prices per species, set by the government trophy fee schedule (Appendix 8, page A77) for Zimbabwe citizen hunters. Hunting administrators then value each species in a hunting bag with the trophy fee; the value of the hunting bag is then the hunt price. The Zimbabwe hunter's Association bases its calculation on the scheduled trophy fees, but adds an association levy to increase each species' fixed price. Market-priced systems (auction and tender) value each hunt according to the hunter's maximum willingness to pay in competition with other applicants. Safari operators use market prices determined by international competition for safari hunting clients, and by business principles to cover costs.

- **Licence issue and payment:**

Once the allocation system has determined which hunt has been allocated to whom and at what price, the hunter is issued with a hunting licence against payment of the hunt price. The hunting licence specifies the hunter's "hunting rights", additional rules and regulations, and any duties that the hunter must perform during or on completion of the hunt. Minimum items recorded on each licence are: the hunter's identity, the hunting bag (sex, species and number of animals), the price paid for hunt, the hunt identification number, the hunting area, the hunting dates.

- **Post-hunt statistics from hunting licences:**

Licences completed by the hunter after his hunting trip are returned to the issuing agency with data on hunting success. Trophies are measured and teeth are aged by DNPWLM staff and data is recorded. These statistics of harvested species are intended to serve resource managers for planning sustainable quotas in future years.

2.2.3. Allocation functions of licensing systems: A market model at zero price and fixed supply

Figure 2.4, page 27 applies a market model to a fictive hunting market to illustrate the principles underlying the allocation of scarce, ie. economic resources. The functions are illustrated more easily by considering the allocation as though hunts were free of charge, ie. valued at zero price. The model assumes that the hunts to be allocated are all homogenous, rather than the extremely diverse hunting packages characteristic of reality.[1] Alternatively, the hunting market may be viewed as the supply of one single hunt to anyone demanding this particular hunt. This view of a "one hunt market" is closer to reality.[2] The interpretation is based on the instructive example used by Lindsay (1984) to illustrate market theory fundamentals.

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[1] See definition of hunting bag in Glossary, page xxi.

[2] An auction system represents a "one-hunt market", where each hunt is an auction lot.

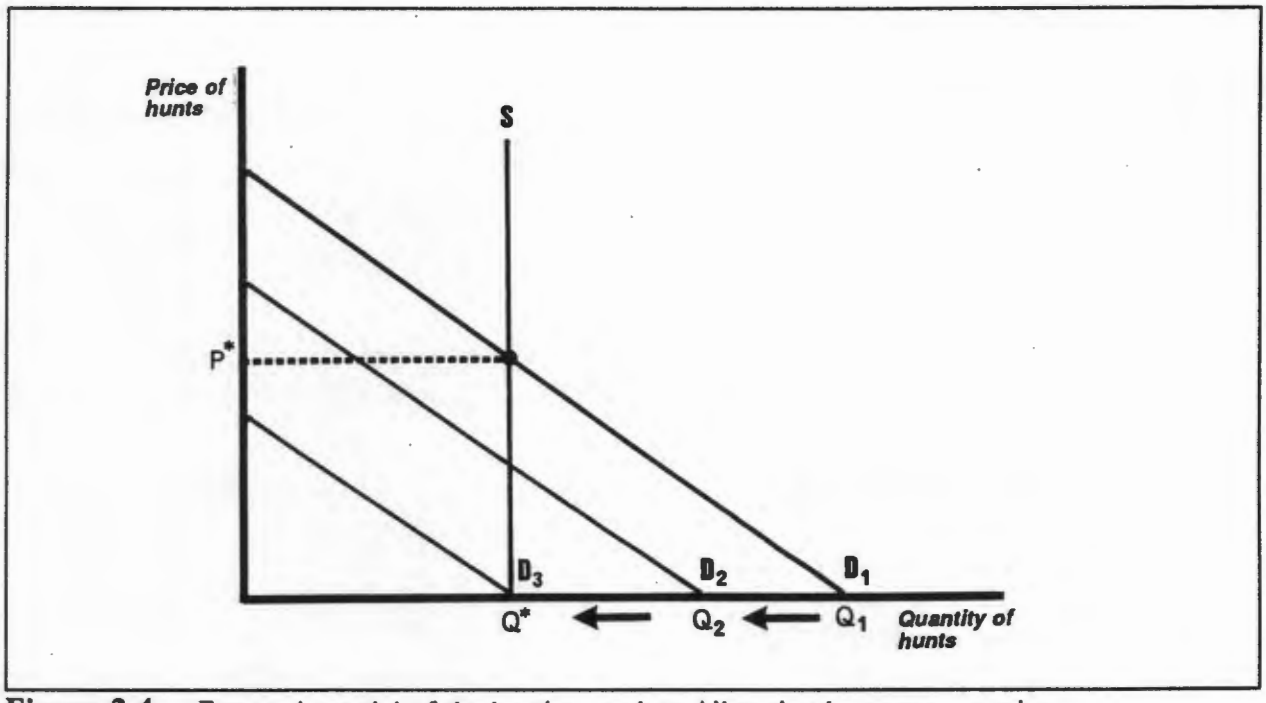

Figure 2.4 Economic model of the hunting market: Allocating hunts at zero price
Source: After Lindsay (1984).

The economic model in Figure 2.4 shows the original demand D_1 for hunts, assuming a fixed supply of hunts S based on the hunting area's sustainable species quotas. The demand curves for hunts (D_1, D_2 and D_3) obey the laws of demand. More hunts are demanded (on the horizontal axis) by hunters the lower the hunt price (on the vertical axis). The supply curve for hunts (S) is vertical, reflecting the short-term assumption that the maximum hunting quota in a hunting area is not a function of price, but depends on the ecologically sustainable quota set by hunting administrators. Therefore, the quantity of hunts supplied is Q* regardless of the hunt price.

At the equilibrium price of hunts P^*, the quantity of hunts demanded is Q^* - equal to the quantity supplied. At zero price, the quantity of hunts demanded by applicants increases to Q_1, which is larger than the fixed number Q^* available. If, to restrict demand, applicants have to queue for hunting licences, the value of each hunt to the hunting applicants at the back of the queue decreases; as queuing time increases, some applicants will be discouraged from demanding hunts. The demand curve shifts to the left at D_2, and a smaller number of hunts (Q_2) is demanded (see Figure 2.4, page 27). In time, the number of applicants demanding hunting will shift further to Q^* - and exactly equal the quantity supplied. At zero price, therefore, when the queuing time is sufficiently long, the hunting market will clear and quantity demanded will equal quantity supplied. Had the hunts been sold at the equilibrium price P^*, instead of at zero price, the market would also have cleared without causing applicants to waste their time queuing for a hunt. Resources would have been allocated more efficiently.

2.2.3.1. Scarcity and the economics of allocation

The model illustrates the everyday problem of resource scarcity. A number of basic problems are indicated that any allocation system needs to address (after Lindsay, 1984: 42). At a hunt price of zero (or any other controlled price below P^*), it follows that:

- More hunts are demanded than are available for allocation (ie. hunts are scarce);
- Some hunters demanding hunts will not get what they want at any price.

An allocation system must address the following economic issues:

- The value of the good that is being allocated (hunts) will vary amongst hunting applicants;
- A hunt's value is a personal measure in terms of what individuals are willing to give up to obtain it, for example money, time, or the certainty (probability) of going hunting;
- Someone will have to decide which demanders get some, or more of the hunts, and which get no hunt at all. This decision may be taken indirectly, if a decision-maker selects a system to allocate the supply;
- Different decision-makers (choosers) and different systems will result in different allocations to different people; thus different hunt distribution patterns imply different equalities[1];
- Under some allocation systems, some hunters will be better off than others; hunters will prefer a system that benefits them personally.
- Under some allocation systems, the decision-maker (resource owner) will be better off than under others; the decision-maker will prefer a system that depends on the institutional arrangements (eg. private enterprise, government policy, or member's association) and power to influence the system.
- Under different systems, hunters will adapt their behaviour to qualify themselves for a share of the scarce hunting resource.

Critical questions in terms of resource allocation are: How are personal valuations and preferences of individual persons to be measured? How are valuations for the alternative hunts to be compared by the individuals themselves? How are valuations made by different individuals to be compared amongst each other?

2.2.3.2. How can licensing systems allocate hunts?

Different systems for allocating scarce resources are discussed and contrasted by Lindsay (1984): 43 according to economic theory and efficiency principles. The alternative systems for hunt allocation listed are:

- Market mechanisms, and market prices for valuing resources;
- Lottery mechanisms, and zero prices for valuing resources;
- First-come-first-served systems and zero prices for valuing resources.

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[1] See definition of equality in the Glossary, page xxi.

By using market mechanisms to allocate (based on the principles of efficiency), money is the measure of relative resource valuations, and individuals take account of their personal preferences by determining their own willingness to pay. By using lottery mechanisms to allocate (based on notions of equality), individual's relative resource valuations and personal differences are ignored, and other criteria such as fairness, probability or need determined by an authority are used instead.

A critical function in any licensing system is whether and how it is designed to accommodate individual preferences and choice of hunts by hunting applicants. As shown, choice is necessary for hunters due to the diversity of hunt characteristics and individual preferences, tastes and valuations of hunters, and their different budgets for hunting. Choice enables personal differences to be accommodated and enhances equality. Choice of hunting opportunities also enhances the efficiency of the allocation system.[1] If, due to choice, any hunter obtains a hunt that exactly matches his tastes, then he values the hunt more highly than any alternative, and will consequently be prepared to pay a higher price to obtain this particular hunt. (Here, price is understood as the hunter's willingness to give up more time, effort, money and other options of spending his recreation in order to obtain his first preference.)

According to economic theory, Lindsay (1984) concludes that the market mechanism and competitive market prices allocate resources most efficiently, at least cost to society, and with the greatest number of people benefitting from the quantity of goods and services produced.

2.2.3.3. How do Zimbabwe's licensing systems allocate hunts?

Since all big game hunts in Zimbabwe are priced, not free, the systems used to allocate hunts in reality are adaptions of the zero-priced model of a one-hunt market (Figure 2.4, page 27). Hunt prices in Zimbabwe vary, depending on:

- Whether the licensing system is based on market or fixed prices, ie. whether a market (eg. an auction) or a non-market mechanism (eg. a lottery) is to be used to allocate and price hunts.
- How the quota is packaged into hunts by the hunting administrators;
- For the non-market fix-priced systems, hunt price depends on: the species in a hunting bag, and what fixed price is used to value each species.
- For the market-priced systems, hunt price depends on: Who can compete in the competitively priced hunting market (eg. Zimbabwe citizens only, Zimbabwe and foreign hunters, all of these including Zimbabwe and foreign safari operators).
- Whether the right to hunt, once acquired, can be freely traded or sold.

For priced allocation systems in Zimbabwe, two categories of systems are used to allocate resources and value:

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[1] "Variety, Equity, and Efficiency" by Lancaster is devoted to this topic. See especially Lancaster, (1979): 5-6.

Market-priced systems include auctions, tenders and commercial marketing systems. These systems maximize revenue by valuing each hunt at market prices using applicant's maximum willingness to pay and personal valuations measured in money determined in competition with other applicants. With a tender system, applicants tender a fixed price for a hunt, whereas an auction system systematically raises[1] the auction price until the final bidder's price clears the market.

Fix-priced systems include lotteries and first-come-first-served systems. These systems limit revenue by valuing each hunt at fixed prices controlled by government. With the price of each hunt fixed, there is invariably more than one person wanting this single hunting opportunity, so applicants are further limited according to some criterion other than price and willingness to pay the fixed price. Lottery systems are adopted where applicants are limited using luck (probability) and random allocations procedures. Lotteries allocate value randomly, not personally, and assume applicants are identical, or that personal valuations do not influence the allocation results.

2.2.4. Dynamic resource coordination with market-prices

In reality, supply is not fixed over the longer term in Zimbabwe, since wildlife can be "produced" by many different landowners in different parts of the country. Hunts that could substitute big game hunts in protected areas, such as the study area of Charara/Makuti, can be supplied on many categories of land. Using economic theory and the market model, it may be predicted that if the price is high enough, then landowners will tend to enter the hunting market and supply hunts, and as competition increases, the price of this hunting supply will tend to decrease.

The important point in this adjustment process, is that market signals and the price mechanism were responsible for "coordinating" this increase in supply in the most efficient and cost-effective manner.[2] The increase in supply was not brought about by a central planning authority deciding to "produce hunting alternatives" in Zimbabwe. Markets and the competitive price mechanism have the property of coordinating an economy to produce and distribute resources in a distributed allocation system, rather than controlling such allocations centrally using, for example, a lottery allocation system.

By introducing competition, more quality for lower hunt prices can be achieved as more people offer hunting packages on their land. By increasing supply in response to people's willingness to pay the current market price, wildlife, land and economic activities are "developed" and welfare is created for the country as a whole. Market allocation systems can

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[1] The system that systematically lowers the auction price, until the first person bids, known as the Dutch auction system. Used to auction flowers in Holland, it aims to achieve even higher prices than the bottom-up auction. It was not considered in this dissertation.

[2] The link between free markets and individual decision-making is emphasized particularly by the Austrian economic school, see O'Driscoll and Rizzo (1985), Shand (1990).

bring about this economic development and welfare, with the consumer paying for the full costs of supplying and distributing resources **during the development process** - no subsidy is necessary, and no debts are incurred. Markets incorporate the principle that the user pays the full costs, if someone feels it is worthwhile producing, distributing and consuming that resource.

2.2.5. Theoretical concepts of efficiency and equality

The theoretical concepts of economically producing and distributing benefits from scarce resources at least cost to society, and enforcing a different political or non-economic distribution of benefits and resources, are at the core of efficient and equitable resource allocation principles.

In this section, an attempt is made to transform the concepts from theory into practice for the problem of allocating sport hunting and understanding the purpose of using lotteries to allocate hunts to people, instead of market determined prices that are so widely used in everyday life.

2.2.5.1. Introducing efficiency, equality and the trade-off problem

The two concepts of efficiency and equality, and the trade-off problem that exists between them are introduced with an analogy.

Imagine that hunting licences are distributed over-the-counter at every post office throughout Zimbabwe. For the purposes of this analogy[1], the number of licences issued is unlimited, and hunters and post offices are evenly spaced throughout the country. Taking the number of hunting applicants in any year, and the total time worked by the post office employees to issue hunting licences, a prospective hunter might expect to queue, on average, for half an hour until his licence application is processed.

Now suppose that the agency responsible for licensing decides to make the post office system more efficient. Licences are to be issued at a central licensing office, using an up-to-date processing system. The modern system allows the same number of hunting applicants to be processed as before, so that the average queuing time for any single hunting applicant remains unchanged, at half an hour. With a licensing system that costs the government less and has the same average queuing time for hunting applicants, clearly the system's efficiency is improved.

How would the new licensing system affect hunters? Once the central licensing office is reached, each applicant then queues for the same amount of time under the old and the new

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[1] The analogy is based on the examples used to introduce, and illustrate the same problem by Lancaster (1979): 1-5. Hunting licences were distributed through the post office system in Zimbabwe from 1964 until 1975. Any further similarity between the analogy and this system is not intended.

system. The total time spent by each applicant in obtaining a hunting licence, however, has altered, and depends on where the hunter's home is located geographically relative to the licensing office. With the more efficient centralized allocation system, the agency has passed the costs of distributing licences on to the hunting applicants. For applicants who are now further from the licensing office than before, these access costs are tangible, and include extra travelling time, extra fuel or bus fares, and added inconvenience. The costs will be unevenly distributed amongst applicants. Hunters living farthest from the central licensing office might now be worst off under the new system.[1]

In this analogy, the trade-off is obvious and explicit for hunters as extra distance. Most hunters must travel further than before to apply for a hunting licence, and might object vociferously to the more efficient licensing system. Improving the system's efficiency (reducing costs of allocation to the government agency for the same average waiting time) has created problems of equality by making some applicants worse off than others.

Carrying the analogy one step further, imagine that a standardized hunt and hunting bag could be offered to all hunters, instead of the present variety of species and hunting dates. For the agency, this would simplify administration, require less time, and be more efficient. If the agency passed these cost savings on to hunters by offering the standard hunts at a lower price, hunters who prefer a standard hunt would now be more satisfied. Hunters who preferred a non-standard hunt - and were willing to pay more for this choice - would be unsatisfied with the standard hunts.

In this extended analogy the trade-off between the efficient allocation of hunts and the issue of equality is less obvious. The distribution of satisfaction or dissatisfaction amongst the individual hunters, due to the standardized hunts, is less tangible, and defies meaningful quantification. Yet the choice of hunts available to hunters has been reduced, and somehow influences the equality and efficiency of hunt allocation.

Both versions of the analogy capture the issues of equality, efficiency, and variety of choice for the individual hunter. The manner in which the efficiency of producing benefits from wildlife is traded off against the equality of benefit distribution is determined by the allocation system. Due to the variety of ways in which wildlife and natural areas can produce benefits, questions concerning which benefits to produce, and how to distribute these benefits amongst individuals are important.

In addition, the analogy indicates that spacial aspects are important to consider when choosing a system to allocate hunting, since they directly influence efficiency of production and equality of access to hunting areas and their benefits.

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[1] The analogy simplifies many examples of worst cases under the new system. Someone with limited or no transport from remote areas would find the costs prohibitive, compared to a person who owns a motor vehicle.

2.2.5.2. Efficiency: Producing benefits - How big is the cake?

In everyday terms, the concept of efficiency means that the maximum benefit is obtained from a given number of resources, or conversely, that to produce a given benefit a minimum in resources is to be used.[1] Efficiency thus relates the value of benefits from something that is produced as an output (a hunting experience) to the resource costs used to produce it as inputs (animal quota, time and space, financial and human resources). Ultimately, the concept of efficiency relates net-benefits to costs of inputs; it is a profit-related concept. Efficiency may also be viewed as not wasting scarce resources - when it does not necessarily require resources or benefits to be valued, but where quantities are sufficient.

For American licensing systems in Wyoming, Crowe (1987) defines the outputs produced for hunting as:

- the number of hunts (for uniform hunting bags);
- the number of quality hunter-days, as valued by hunters.

The costs of resources are the actual administration costs incurred by the agency to achieve the programmes necessary for this particular objective.

The efficiency of a licensing system would then be defined as the number of hunts (or value of the hunter-days) produced in relation to the administration costs incurred by the agency. In Zimbabwe, data on both the valuation of the hunting experience by citizen hunters, and on the agency's costs of producing the hunts (or hunter-days) are not available. There is a compounding problem, because for African wildlife hunting bags are not homogenous with single species bags, but consist of mixed bag of big game and plains game species.

Instead of relating the value of citizen hunting to its costs of production, a licensing system's efficiency was measured firstly as the number of hunts actually benefitting hunters of those planned for the hunting area (Chapter 4), and secondly as revenue from hunting resources (quotas and access time) in Chapter 5.

2.2.5.3. Equality: Distributing benefits - How is the cake sliced?

The concept of equality in this dissertation means a particular pattern of resource distribution. Thus, there are many possible equalities - distribution patterns - and not only a single best equality. This notion of equalities as resource distribution patterns therefore includes all similar terms referring essentially to this notion, such as: equity, equal opportunity, equal access, fairness of allocation, pricing, or lottery. As used here, the concept of equality extends beyond the welfare notion of equal income and/or wealth for all persons (Samuelson, 1973: 801-810), and includes other resources and distribution patterns. Although equality is

[1] Literature on efficiency is extensive, and the terminology varies: See Taylor (1911); Martindell (1950); Shepherd, *et al.*, (1983); Silberston (1983); Lange (1963); Stem (1983) and Lyons (1983).

generally accepted as a principle of resource allocation (Stauth, 1980; Lancaster, 1979), many authors fail to define the concept and make it operational.[1]

The political nature of equality as a distribution pattern is summarized by Coleman:

> "The very use of the term "equality" is often clouded by imprecise and inconsistent meanings. For example, "equality" is used to mean (1) equality before the law - equal treatment by the authorities, (2) equality of opportunity - equality of chances in the economic system, (3) equality of result - equal distribution of goods, amongst others. These different meanings often conflict, and are almost never wholly consistent." Coleman (1987): 169.

He then relates equality to economic theory:

> "The concept of equality has no place in positive economic theory. There is in the concept of free choice, however, something closer to the idea of equality before the law, than to equality of opportunity. Equality of result implies a distribution process that is the antithesis of the market". Coleman (1987): 170.

Thus, it is clear that the concept of equality is normative (how resources and benefits ought to be distributed), and deals with the distribution pattern of benefits and costs. In a succinct and authoritative treatise on the subject in "Equalities" by Rae, *et al.* (1981), the authors define the concept and order the popular meanings given to equality. By so-doing, the authors show that there are almost unlimited dimensions to the concept of equality, and many "rules" by which resources can be distributed among people: in other words, Rae, *et al.* prove that many different equalities can be achieved, which depend on the precise definition of the dimensions of "equalness" by the decision-makers who are in a position of power to choose the allocation system.

Taking the example of allocating hunts using a lottery, the following vexatious yet practical questions arise. The idea of using a lottery, rather than an auction price to allocate hunts, is that the criterion of randomness, rather than a hunter's maximum willingness to pay, should determine whether he hunts. Rae, *et al.* define this allocation as prospect-regarding equality of opportunity, that is:

> "Two persons, j and k, have equal opportunities for some end-good X if each has the same probability of attaining X." Rae, *et al.*, (1981): 65-67.

With a lottery, nothing about people should affect the allocation result, and the authors recognize that the prospect-regarding equality of opportunity is rare in practice. If this theoretical definition is applied to citizen hunting, several questions arise before the equality concept can be made operational and applied to allocate hunts by lottery.

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[1] See for instance: Sinden and Worrel (1979): 64, who use "social utility"; Zimbabwe Government (1986): 26, who use "equity"; Zimbabwe Government (1992): 8, who use "equitable and efficient allocation of opportunities"; Preston, *et al.*, (1991): 545-547, who use the synonyms "equity in a user-pays system", "unfair advantage", "appropriately priced resources" and "equitable drop in basic entrance charges and accommodation fees at reserves".

- **What is the end-good X?:**

Is X an option to hunt, meaning the right to access and to hunt an unspecified hunt (*Any Hunt*), or does X mean the right to hunt a specific hunt of known characteristics that the hunter has chosen personally (*First Hunt Preference*)? Clearly, these are different cases. In the first instance, the rights to access and to hunt are randomized and the probability of winning them can be the same for all persons; hunters are not given a choice of which hunt they are allocated. In the second instance, hunters are given a choice of hunts; access and the right to hunt a specific hunt preference is then randomized for all persons who chose that same hunt and preference. Hunters choosing different hunts then need not necessarily have the same probability of winning that particular hunt preference.

- **What is meant by attaining X?:**

Is it enough to have an equal probability of winning a hunt in the lottery, yet allowing some persons to access the actual hunting benefits in ways other than by applying in the lottery (the free-rider problem)? In Zimbabwe this possibility exists and does occur, since co-hunters in the hunting party are not necessarily part of the lottery draw procedure, and by cooperating with other applicants can adopt a strategy to enter the hunting area and benefit inspite of the lottery system.

- **What persons are meant?:**

Following on from above, is **each applicant** who applies to hunt to have an equal probability, or is **each hunter** who enters the hunting area (the hunter and co-hunters in any size of hunting party) to have an equal chance?

The answer to this apparently trivial question is complicated, because the logical answer contradicts practice in Zimbabwe today. Logically, since the aim of applying is to participate as a hunter in a hunt, one expects prospects of winning a hunt to be the same for all hunters. In practice, however, no lottery system in Zimbabwe currently gives hunters, rather than applicants, equal prospects of success. No Zimbabwean lottery system's rules require applicants to specify their co-hunters. Co-hunters are thus not amongst the persons participating in the draw. In this dissertation it is assumed that for lottery allocation systems the prospects are to be equal for **all hunters**, not for all applicants (Chapter 4).

A second interpretation of equality was adopted in Chapter 5. This definition of equality seeks to establish how widely the benefits of hunting (measured as numbers of persons) are distributed amongst hunters and other members of society in Zimbabwe, of those who benefit directly and personally from access to the hunting area. In this definition, an allocation system that earns large amounts of revenue in such a way that many people have access to the natural resource areas (eg. tourism, educational group outings) is considered to be more equitable than one which may earn the same revenue from a few persons only, but fails to invest this revenue and develop facilities and access for other user-groups. This interpretation

is similar to asking at which level of economic activity (large or small cake) a particular equality of resources or benefits (distribution pattern) should be achieved (see Rae, *et al.*, 1981: 128). (It should be noted that to be able to invest revenue from any activity (eg. sport hunting) and develop other benefits (eg. educational facilities and access), the first activity must produce a profit; revenue must exceed costs of production and distribution. Only then can an additional activity be funded and undertaken in terms of an equality objective.)

2.2.5.4. Finding the balance

There is an inherent conflict between allocating resources according to economic principles based on prices that reflect costs of production, and their allocation according to politically pre-determined criteria. In this dissertation an essentially economic view of all resource allocation decisions is adopted based on decision-making by individual persons as far as possible, rather than central authorities.

The question for policy- and decision-makers is therefore not: Whether or not citizen hunters should be allocated hunting. In economic terms, the question becomes: What does it cost to allocate hunting resources to citizen hunters, as opposed to allocating the same resources for a different purpose, such as safari hunting or tourism? This essentially economic approach can be justified with the argument, that without a larger economic cake (consisting of wealth, income and jobs) which is growing at the same rate as Zimbabwe's population (3.13% in 1992)[1], each person's slice of the economic cake will diminish, increasing poverty and decreasing the prospects for sustainable development of all persons. The "World development report 1991" focused on the links between poverty and lack of development on the one hand, and reducing poverty with sustainable market oriented economic growth on the other (World Bank, 1991).

The political question for rational decision-makers is then, whether the differences in costs and benefits of one resource allocation over another (opportunity costs) are warranted, or can be justified for Zimbabwe as a developing country.

This dissertation quantifies some opportunity costs of allocating citizen hunting using a particular lottery system in the Charara/Makuti hunting areas. Zimbabwe's current economic and social development priorities are outlined in section 2.6 of this chapter.

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[1] Zimbabwe's population of 10.4 million persons was growing faster according to the 1992 census (3.13% p.a.), than previously estimated (2.8% p.a.) by the World Bank (1991).

2.3. Zimbabwe's legislation, policy and practice for allocating wildlife, land categories and land-use

2.3.1. Introduction

This section summarizes in point form policy and policy related statements relevant to citizen hunting in Zimbabwe. It documents the conflicting policy context for the allocation of wildlife, land-use and sport hunting activities in protected areas and other land categories in Zimbabwe.

Six key documents contain policy and policy related statements relevant to wildlife in Zimbabwe, to sport hunting[1] on state land in the Parks and Wild Life Estate, and to citizen hunting in the Charara/Makuti study area. The key documents are:

(1) Parks and Wild Life Act of Zimbabwe
(Act No. 14 of 1975, as amended on 1.8.1990);

(2) Zimbabwe's National Conservation Strategy
(Zimbabwe Government, 1987b);

(3) Policy for Wild Life
(Zimbabwe Government, 1989d);

(4) Draft Wild Life Policy on Sport Hunting
(Zimbabwe Government, 1990b);

(5) Updated policy for Wild Life
(Zimbabwe Government, 1992);

(6) Workshop proceedings: "Recreational Hunting on State Land in Zimbabwe: Options for the Future"
(Zimbabwe Government, 1984a).

Two further draft policy documents for land-use management of the Charara/Makuti areas were consulted, but their contents remained as inofficial draft documents. The drafts do not clarify citizen hunting policy, but specify land-use intentions by the then decision-makers for the Charara/Makuti hunting areas. Non-consumptive land-use options were consistently underlined for these areas, due to their wilderness qualities and proximity to the Lake Kariba shoreline. The documents are mentioned here for completeness, in the absence of other formal documents (policy or park plan) that should guide management and research of present-day citizen hunting activities in the Charara/Makuti study area. The documents are:

(7) Draft Policy Document for Charara Safari Area, 24.2.1991
(Zimbabwe Government, 1981);

(8) Draft Policy Document for Charara Safari Area, 19.7.1974
(Zimbabwe Government, 1974).

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[1] Formulations in policy documents such as "...sport hunting for Zimbabweans..." and "...hunting for citizens..." (Zimbabwe Government, 1989d: p. 4) or "...recreational hunting opportunities ... (for) indigenous Zimbabweans..." (Zimbabwe Government, 1992: 11) have been defined as "Citizen hunting" in this report. Policy which is cited in the original must be interpreted according to the citizenship of the sport hunter.

2.3.2. Parks and wild life act: Act No. 14 of 1975

The act states general policy for wildlife, land categories and landowner responsibility for hunting and wildlife on their land. The Act describes the system of protected areas, their purpose and permitted land-uses.

2.3.3. National conservation strategy: 1987

In the section on wildlife and protected areas, the use of economic principles for conservation and wildlife utilization is endorsed:

> "In the more remote farming areas, by giving wildlife economic values, and treating it like any other renewable resource, albeit one that requires special management and marketing skills, many benefits are realized." (Zimbabwe Government, 1987: 11)

2.3.4. Policy for sport hunting

2.3.4.1. Introduction

The policy relating to allocation principles for land-use in protected areas, the use of wildlife for sport hunting activities, the provision of citizen hunting by the DNPWLM in protected areas is now summarized, with verbatim quotes from the five documents mentioned above.

2.3.4.2. Policy for wild life: 1989

The document "Policy for Wild Life" was valid in 1991 during the research period, but has since been updated to include the document "Draft Wildlife Policy on Sport Hunting" (see section 2.3.4.3), and now forms the current "Policy for Wild Life" as of 1992 (see section 2.3.4.4). The 1989 version is in some respects more explicit, but contains statements that are ambivalent and remain so in the updated 1992 version.

In section 3 of the policy, reference is made to the role of wildlife as an accepted ecologically and financially sustainable productive form of land-use, and linked to the passage quoted above from Zimbabwe's National Conservation Strategy. For land outside protected areas, wildlife production systems are to compete with conventional land-use (agriculture and domestic livestock) as a land-use according to "the outcome of competition ... [and]... economic processes" (Zimbabwe Government, 1989d: 7).

For land set aside as protected areas, section 11 of the policy, entitled "Recreation and Tourism", states:

> "In setting aside national parks[1] for the conservation of biological diversity, government is aware that this is a direct cost to the taxpayers of Zimbabwe and uses land which could otherwise be put to alternative uses. For this reason, government intends that **citizens of Zimbabwe shall have a primary claim on the Parks and Wild Life Estate.**" (Government of Zimbabwe, 1989d: 19. Emphasis my own)

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[1] Zimbabwe's system of protected areas (Parks and Wild Life Estate) comprises a category called "National Parks". In the context of the policy quoted from section 11, however, the entire system of protected areas is implied, since the conservation of bio-diversity is the purpose of the entire system, and not just the one category.

This statement is reinforced one page later:

> "Government recognizes the primary right of Zimbabweans to benefit from the Parks and Wild Life Estate. It will ensure that **the cost of recreation for Zimbabweans remains compatible with local incomes**, and that there is a strong inducement for Zimbabweans to make use of their own natural and cultural heritage" (Zimbabwe Government, 1989d: 20. Emphasis my own)

In section 12 on "Commitment to Funding", a financial strategy is outlined. The conservation (as preservation) of bio-diversity in key minimum areas within the protected areas is to be a priority, whilst the conservation (as utilization) of all remaining non-key park areas is accepted. Key areas should be adequately funded with the "entire annual budget [of the DNPWLM] ... allocated to them." (Zimbabwe Government, 1989d: 22). For non-key bio-diversity areas, the document specifies that:

> **"The remaining extent of the Parks and Wild Life Estate should be planned so that it generates, at a minimum, sufficient income for its own maintenance."** (Zimbabwe Government, 1989d: 22. Emphasis my own).

Key bio-diversity areas have yet to be mapped and defined in a park plan for the Charara/Makuti study area. The dilemma between using economic incentives to generate revenue and subsidizing access for Zimbabwe citizens by treating parks as open access resources is apparent in the following draft policy.

2.3.4.3. Draft wild life policy on sport hunting: 1990

This document was available when the research for this dissertation was conducted in 1991, but has since been partially included in the revised "Policy for Wild Life", dated 1992 (see section 2.3.4.4). A feature of this document is the dichotomy between promoting wildlife conservation as an industry by harnessing economic incentives and market principles on all categories of land in Zimbabwe, with the exception of those activities supplied to Zimbabwe citizens on the Parks and Wild Life Estate. For the sport hunting industry, section 8 of policy states:

> "Because of the potentially high returns from sport hunting, the Department (DNPWLM) will administer the industry **for the maximum long term benefit to the nation** rather than for short term profits to individuals. Allocation of state hunting areas will be done without favour, with the object of **realizing the greatest overall gain to the national economy** through efficient operators." (Zimbabwe Government, 1990b: 3. Emphasis my own).

Further, section 12 of the draft policy states that the economic return from land should be the criterion for determining the land-use:

> "**Sport hunting** will not be entrenched as a form of land-use in any area, but **will be managed** on a flexible approach **based primarily on economic returns from land**. Non-consumptive uses of wildlife will be preferred wherever they offer a better financial returns from land." (Zimbabwe Government, 1990b: 4. Emphasis my own).

In section 16 of the draft, an unqualified commitment is made to provide Zimbabwe citizens with sport hunting:

> "Government recognizes the right of Zimbabweans to enjoy sport hunting as a form of recreation. **It [Government] will ensure that opportunities exist on State Land for hunting by citizens at affordable rates**..." (Zimbabwe Government, 1990b: 4. Emphasis my own).

The interpretation of affordable in the context of a developing country with large differences in income is not attempted.

Section 17 specifies the lowest price at which sport hunting on state land is to be made available:

> "No wild animal will be hunted on state land for less than the prevailing market value of its meat and hide." (Zimbabwe Government, 1990b: 4).

Market prices for wildlife and its products are extremely variable, and it is difficult to establish "average market prices" for the country as a whole. The problem is due to the lack of competitive, widely distributed formal markets for most wild animal products, and the influence of where the market is established for meat and hide. In rural markets, meat and hide prices are very low, but by transporting the products to larger urban markets with greater consumer purchasing power, prices for the same products can be increased many times over.

2.3.4.4. Updated policy for wild life: 1992

This document updates the two previous documents that were available at the time this research commenced (Policy for Wildlife: 1989 and Draft Wildlife Policy: 1990). Apart from incorporating some policy statements from both documents and introducing new terms, this updated version does not clarify policy on allocating wildlife in protected areas for citizen hunting. Wildlife, land and their land-uses are treated as economic resources when allocated for safari hunting on all land in Zimbabwe, but the same resources are treated as open access resources when allocated for citizen hunting in protected areas. Economic trade-offs are not clarified.

In the preamble to section 2 of the current policy entitled on the "Public use of the Parks and Wild Life Estate", reference is made to the question of access for foreign versus Zimbabwean visitors:

> "Government places considerable importance on **the primary right of Zimbabweans to have access to recreation** in the Estate and will seek an **equitable balance** between domestic and international tourism." (Zimbabwe Government, 1992: 11) Emphasis my own.

Section 2.3.2 then explicitly mentions citizen hunting:

> "**Recreational hunting will be** encouraged in appropriate areas of the Estate and opportunities **provided to ensure that indigenous** (*sic*) **Zimbabweans**[1] **have access to hunting.** (Zimbabwe Government, 1992: 11) Emphasis my own.

The dichotomy between using market principles and non-market principles for resource allocation is clearly evident in section 4.4.4 on the pricing policy of wildlife resources:

> The Department will: "Ensure that **wild life-based tourism in the Estate is priced so as not to undervalue the resource or to be subsidized, except** in the case of facilities used by Zimbabwe residents, especially of low income, or where the tourism opportunities have a strong educational component for local people." (Zimbabwe Government, 1992: 16) Emphasis my own.

Section 4.4.8 makes unqualified reference to the economic market model and the exception afforded to Zimbabweans for access:

> The Department will: "Market all tourist opportunities within the estate so as to **rationalize supply and demand** and ensure that **Zimbabwean residents have a reasonable opportunity to enjoy the Estate.**" (Zimbabwe Government, 1992: 16) Emphasis my own.

The terms "rationalize" and "reasonable" are meaningless in economic terms, and avoid the issue of costs of supplying any sport hunting activity to the public with scarce resources.

The preamble to section 5 of the updated policy concerns sport hunting. The terms "recreational hunting" and "sport hunting" are used synonymously, but it is not always clear if reference is made to sport hunting as an "industry", or as a land-use that applies to citizen **and** to safari hunting activities. Initially, a clear commitment to allocate sport hunting using economic principles is made:

> "Recreational hunting is an economically and ecologically efficient use of wild life consistent with policy for high quality and low density tourism. Recognizing the substantial foreign exchange earnings which hunting generates, **Government will administer the industry for the maximum** long term benefit to the nation rather than for short term profits to individuals." (Government of Zimbabwe, 1992: 17) Emphasis my own.

In section 5.4, economic principles for resource allocation within protected areas are further endorsed, but unspecified reservations are made for the allocation of citizen hunting:

> "The Department [DNPWLM] will not entrench sport hunting in all Safari Areas in the Estate but will maintain a flexible **approach based primarily on economic returns from land,** provided that opportunities exist in the Estate for hunting by Zimbabwe citizens." (Zimbabwe Government, 1992: 17) Emphasis my own.

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[1] In current political interpretation and daily usage, the term "indigenous" in Zimbabwe has a racial connotation. To adopt this usage for the allocation of sport hunting would mean, in the first instance, that a licensing system must discriminate according racial criteria, not according to every person's willingness to pay or every person's probability of being drawn in a lottery. A racial interpretation is rejected by the author. Firstly, the approach taken here to the allocation problem is an economic one, not a political one: thus, the opportunity costs of any hunt allocation are relevant. Secondly, a racial interpretation is not compatible with democratic government and market principles (World Bank, 1991): competitive market prices have the ability to supply *all citizens* (not only an elite) with hunts at least cost to Zimbabwean society.

In section 5.5 of the policy, a minimum price for the sale of sport hunting is formulated less precisely than that of the draft version on wildlife policy for sport hunting in 1989:

> "No animal will be hunted in the Estate for less than the market value of its raw products." (Zimbabwe Government, 1992: 17).

In a policy statement on the conservation of the African elephant species in section 9.3.2 of the policy for wild life, economic incentives are clearly highlighted as the general economic principle endorsed by the DNPWLM for resource allocation:

> "Consistent with its [Government] **policy for placing a high economic value on all wild life**, Government will defend Zimbabwe's right to trade in elephant products internationally." (Zimbabwe Government, 1992: 34) Emphasis my own.

2.3.4.5. Workshop on land-use policy for the study area

The proceedings of the DNPWLM workshop, entitled "Recreational Hunting on State Land in Zimbabwe: Options for the Future", refer to citizen hunting for the Charara/Makuti study area, but fail to resolve key economic policy issues. Points of policy can be summarized as follows:

- Zimbabwean hunters should be provided with hunting opportunities;
- The conflict between the economic benefits of earning foreign exchange (from safari hunting) for the Zimbabwe economy on the one hand, and the policy statement of offering Zimbabweans citizens affordable hunting was recognised, but not resolved. The key policy issue of which pricing system to adopt for citizen hunting remained open (Zimbabwe Government, 1984a: 47).
- The workshop recommended revenue maximization (in Zimbabwe dollar and foreign exchange currencies) for the predominantly big game quota in the Charara Safari Area.
- Revenue maximization in foreign exchange currencies for the predominantly big game quota in the Makuti Section of Hurungwe Safari Area was recommended by the workshop by selling specialist big game hunts[1] to safari hunters. (Zimbabwe Government, 1984a: 2-3; 46)
- The remaining big game on quota in Charara/Makuti was to be sold to safari operators who had no access to big game (game ranchers) to balance and raise the marketable value of their plains game hunts (Zimbabwe Government, 1984a: 44-45).

Despite these recommendations for land-use and allocation of Charara/Makuti hunting areas as safari hunting in 1984, land-use practice in both areas has reverted from safari to citizen hunting as of 1987 (details in Chapter 3, section 3.2.1.2, page 62). By so-doing, all foreign exchange revenue has been foregone for these protected areas.

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[1] Specialist big game hunts include elephant hunts, buffalo hunts and leopard and lion hunts (Seymour-Smith, personal communications). For an hunt allocation example, see Appendix 16, page A109.

2.3.5. Critical summary and conclusions: Conflicting allocation principles, policies and practices

Farsighted legislation and sport hunting as an experimental land-use in Zimbabwe viewed wildlife and land in agriculturally marginal areas as economic resources. Successful conservation was achieved by giving land authorities rights as custodians to use, benefit from and thereby protect the resource and its ecological land base. Utilization and the right to benefit allowed these scarce and valuable resources to be priced using money at their highest marketable value. Wildlife in Zimbabwe was thus effectively turned from a public access and common property resource (ownerless) into an economically controlled access and private property (owned) resource, because economic values of wildlife to landowners greatly exceeded its costs of protection in this type of system. This economic principle of allocation has been endorsed by the DNPWLM and successfully applied on private land by landowners, on communal land by appropriate land authorities[1], on state owned forest land by the state Forestry Commission agency, on state owned private land by state agencies[2] - all based on **safari hunting** as the economically most valuable form of utilization.

In contrast to the above, section 2.3 on legislation, policy and practice has shown that economic principles of allocation have yet to be fully endorsed by the Zimbabwe Government and DNPWLM and consequently applied on land designated as Parks and Wild Life Estate - Zimbabwe's protected area system. The economic and social benefits of this land may be valuable in terms of conservation value, but the costs of protecting these valuable assets for Zimbabwe presently exceed the financial resources of the DNPWLM under this non-economic system.

Costs of enforcing protection, management and research for all protected areas are largely incurred by the DNPWLM, although donor-funding of endangered species protection is taking place.[3] Some costs are borne by persons leasing protected areas (safari operators and the ZHA). Increasingly, there are disturbing signs that many costs are being borne by society but remain unquantified. For example, the loss of endangered black rhinoceros and elephant species in protected areas[4], deforestation of protected areas[5], insufficient resources for

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[1] See the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe Trust, *et al.*, (1990) and Child and Peterson (1991) for some recent results.

[2] Two state agencies own significant tracts of private land in Zimbabwe with developed wildlife resources. The Agricultural Development Authority (ADA) owns 1'096km^2, whilst the Cold Storage Commission (CSC) owns 2'095km^2, both with wildlife potential (Price Waterhouse: Volume 5, 1992b: 38-42). Safari hunting occurs at present on ADA ranches (Zimbabwe Herald, 16.2.93).

[3] Zimbabwe Herald (6.2.93) reported that the DNPWLM had received a helicopter and materials worth Z$3 million.

[4] Press reports in Zimbabwe Herald issues: 15.12.92; 21.1.93 (editorial); 28.1.93; 22.2.93.

[5] Coates-Palgrave (in press) reported at a conference "Our endangered environment" on the 6.2.1992 that the Haroni and Rusitu Botanical Reserves (two areas protected for their bio-diversity) on the border to Mozambique had never been mapped on the ground by the DNPWLM, and had both been almost deforested of their former lowland tropical forest flora and fauna.

protection and management by the DNPWLM[1]). Due also to the lack of financial resources allocated to the DNPWLM budget by central government for conservation and development[2] in protected areas (Child and Heath, 1990), present and future generations in Zimbabwe arguably also bear the indirect costs of species loss, understaffed protection and management, and the lack of significant development and conservation benefits. These benefits may be significant, but are being foregone, that is not realized, despite the inherent economic and ecologically sustainable high value of wildlife and natural resource areas.

From an economic perspective, it would appear that conservation and development activities - such as sport hunting - in protected areas must adhere to ecological sustainability, as proposed by numerous environmentalists (eg. IUCN/UNEP/WWF, 1991; World Commission on Environment and Development, 1987). The activities in protected areas also needs to incorporate a further principle, that of financial sustainability, in order to become truly sustainable for present and future generations alike. Leaving ecological debts (deforestation) and financial debts (eg. Zimbabwe's national and foreign debt) is shifting the burden of present resource allocation to future generations to deal with.

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[1] In the press, Martin reported that the DNPWLM had insufficient funding to carry out an elephant culling exercise, and that the department had run out of funds (Zimbabwe Herald, 2.2.93). See also Zimbabwe Herald (20.1.93; 6.2.93). Child and Heath (1990): 223 report a declining real budget against growing commitments by the DNPWLM, and lack of funds. Earlier reports by Pittman focused on the lack of funds even earlier (Financial Gazette (Zimbabwe), 21.12.84).

[2] Of the total DNPWLM budget in 1991 (ZS33 million), 63% was planned for salaries and only 3.5% for capital expenditure (Parliament of Zimbabwe, 1991). Capital development expenditure by the department has not exceeded 10%, and has often been less than 5%, for DNPWLM budgets since 1980.

2.4. Zimbabwe's sport hunting: Land resources, licensing systems and their administration

2.4.1. Introduction

Zimbabwe's total land area of 390'310 km^2 is classified into four main categories, with the following areas and proportions:

Table 2.4 Zimbabwe's land classification, by landowner category

Land Category	Area	% of Zimbabwe
privately owned Commercial farm land	168'025 km^2	43.0%
state owned Communal farm land	152'038 km^2	41.9%
state owned Parks and Wild Life Estate	49'781 km^2	12.7%
state owned Forest land	9'378 km^2	2.4%
Total	**390'310 km^2**	**100.0%**

Source: Sayee (1987); DNPWLM list of promulgated Parks Estate, dated 1983; Adjustment made for a reduction in communal land area due to the increase in the Parks and Wild Life Estate since 1987.

As a result of the legal reforms for wild life management which were initiated in 1960 and culminated in the proclamation of the Parks and Wild Life Act in 1975, landowners on all categories of land in Zimbabwe were made responsible for the management of wildlife on their land.[1] On commercial land, the private landowner is authorized; on communal land, the state or the appropriate rural district council is authorized; on Parks and Wild Life Estate, the government Department of National Parks and Wild Life Management (DNPWLM) is responsible; on forest land, the government Forestry Commission is authorized.

In 1975, state controlled hunting licenses and license fees for wildlife were abolished for hunting activities. Appropriate land authorities were given the power to decide on hunting and issue licences. For areas hunted within the protected areas (Parks and Wild Life Estate) the DNPWLM remained responsible for licensing hunting. Thus the respective land authorities have had real economic incentives to conserve and manage wildlife on their land for their own benefit. Extensive restocking of suitable private and communal wild land with wildlife over the last 10 to 20 years has increased the potential supply of plains game quotas for utilization. Hunting is only one of these forms of consumptive utilization, but plains game quotas could become increasingly available for hunting on private land in the future.

As the government agency responsible for implementing the Act, the DNPWLM has attempted "to follow free market principles to the maximum extent possible" (Child and

[1] Historical reviews by: Tomlinson (1980); Cumming (1988); Child and Heath (1990).

Heath, 1990: 216). Certain sections of the policy documents also reflect these economic principles (see section 2.3.4, page 38), whilst policy and practice have excluded economic principles from allocating citizen hunting.

Sport hunting takes place on land in each of Zimbabwe's four land categories distinguished above. At present, all hunting alternatives supplied on land categories outside protected areas consist of safari hunting. Big game populations in these areas, together with those on forest land and areas hunted in the protected areas of the Parks and Wild Life Estate, form the core of the safari hunting industry. The supply of wildlife for safari hunting available on any land type in Zimbabwe is allocated using competitively determined market prices. Being commercial, the safari hunting allocation systems are termed safari operator marketing systems in this dissertation.

The potential and type of hunting offered on private land, forest land, and communal land will be briefly reviewed here, before sport hunting activities in Zimbabwe's protected areas are then considered in detail.

On private land, plains game species are used for safari hunting, together with big game quotas on state land which increases the hunt value to the private landowner. No data on the supply of citizen hunting on commercial farm land is available (White, personal communication), although the ZHA regularly advertises short, individual plains game hunts to association members.

On communal land, quotas comprise predominantly big game, but include plains game. Rural communities have opted for safari hunting to maximize the revenue from their wildlife resource base in the communal areas management programme for indigenous resources (CAMPFIRE). Safari operators tender for a lease on their land. To date, rural communities have not decided to use their wildlife resources for citizen hunting, either for their own benefit, or as a form of land-use and source of income.

On all other state owned land (forest areas, state owned private land) safari hunting, as the economically most valuable use of wildlife, is being developed.

2.4.2. Protected areas used for sport hunting: Location, area, licensing systems and administration

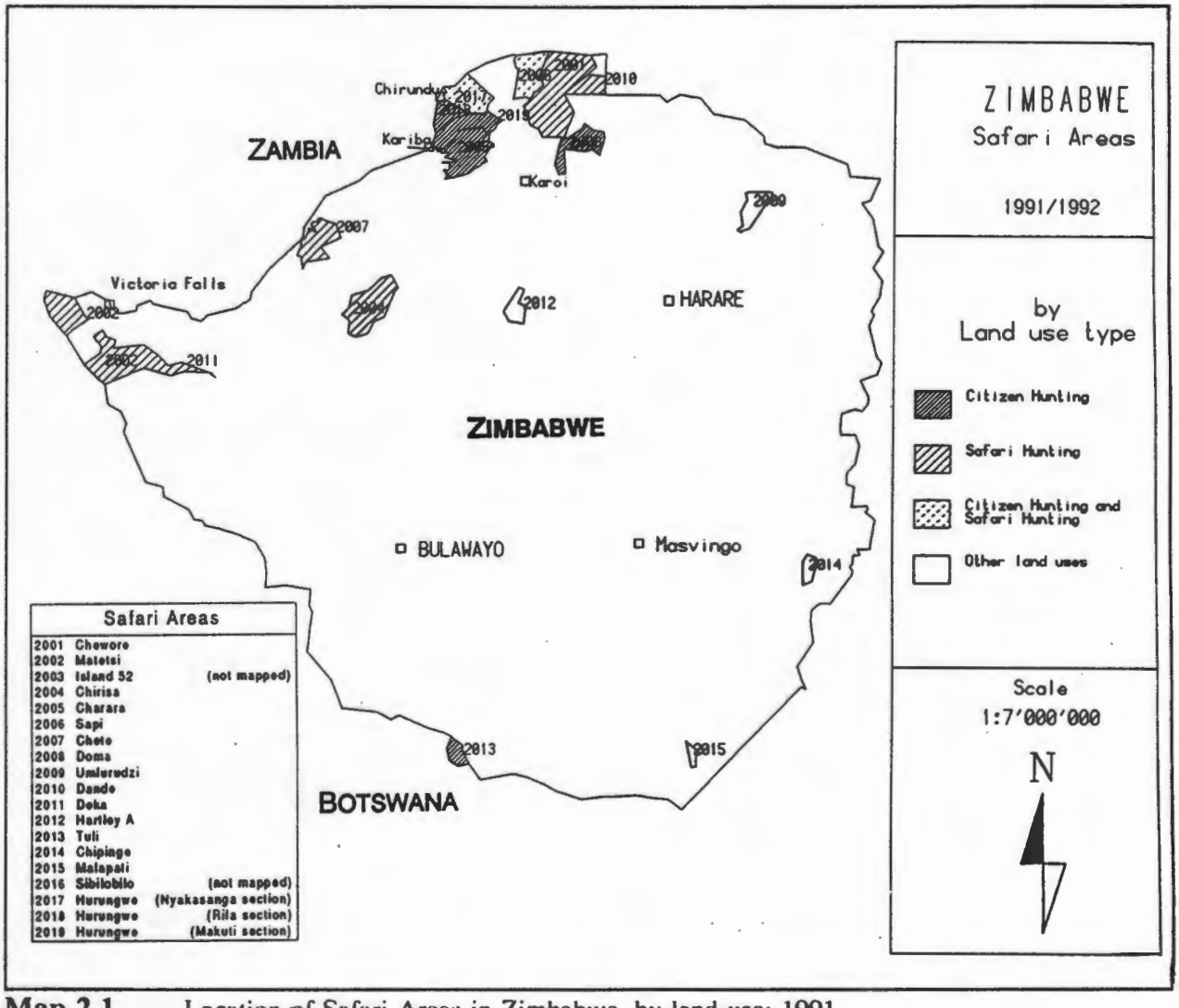
The Parks and Wild Life Estate covers almost 50'000 km^2, or 12.7% of Zimbabwe (see Table 2.4, page 45). It is divided into six classes of protected areas. Legislation currently permits sport hunting in only one category, known as Safari Areas. A total of 38% (18'963km^2) of the Parks and Wild Life Estate has been set aside as Safari Areas.

The purpose of designating Safari Areas is to provide for a wide range of outdoor recreational pursuits (Section 26, Parks and Wild Life Act 14 of 1975). These may range from

consumptive uses of wildlife, such as hunting and fishing, to any form of non-consumptive use, such as camping, photography, game viewing, bird watching . Although sport hunting as a land-use predominated in these areas historically, Safari Areas are not intended by legislation to be used solely for hunting, but are meant to be multi-purpose areas.

The research concentrates on populations of big game and dangerous game restricted to the category of protected areas known as Safari Areas, referred to as hunting areas in this dissertation. These species are arguably some of the largest, most spectacular and valuable of Africa's wildlife resources.

The location of Safari Areas within Zimbabwe and their current land-use is shown in Map 2.1, page 47. The extent of each Safari Area used for the three types of sport hunting (citizen hunting, citizen/safari hunting and safari hunting, as defined in section 2.1.7.2, page 19) and for other non-consumptive activities in each Safari Area is shown in Table 2.5, on page 48.



Map 2.1 Location of Safari Areas in Zimbabwe, by land-use: 1991

At present, 13% of all land in the Safari Area category is devoted to non-hunting activities. Sport hunting activities predominate in the remaining areas. **Safari hunting** takes place in over half (57%) of the land area set aside as Safari Areas. These areas are leased to commercial safari operators as exclusive hunting concessions.

Table 2.5 Extent of Safari Areas in Zimbabwe, by land-use: 1991

SAFARI AREA in km²	Land-use				
	SPORT HUNTING			OTHER USES	TOTAL
	Citizen Hunting	Safari Hunting	Citizen/Safari Hunting		
Charara Safari Area	570	954		167	1'691 9%
Chete Safari Area		1'081			1'081 6%
Chewore Safari Area		3'390			3'390 18%
Chipinge Safari Area				261	261 1%
Chirisa Safari Area		1'340		373	1'713 9%
Dande Safari Area		523			523 3%
Deka Safari Area		510			510 3%
Doma Safari Area	945				945 5%
Hartley "A" Safari Area				445	445 2%
Malapati Safari Area				154	154 1%
Matetsi Safari Area		2'955			2'955 16%
Hurungwe Safari Area	1'485		1'196	214	2'895 15%
- Rifa section	603				603 3%
- Nyakasanga section			1'196		1'196 6%
- Makuti section	882		1'180		1'180 6%
Sapi Safari Area			1'180		1'180 6%
Tuli Safari Area	416				416 2%
Umfurudzi Safari Area				760	760 4%
Sibilobilo Safari Area				44	44 0%
Island 52 Safari Area				0	0 0%
TOTALS	**3'416 18%**	**10'753 57%**	**2'376 13%**	**2'418 13%**	**18'963 100%**

Sources: Boundaries as legislated for Safari Areas according to Parks and Wild Life Act 14 of 1975, and amended at the 1st August 1990; Department of National Parks and Wild Life Management; Cumming (1988); Digitized topographical maps (Appendix 17, page A110), calculated to the nearest 1 km².

Citizen/safari hunting, open to both foreign and Zimbabwe citizen hunters, is offered on a further 18% of the land area in two areas: in part of the Hurungwe Safari Area called the Nyakasanga section, and in the Sapi Safari Area. The allocation of hunts takes place using an auction system administered by the DNPWLM. The licensing system in both hunting areas is termed the DNPWLM auction system for Nyakasanga/Sapi (see Table 2.6, page 49).

The remaining 18% of the Safari Areas is allocated to *citizen hunting*. Citizen hunting is administered using three licensing systems, and each system applies to different hunting areas. The DNPWLM allocates citizen hunting using a lottery in the Charara/Makuti study area, which comprises portions of two separate Safari Areas: one portion of 570km² is situated within the Charara Safari Area, the other of 882km² is situated within the Makuti Section of

the Hurungwe Safari Area. Together, they comprise the Charara/Makuti hunting area and cover 1'452km^2. This allocation system is termed the DNPWLM lottery system for the Charara/Makuti hunting areas (see Table 2.6, page 49).

Citizen hunting is administered secondly by the Zimbabwe Hunters' Association (ZHA). The organisation allocates citizen hunting to members using a lottery system for three hunting areas: part of the Hurungwe Safari Area called the Rifa section, Doma Safari Area and Tuli Safari Area. These licensing systems are termed the ZHA lottery system for Tuli/Doma/Rifa hunting areas (see Table 2.6, page 49).

In the third system, the DNPWLM allocates citizen hunting of impala using a tender system at a hunting camp called Dandawa, located in the Nyakasanga section of Hurungwe Safari Area. This licensing system is termed the DNPWLM tender system for Dandawa.

Table 2.6 summarizes the licensing systems that allocate citizen hunting in Zimbabwe's protected areas.

Table 2.6 Licensing systems allocating citizen hunting in Zimbabwe's protected areas

Administrative Agency	Type of Allocation System	Hunting Areas	Type of Sport Hunting
DNPWLM	lottery system	Charara hunting area	Citizen Hunting
		Makuti hunting area	
ZHA	lottery system	Tuli hunting area	Citizen hunting
		Doma hunting area	
		Rifa hunting area	
DNPWLM	tender system	Dandawa in Nyakasanga hunting area	Citizen hunting
DNPWLM	auction system	Nyakasanga hunting area	Citizen/Safari hunting
		Sapi hunting area	

2.5. Citizen hunting in Zimbabwe: Supply and demand dynamics

2.5.1. Supply of citizen hunting in protected areas

The number of citizen hunters that could be accommodated by the hunts supplied in protected areas is shown in Table 2.7. The table summarizes data from Chapter 3, where each system is reviewed separately. The calculation is based on the number of hunts and maximum number of hunters allowed per hunting party.

Table 2.7 Supply of citizen hunting in protected areas (Safari Areas): 1991

Licensing System	Hunting Area	Number of Hunts (hunting parties)	Hunters per Hunt	Total Citizen Hunters
DNPWLM lottery system for	Charara	40	2	80
	Makuti	60	2	120
ZHA lottery system for	Tuli	26	4	104
	Doma	10	4	40
	Rifa	39	4	156
DNPWLM tender system for	Dandawa	30	2	60
DNPWLM auction system for	Nyakasanga	42	2	84
	Sapi	30	2	60
Totals		**277**		**704**

A total of 277 predominantly big game trophy hunts of various types, are available to accommodate a maximum of 704 Zimbabwe citizen hunters.

2.5.2. Demand for citizen hunting protected areas

Data on the number of hunters participating in hunting in Zimbabwe are limited. Describing the early development of sport hunting, Cumming (1988) reports between 86 and 213 participating sport hunters on state land in 1969 to 1973. An increase in the number of participating non-resident (foreign) hunters from 36% to 47% is noted for the same period. Further data after 1973 is not available. These figures do not indicate demand, ie. the number of people willing to pay a certain price to hunt in Zimbabwe (Samuelson, 1973). Demand would include those hunters who applied to hunt, and could not participate, and should be related to the price of hunting.

No estimate has been made to date of the type and size of the demand for hunting and its benefits (trophy, venison, recreation) in Zimbabwe. The author considered using a questionnaire to surveying demand for each type of hunting in Zimbabwe, but the method

exceeded the scope of the dissertation and the available financial resources to conduct it in rural areas[1].

Three methods were used to gather information on the demand for citizen hunting by Zimbabweans. First, a few Zimbabwe hunters were questioned informally. Qualitative information was sought, in preference to quantitative data. Second, the actual number of citizen hunters who demanded hunts in 1991 was quantified using licence data. The third method estimated the number of Zimbabweans who potentially qualify as citizen hunters, based on available income distribution data.

2.5.2.1. Demand perceptions by citizen hunters

A limited number of Zimbabwean hunters were interviewed to gather qualitative information on Zimbabwe citizen hunter's expectations. Their experiences and suggestions for improving the DNPWLM lottery system for Charara/Makuti used in 1991 were sought.

The interviewed hunters (Appendix 3, page A27) were selected according to their sport hunting experience and their membership in the Zimbabwe Hunters' Association. Interviews lasting on average half an hour were conducted by appointment at the hunter's place of work during working hours, on an informal basis. The initial questions asked were general (Appendix 4, page A27), in order to give the interviewee scope to elaborate on his personal experiences, after which more specific follow-up questions attempted to find out particular motives for hunting, expectations of the hunting bag and infrastructure in particular areas, and any suggestions for improving any aspect of hunt allocation.

The summarized results of the hunter interviews are as follows:

- The motives for hunting ranged from being dedicated to the sport of trophy hunting, enjoying the venison, and to seeking the hardships, relaxation, and bush-life experience.
- Sport hunting activities are undertaken in tightly knit groups of people. The combined application by several hunters for a hunt, and subsequent sharing of costs and participation in the camp activities is common practice.
- Hunters were well aware of the economic value of venison from game; hunters plan their hunting trip to make full use of the value of the animals on quota, frequently selling venison to recover some costs of the hunting trip on their return.
- No hunter was fully aware, or informed, about the licensing systems available to citizen hunters in Zimbabwe. Hunters not well informed about how to apply for the hunting opportunities, or how individual licensing systems worked.
- Hunters were very dissatisfied with the DNPWLM lottery system for Charara/Makuti from experiences in 1991 and previous years. They felt the system

[1] The cost of a household survey of 1'000 people (660 rural, 250 high density urban, 90 low density urban interviews) by a local market research institute was quoted at Z$60'000.

was particularly unsatisfactory since the latest changes made to the system in 1991.

- One interviewed hunter who had hunted for over 20 years, further specified his displeasure with the lottery system for Charara/Makuti in 1991. He stated that the hunting bag he had been allocated by the lottery draw had not included a major trophy animal, and he admitted that it was not worth his while to pay for the hunt, or to go hunting, and he forfeited his right to hunt.
- Hunters who had experience of the hunting camps in the ZHA lottery system for the Rifa hunting areas stated that the lack of facilities and infrastructure in the Charara/Makuti area made it more expensive and less attractive for a hunting party to go there. Items mentioned that were lacking included: slaughter facilities, meat drying facilities and water availability for the camp.
- All hunters either volunteered the information, or agreed when prompted, that the DNPWLM lottery system for Charara/Makuti (1991 version) did not allow applicants to choose any of the important hunt characteristics. Those mentioned included: the hunting bag, the hunt price, the hunting dates.
- Hunters emphasized that hunting for sport was an expensive recreation in terms of money, and time. A hunter has to take leave from his workplace for the hunting period (six days for Charara/Makuti hunts). This means that only persons in higher salaried positions could afford to hunt, or could take a week's unplanned leave during the year for the hunt they had been allocated in the DNPWLM lottery system in 1991.

2.5.2.2. Estimating present demand for citizen hunting in protected areas

In the following, the present number of citizen hunters in protected areas is estimated based on known hunting applicants. For the DNPWLM auction system, the number of participants was not available; instead, the number of hunts actually bought by citizen hunters is used. For the DNPWLM tender system application data was not available from the Harare licensing office, and an assumption is made (Tavona, personal communication).

For 1991, the number of Zimbabwe citizens demanding various types of big game hunts in Zimbabwe is estimated in Table 2.8, page 53. At minimum, about 1'000 Zimbabwe citizens demanded hunts in protected areas in 1991. Prices for the hunts varied considerably, depending on the licensing system used (market-priced or fix-priced), the species composition of the hunting bag (big game or plains game, trophy or non-trophy species) and the presence of foreign hunters (eg. in Nyakasanga and Sapi hunting areas). Hunt prices ranged between Z$18'000 and Z$1'000 per hunt. The table summarizes data from Chapter 3, where each licensing system is reviewed separately.

Table 2.8 Estimated present demand for citizen hunting in protected areas (Safari Areas): 1991

Licensing System	Hunting Area	Applicants/ Members/ Hunts		Notes	Citizen Hunters
DNPWLM lottery system for	Charara/Makuti	196	a)	52% were also members of the ZHA with access to Tuli/Doma/Rifa	98
ZHA lottery system for	Tuli/Doma/Rifa	702	m)	Hunting members of ZHA	702
DNPWLM tender system for	Dandawa	30	h)	Applicant data not available. Assumed 3 applicants applied for each of 30 hunts available	? 100
DNPWLM auction system for	Nyakasanga	42	h)	Data on bidders not available. 25% of hunts sold to Zimbabwean hunters.	? 10
	Sapi	30	h)	Data on bidders not available. 25% of hunts sold to Zimbabwean hunters.	? 8
Totals					**918**

a) Applicants demanding hunts.
m) Hunting members registered with the Zimbabwe Hunters' Association.
h) Number of hunts supplied by system.

2.5.2.3. Estimating potential demand for citizen hunting in Zimbabwe

Potential demand for hunting by Zimbabwe citizens was estimated using data on income distribution by wage category, as reported by the Central Statistics Office (Zimbabwe Government, 1988b). Although the author is aware of the shortcomings and tentative nature of these data on income distribution, comprehensive data is not available. It is frequently reported that Zimbabwe has a very unequal income distribution (see World Bank, 1992: 592; Zimbabwe Government, 1986: 19-27). For the purpose of estimating a maximum number of persons who would qualify by their reported gross income alone to spend between Z$11'000 and Z$28'000 for a big game hunting trip (see section 2.1.1, page 13), the data quality was judged to be adequate.

In 1985, the highest wage category distinguished by the survey was for "urban high income households" with an average income of Z$10'100 per annum, or greater. This wage category represents the minimum gross income that might allow a person a disposable income high enough, to afford the expensive sport of hunting big game. This income level in 1985 prices was adjusted to 1991 prices by multiplying it with the rise in the consumer price index for higher income urban families (taken from Zimbabwe Government, 1991a). Between 1985 (index 198%) and 1991 (index 409%) the index rose by 211%. The urban high income thus represented households earning on average about Z$21'000 per annum in 1991, or greater. In rural areas in Zimbabwe, average income is lower by several orders of magnitude compared to urban centres.[1]

[1] For the Omay communal land in the Zambezi valley during the period 1984-1985, Reynolds (1991: 31) calculated a total annual income for 12 families of Z$5'930, or about Z$500 per annum per household.

The urban high income household category represents 14% of all households surveyed (Zimbabwe Government, 1988b). Taking this proportion to be representative for Zimbabwe's whole population of 10.4 million (1992 census), a total of 1.4 million citizens (14%) would be in this highest income category and earning over Z$21'000 per annum.

Of these persons, what proportion are sport hunters? Dagg (n.d.) reports that hunters constitute between 0.18% and 8.5% of the total population for various European countries, and America respectively. In the absence of similar baseline data from the southern African countries, it is assumed here for Zimbabwe that sport hunters represent a maximum of 5% (about 72'000 persons), or a minimum of 0.2% (or 1'400 persons) of this country's so-calculated highest income category.

Therefore, it is estimated that in Zimbabwe there are potentially a maximum of 72'000 citizen hunters (or less than 100th of the total population), and potentially a minimum of 1'400 citizen hunters (or more than 10'000th of the total population). The minimum estimate of potential citizen hunters compares closely with the 1'000 estimated actual number of citizen hunters in Zimbabwe for 1991. Evidently citizen hunting is a sport that only very few Zimbabweans actually engage in at present, and potentially could engage in, due to the high cost of a hunting trip.

2.6. Resource allocation, protected areas and development in Zimbabwe: A national perspective

2.6.1. The status: Selected development indicators for Zimbabwe

Table 2.9 summarizes selected indicators of Zimbabwe's current development status. The table reflects that Zimbabwe is a "typical" developing country, with a rapidly growing population, a stagnating economy, and large foreign and public sector debts.

2.6.2. The priorities: Conservation, development and markets

The economic and social development priorities for Zimbabwe are outlined clearly in documents announcing ESAP, Zimbabwe's Economic Structural Adjustment Programme (Zimbabwe Government, 1991b); Zimbabwe Government, 1990c). The key areas for action listed are:

- Earning foreign exchange by promoting economic export activity and investment;
- Creating employment, income and wealth;
- Reducing the Zimbabwe government's budget deficit and the national debt;
- Reducing Zimbabwe's balance of payments deficit and the national foreign debt;
- Promoting a dynamic market-oriented economy, with less government involvement.

The documents also emphasise that Zimbabwe's economic development priorities must take place within the limits of natural resource sustainability.

Table 2.9 Indicators of Zimbabwe's socio-economic development

Source				
	Demographic and Economic:			
a) b) c)	Population Total Growth rate (%)	9.5 10.4 3.13	million million p.a.	6.1989 8.1992
d)	Land area	391'000	km^2	
e) f)	Gross National Product (GNP) per capita Growth rate per capita (%)	650 1.2	US$ p.a. p.a.	1990 US$
g) h) i)	Inflation rate (%)	5.8 11.0 40	p.a. p.a. p.a.	1965-80 1980-89 1992
j)	Life expectancy	64 years		1989
k) l) m)	Foreign debt Total in terms of Exports in terms of GNP	3'088 170% 54%	million US$	1989 US$ 1989 1989
n) o)	Public expenditure in terms of GNP Public deficit in terms of GNP	41% 9.1%		1989 1989
p)	Median income per Household	Z$2'600		1990/91
q)	Mean income per Household	Z$5'300		1990/91
r)	Mean Household size	4.8	persons	
s)	Urban low-density income per Household in terms of total population	Z$11'500 22%	p.a.	1990/91
u) v)	Urban high-income total income per Household Total in terms of total population	1985: Z$10'100 14 %	1991: Z$21'000	
	Protected Areas:			
w)	Parks and Wild Life Estate Total area in terms of total land area	49'781 12.7%	km^2	1991
	Sport Hunting in Protected Areas:			
x)	Total Area for Sport Hunting in terms of all protected areas	16'545 33.2%	km^2	1991
	Income Distribution in Zimbabwe's population:			
y)	Mean Household income bracket p.a. Total persons in terms of total population	≥ Z$21'000 1.4 million 14%	< Z$21'000 9 million 86%	1991 Z$
	Sport hunters in Zimbabwe's population:			
z)	Estimated active number Total Citizen Hunters in terms of total population	1'000 0.01%		1991
aa)	Estimated potential number Total Citizen Hunters in terms of total population	1'400 - 70'000 0.01 - 0.6%		1991

Sources: World Bank (1991) [for a), d), e), f), g), h), j), k), l), m)]; 1992 Census of Zimbabwe [for b), c)]; Zimbabwe Government (1988b) [for u), v), y)]; First Merchant Bank (1992) [for i)]; Stenflo (1992) [for p), q), r), s)]; DNPWLM protected areas [w)]; Table 2.5 [for x)]; Table 2.8 [for z)].

2.7. Conclusions and progression of study

Sport hunting activities, of which citizen hunting by Zimbabweans is one type, are not a basic human need. Citizen hunting is an expensive luxury practised by an estimated 1'000 persons in Zimbabwe in 1991. A citizen hunt costs between Z$11'000 and Z$28'000 to undertake, although these expenses may be shared out amongst members of the hunting party. An important component of citizen hunting is the number of non-hunters in a hunting party who benefit from the hunter's right of access to the protected area, and undertake a wide range of non-consumptive (recreational) activities as a result.

Citizen hunting encompasses hunters who may be interested in two very different types of hunts: trophy hunters, who are willing to pay high prices for quality big game and plains game trophy hunts, and venison hunters, who are mainly interested in hunting for the venison meat but are prepared to pay less than trophy hunters.

By national income standards for Zimbabwe's population, however, citizen hunters must be amongst the wealthiest segment of the population to afford to hunt big and plains game in protected areas. This is because the available hunts consist of a hunting bag with several animals and species to be hunted over a 7 to 10-day period, which requires hunters to be take leave from work for this time period. The bags include at least one major big game species - the most expensive and valuable species of African wildlife.

This chapter showed that citizen hunting in Zimbabwe is allocated using a variety of licensing systems under different institutional arrangements. The majority of citizen hunters benefit from hunts offered by the DNPWLM or the ZHA using different versions of a lottery system at fixed prices. Policy relating to citizen hunting and resource allocation principles stands in direct conflict with the economic approach that has otherwise been encouraged by the DNPWLM for the economic allocation and valuation of wildlife, and land-use, for safari hunting at market prices on all other land inside and outside protected areas.

The concept of using a lottery to give Zimbabwe citizens an "equal opportunity" to benefit from citizen hunting - termed equality in this dissertation - can be expected to be difficult, and costly to achieve in practice. Foreign exchange, a resource of top priority for Zimbabwe's declared national economic and social development goals, is being foregone outright by allocating certain hunting areas exclusively to Zimbabwe citizens.

Chapter 3 following gives a technical review of licensing system alternatives in Zimbabwe and other countries. The procedures used by lottery systems to allocate hunts are considered in detail, and compared. Additional licensing systems used in other countries are reviewed briefly.

Because of indications given by hunters interviewed in Zimbabwe and data from Chapter 3, the DNPWLM lottery system hunt allocation was known to be problematic in 1991.

Chapter 4 assesses the lottery system's efficiency and equality. Chapter 5 then assesses the DNPWLM lottery system for the Charara/Makuti study area comparatively against other Zimbabwe licensing systems to establish some of the principle opportunity costs of using a lottery at fixed prices, rather than market prices, to allocate resources.

CHAPTER 3
REVIEW OF LICENSING SYSTEM ALTERNATIVES

3.1. Introduction

This chapter describes five licensing systems that allocated sport hunting during 1991 in Zimbabwe. Three of these systems supplied hunting exclusively to Zimbabwe citizen hunters (citizen hunting); one system supplied hunting to both Zimbabwe citizens and foreign hunters (citizen/safari hunting); one further system markets internationally competitive hunting only to foreign hunters (safari hunting). A brief description of three further systems supplying sport hunting in other countries follows, highlighting aspects that differ to the Zimbabwean allocation systems.

Table 3.1 below shows the alternatives reviewed in this chapter.

Table 3.1 Zimbabwean and foreign licensing systems reviewed

Administrative Agency	Type of Allocation System	Hunting Areas	Prices set by:	Report Section
Zimbabwean licensing systems:				
DNPWLM (agency)	lottery system	Charara hunting area Makuti hunting area	fixed by Government in Z$	3.2.1
ZHA (association)	lottery system	Tuli hunting area Doma hunting area Rifa hunting area	based on Government, fixed by ZHA in Z$	3.2.2
DNPWLM (agency)	tender system	Dandawa in Nyakasanga hunting area	competitive tenders in Z$	3.2.3
DNPWLM (agency)	auction system	Nyakasanga hunting area Sapi hunting area	competitive bidding by applicants in Z$	3.2.4
Safari Operator (private enterprise)	marketing system	Charara/Makuti hunting area	internationally competitive and commercial	3.2.5
Foreign licensing systems:				
Wyoming Game & Fish Department (agency)	lottery system	state and private land in Wyoming state, U.S.A.	fixed by Government	3.3.1
NPB (agency)	lottery system	Mkuzi and Spioenkop hunting areas, South Africa	fixed by Government	3.3.2
Ciskei Safaris (private enterprise)	first-come-first-served system	various hunting areas in Ciskei, South Africa	locally competitive and commercial	3.3.3

As indicated in Table 3.1, each system regulates sport hunting activities in one or more hunting areas. Each Zimbabwean licensing system is first introduced with a location map of the hunting area in Zimbabwe. Each system's allocative functions are then reviewed

according to the framework for licensing systems introduced in Chapter 2 (see Figure 2.3, page 23). The description follows the sequence of functions proposed by this framework. The lottery systems are a complex allocation method, and are reviewed in some detail (the DNPWLM, ZHA and Wyoming lottery systems). Their hunt allocation procedures are compared and contrasted to reveal the type of "fairness" attained by each lottery.

According to the framework, each licensing system's major components are:

- the quota (species, sex and composition);
- the quota allocation to hunts (hunting bag, hunting period, hunting dates);
- the pricing of hunts (at fixed prices or market prices);
- the demand for hunts by applicants;
- the procedure that allocates hunts to applicants (is personal choice possible?);
- the procedure that re-allocates any surplus hunts after the first allocation procedure;
- facilities available to hunters at campsites and hunting rules.

Detailed data for each licensing system are included in appendices, to which the reader is referred throughout the chapter. This data has been organised according to the order in which licensing systems are reviewed here, with the following categories:

- Quota allocations to hunts (Appendices 2.1 to 2.7.2);
- Fixed prices for each species sold by lottery systems, set according to the government trophy fee schedule (Appendix 8);
- Prices of each hunt sold to hunters (Appendices 7.1 to 7.7.2);

For the hunts sold by a safari operator marketing system details on the quota allocations, prices charged and hunt prices are shown separately (Appendix 16, page A109).

Two foreign licensing systems emphasize venison hunting of plains game rather than trophy hunting of big game and plains game. Examples of their hunts and hunt prices are also included in appendices:

- for the NPB lottery system, see Appendix 15.1;
- for the Ciskei first-come-first-served system, see Appendix 15.2.

For a summary of the Zimbabwean systems and the Wyoming lottery system, readers are referred to the final section of this chapter. The market model presented in Chapter 2 (Figure 2.4, page 27) is applied in turn to summarize each licensing system. The specific economic model shows the different ways that licensing systems:

- Limit the number of applicants demanding hunts to the fixed supply;
- Distribute the available hunt variety amongst hunting applicants according to some rule (eg. personal willingness to pay, or probability);
- Price hunts using fixed, or market prices.

Finally, each alternative's main aspects are summarized in point form.

3.2. Review of Zimbabwe's licensing systems

3.2.1. The DNPWLM lottery system for Charara/Makuti

3.2.1.1. The Charara/Makuti study area

The Charara/Makuti study area is part of two protected areas of the Parks and Wild Life Estate in northern Zimbabwe: the Charara Safari Area and the Makuti Section of Hurungwe Safari Area. The general terrain is very rugged as the escarpment descends from the plateau to the Zambezi valley and the eastern shores of Lake Kariba. The Charara/Makuti study area is mapped as a foldout in Appendix 20, page A113.

The boundaries of the Charara/Makuti study area are complicated by the fact that three areas exist that are utilized differently for hunting and non-hunting activities within the two protected areas, namely:

- The Charara/Makuti hunting area is administered by the DNPWLM for citizen hunting;
- The Kuburi Wilderness Area is zoned as a non-hunting area, leased by the DNPWLM to the Zimbabwe Wildlife Society for recreational development;
- The area situated south of the game fence within the remaining portion of Charara Safari Area is leased by the DNPWLM to a safari operator for safari hunting.

The portion known as the Charara/Makuti citizen hunting area is indicated on the map (Appendix 20, page A113) by wide diagonal hatching. The Zambezi escarpment forms a natural boundary to the north, running in a north-easterly direction. The game-proof veterinary control fence forms a physical boundary to the south. It runs in a north-easterly direction, bisecting the entire Charara Safari Area from southwest to northeast. The main road along the watershed from Makuti to Kariba defines the boundary between Charara Safari Area and the Makuti Section of Hurungwe Safari Area.

The Kuburi Wilderness Area is indicated on the same map by narrow vertical hatching. The unshaded area between the game-proof veterinary control fence and the cattle-proof veterinary control fence, which forms the southernmost boundary of the Charara Safari Area, is leased to a safari operator for safari hunting.[1] The two metre high game-proof fence is well maintained by the Tsetse and Trypanosomiasis Control, and prevents any movement of any wildlife between the southern part used for safari hunting and the northern parts used for citizen hunting and tourist development.

The government Department of Veterinary Services is currently substituting the existing cattle-proof veterinary control fence on the southern border of Charara Safari Area for a buffalo-proof fence with the aim of controlling the spreading of foot-and-mouth disease to

[1] The author is grateful to Cunliff (personal communication) for this point, later confirmed as Vadoma Safaris by Meyer (personal communication).

cattle south of the fenceline (Hargrieves, personal communication). Once this work reaches the eastern boundary of the Charara Safari Area, near the section marked "Provisional fence alignment" on the foldout map (see Appendix 20, page A113), the present game-proof fence bisecting the Charara Safari Area will be removed in its entirety. This can be expected by the end of 1993 at the earliest (Flanagan, personal communication). The removal of the game-proof fence will have important consequences for the future planning, vegetation and wildlife management in the area, as well as for Charara's consumptive and non-consumptive utilization potential. Management actions of particular importance will be those concerning *Brachystegia* woodland management in the escarpment, early burning programmes[1] and elephant population management. Deforestation of the woodland is documented clearly by aerial photographs[2] for the fence section that crosses the main road between Vuti and Makuti.

3.2.1.2. Introduction to licensing systems used in Charara/Makuti

Charara was designated as a Safari Area in 1975.[3] Until the end of 1986, all of Charara Safari Area was leased to professional safari operators for big game trophy hunting (with interruptions during the war in the early 1980's). Since 1987, the area's land-use has been split into the three categories mentioned above. Until 1986, all of the Makuti Section of Hurungwe Safari Area was allocated for citizen/safari hunting. Since then, this area has been given over to hunting exclusively for Zimbabwe citizens.

For the remainder of the report, "Charara/Makuti study area" refers only to those parts of Charara and Makuti that are presently used for citizen hunting.

The licensing systems used to regulate citizen hunting in Charara/Makuti are administered by the DNPWLM. Since citizen hunting was introduced in 1987, the lottery system has been altered three times.

The **first version (1987-1989)** of the lottery system allowed each applicant to purchase unlimited numbers of lottery tickets, at Z$20 per ticket. Applicants submitted a preference list of animals (species, and numbers of animals) and were able to compose their own hunting bag, based on personal choice and a fixed trophy price for each species in the bag.

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[1] For the problem and management of *Brachystegia* woodland in the escarpment, see: Zimbabwe Government (1989b) and Robertson (in press). For practical early-burning recommendations, see Robertson (n.d.).

[2] See 1:25'000 aerial photographs for the years 1973 (Kariba North: Nos. 607, 658, 660, 714, 716); 1981 (Bumi Hills/Kariba: Nos. 530, 592, 593, 654, 655); and 1989 (Bumi Hills/Kariba: Nos. 522, 582, 584, 648, 649), obtainable from Surveyor General Department, PO Box 8099, Causeway, Harare, Zimbabwe.

[3] Parks and Wild Life Act (Act No. 14 of 1975), fourth schedule to section 27, item 5. The area first designated was 170'000 ha, which has subsequently been altered to 169'000 ha in 1979, to 169'214 ha in 1981, and most recently to 169'200 ha in 1983. Historical and administrative details for the area are documented by Hutton (1991): 25-31.

For this version, an arbitrary number of tickets were drawn randomly by hand, the applicants identified, and their preference lists consulted. Animals on a winner's preference list was allocated on a first-drawn, first-served basis. As each animal was allocated, it was struck off, animal by animal, from the species quotas set by the DNPWLM for the Charara/Makuti area, until the whole quota was allocated. Ticket winners who were drawn at the beginning of the lottery received their full preference list of animals, while those drawn later had to make do with those animals that remained. Some winners, however, could not be allocated any game at all, causing dissatisfaction amongst applicants (Drury, personal communication). Although applicants had won the right to hunt in the lottery, no hunting bags were defined prior to the draw. Consequently, the fixed supply of animals on quota ran out before the last hunter was drawn. This problem was addressed in the second 1990 version of the lottery system.

The first version allowed hunters to access the hunting area at any time during the hunting season, without prior arrangement. Because all hunters on state land in Zimbabwe must hunt accompanied by a DNPWLM staff-member, for control and personal safety of the hunter, difficulties arose when the number of unannounced hunting parties exceeded the available personnel. Some hunters benefitted from this system of multiple entry, in that they were able to complete the quotas remaining unshot from their first hunting trip at their leisure during the hunting season.

In 1990, this lottery system was modified slightly for the **second version (1990)**. Using the total species quota set for Charara/Makuti, fifty hunting bags were defined prior to the lottery, each valued at fixed prices for each species, as set by the government schedule. Once more, applicants bought an unlimited number of tickets for the right to hunt. The fifty winners who were drawn in the lottery were thus guaranteed a hunting bag. Winners of this 1990 lottery system were allotted hunting bags by the DNPWLM, and could not choose according to their personal preferences. The hunting bag's species, animal numbers, and total value were not known to hunters until they were notified of their successful draw. This lack of choice again caused dissatisfaction amongst hunters (Drury, personal communication). Some hunters chose to forfeit their right to hunt by not paying for their bag to obtain a hunting licence (personal observation, Harare licensing office). As before, hunters who did take up the hunt had unrestricted access to the hunting area during the entire hunting season.

The lottery system was modified a third time for the 1991 hunting season. The dissertation and the remainder of this section analyze the **third version (1991)** of the DNPWLM lottery system.

3.2.1.3. The DNPWLM lottery system for Charara/Makuti (1991)

Hunts were allocated in two distinct stages to applicants. The components involved in the first stage allocation by lottery are depicted in Figure 3.1, page 65, marked as "First stage hunt allocation by DNPWLM lottery system". Components involved in the second stage first-come-first-served allocation are depicted on the overlay to the same diagram, marked as "Second stage hunt allocation by DNPWLM first-come-first-served system (Overlay)". The first stage DNPWLM lottery system is now described in chronological order of the components in Figure 3.1. (For the second stage, see page 69.)

- **Quota allocation to hunts:**

The 1991 sport hunting quota for the Charara/Makuti study area was almost identical to that of previous years. It comprised a high proportion of big and dangerous game[1], and included good numbers of trophy and non-trophy buffalo, a particularly valuable and sought after trophy species in the safari hunting industry.[2] Instead of fifty hunts, as in the 1990 version, 100 hunts were defined prior to the lottery: 40 hunts in Charara hunting area (Appendix 2.1), and 60 hunts in Makuti hunting area (Appendix 2.2). The size of the hunting bag for each hunt was consequently much reduced. The hunts were mainly buffalo hunts, with either a trophy or a non-trophy buffalo as the main animal. Each hunt in Charara/Makuti had a hunt number that was linked to the hunting area (C1 to C40 for Charara, M1 to M40 for Makuti), lasted 6 days between specified dates for the pre-defined hunting bag.

- **Pricing of hunts:**

Hunts were priced by valuing each animal in the hunting bag at the fixed price set for each species and sex in the government trophy fee schedule for local hunters (see Appendix 8, page A77). Table 3.2 shows the maximum and minimum range of total hunt prices for the 100 citizen hunts available in the Charara/Makuti hunting areas.

Table 3.2 Maximum and minimum hunt prices in Charara/Makuti hunting areas: 1991

in Z$	Maximum Price	Minimum Price
Total hunt price	7'749[a]	281[b]
Average hunt price per hunter	3'875	140
Average hunt price per hunter per hunting day	646	23

a) Hunt C8, six hunting days.
b) Hunt C39, six hunting days.

Source: Charara/Makuti hunt prices calculated in Appendix 7.1 (page A49), and Appendix 7.2 (page A53).

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1 For definition of hunting terms, see Glossary, page xxi.

2 See analysis by Child, B., in Zimbabwe Government (1984b).

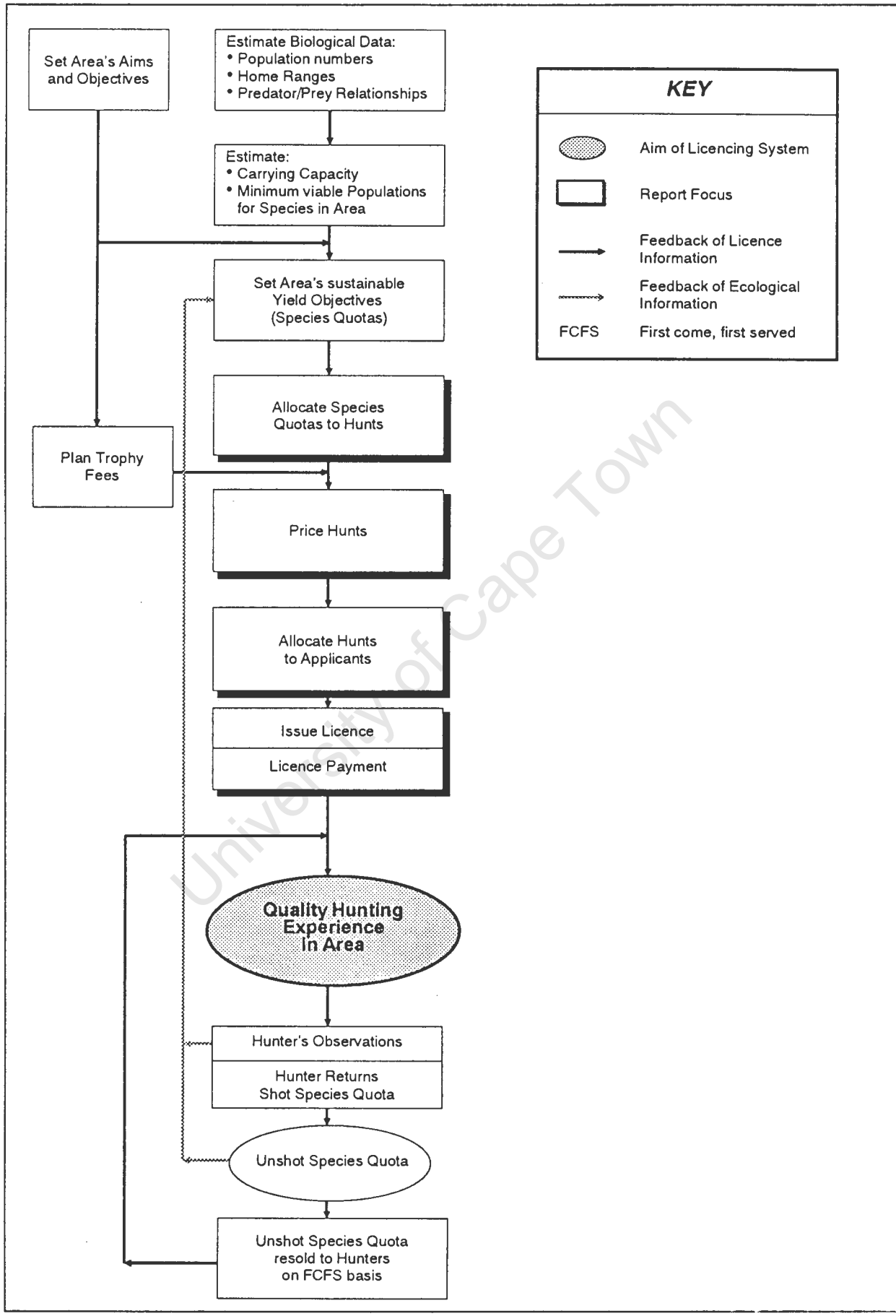


Figure 3.1 Components of the two-stage hunt allocation for Charara/Makuti study area **First stage** hunt allocation by the DNPWLM lottery system.

Desktop publishing assistance by J. King is gratefully acknowledged.

By allowing for a maximum of two hunters who can share a hunt (1 hunter and 1 co-hunter), each hunter's average contribution towards the hunt price, and towards the hunt price per hunting day, is shown. Since most hunting bags contained a buffalo as their principal quota, most hunts sold for between Z$700 and Z$1'000 (see Figure 3.2 and Figure 3.3), except for those hunts with a trophy bull elephant which has a trophy price of Z$7'500 alone.

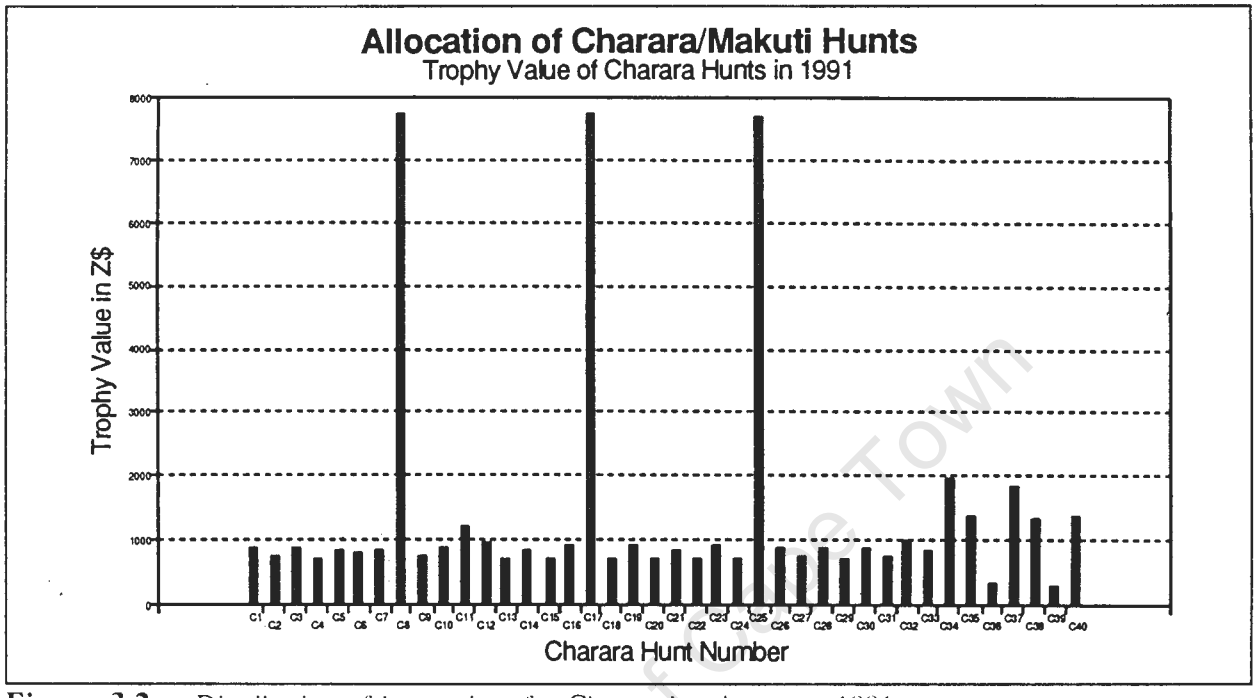


Figure 3.2 Distribution of hunt prices for Charara hunting area: 1991

Source: DNPWLM hunt valuation for Charara, Appendix 7.1, page A49.

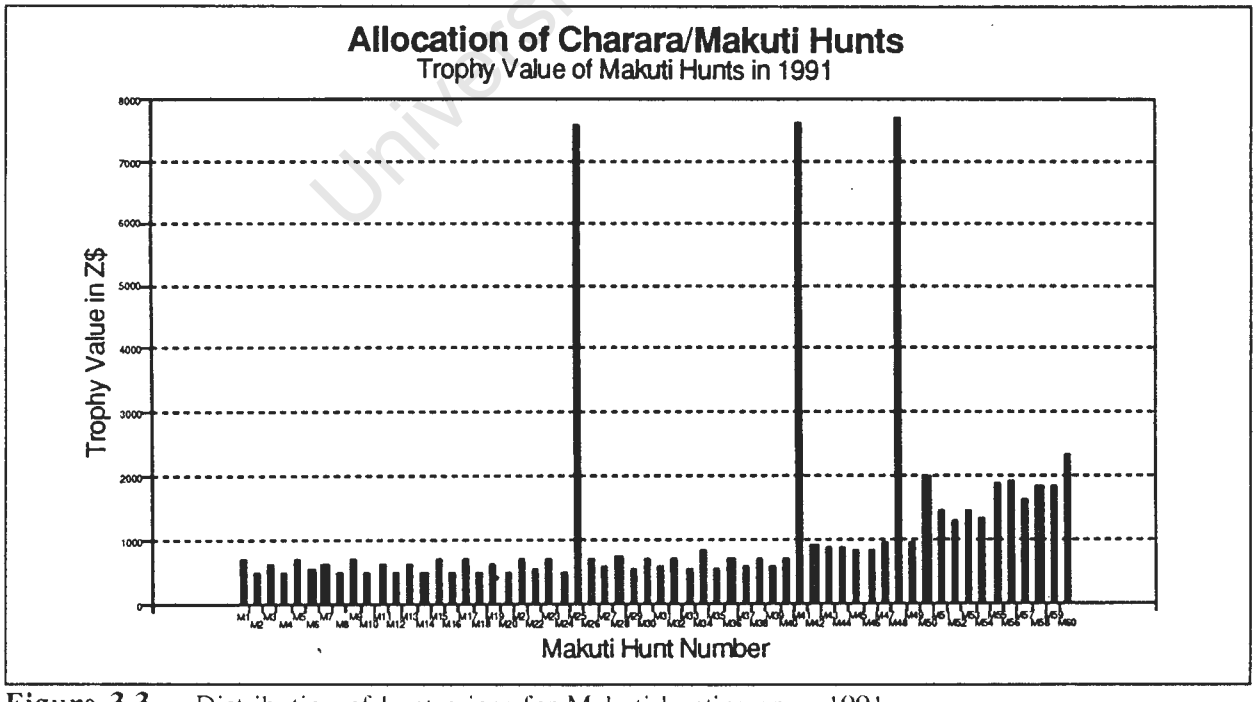
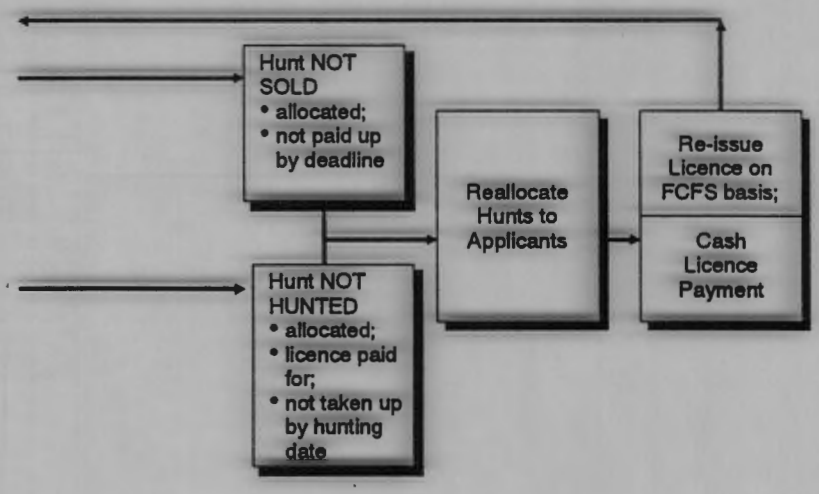


Figure 3.3 Distribution of hunt prices for Makuti hunting area: 1991

Source: DNPWLM hunt valuation for Makuti, Appendix 7.2, page A53.

Second stage hunt allocation by the DNPWLM first-come-first-served system (Overlay).



Second stage hunt allocation by the DNPWLM first-come-first-served system (Overlay).

This uniform distribution has implications for the variety of hunts supplied in the study area. A majority of 85% of Charara/Makuti hunts (35 in Charara, 50 in Makuti) had a total hunt price of less than Z$1'500, or cost less than Z$125 per hunter per day. As will become evident during the review of all Zimbabwean licensing system alternatives, these prices are the lowest prices for big game sport hunts in the whole of Zimbabwe.[1]

- **Hunt characteristics known to applicants:**

Essential hunt characteristics for applicants such as hunting bag, hunt price, hunting dates, hunt duration and hunting area (Charara or Makuti) were not available to hunters before they applied to hunt in Charara/Makuti, which meant that applicants were buying in the dark.

- **Application procedure for the lottery system:**

The lottery for Charara/Makuti was advertised in the national press and applicants were invited to enter the draw by purchasing tickets. The text is reproduced in Figure 3.4.

Department of National Parks
and Wild Life Management[a)]

MAKUTI/CHARARA
HUNTING DRAW

The Department invites bona fide citizens or permanent residents of Zimbabwe to participate in a draw for hunting in Makuti/Charara area.

A non-refundable deposit of Z$20.00 for the right to participate shall be payable.

Further details of the Draw can be obtained from: **The Director of National Parks and Wild Life Management, PO Box 8365, Causeway, Harare.**

Entries for the Draw close at the end of business on Friday, 15th February, 1991. Draw will be held on 19th March, 1991.

a) This advertisement appeared in the Zimbabwe Herald on Tuesday, 15th January 1991. Emphasis in original.

Figure 3.4 Text of press advertisement for Charara/Makuti hunts: 1991

It is significant that the advert made no mention of hunting opportunities, hunting bags, or hunts, since applicants were in effect purchasing an option to win an undefined hunting opportunity, not a specific hunt. Many applicants returned at later dates and bought more tickets (to improve their draw chances), as successive entries under the same name in the ticket register indicated (personal observation, Harare licensing office).

[1] Compare the hunt prices in Table 3.2 with: those for the ZHA lottery systems in Table 3.3 (page 72), Table 3.4 (page 74), and Table 3.6 (page 79); with those for the DNPWLM auction system in Table 3.10 (page 93); and with those for the commercial safari operator marketing system in Table 3.11 (page 96).

- **Demand by hunting applicants:**

Application data was sourced from the DNPWLM ticket register at the Harare licensing office. Full details of application data and ticket distributions are given in Chapter 4 (see section 4.3.4, page 145). Records showed that 196 applicants bought 2'153 tickets between them, with a total ticket revenue of Z$43'060. Most people bought between 1 and 20 tickets each, worth Z$20 and Z$400 respectively. The opportunity to hunt in Charara/Makuti was highly valued by hunting applicants.

Of the total 196 applicants for Charara/Makuti, it was also estimated that 133 applicants (or 52%) were also members of the Zimbabwe Hunters' Association, and had access to this association's equivalent big game hunting areas. This means that the DNPWLM lottery system only catered for 63 additional Zimbabwe citizen hunters in 1991 - a very small number of persons.

- **Hunt allocation procedure with no preferences or equal probability:**

To prepare the lottery draw, the total number of tickets bought (2'153) were individually numbered and placed in a barrel (Tavona, personal communication). The draw was conducted in public by hand. At each draw, the ticket number was cross-referenced with the ticket record book to determine the winner's identity. The winner was then allotted a hunt depending on his draw order and an **arbitrary 3:2 allocation rule** for hunt numbers in Makuti, or hunt numbers in Charara.

The outcome of this allocation rule is now illustrated with an example. The following notation is adopted:

W_1, W_2, through to W_5 for the first five winners drawn in the lottery.

Applying the 3:2 allocation rule to hunts in the hunting areas of Makuti, and Charara, respectively, winners W_1, W_2, and W_3 were then allotted the hunt numbers M1, M2, and M3 in Makuti hunting area, whilst winners W_4 and W_5 were allotted hunt numbers C1 and C2 in Charara hunting area. The same rule was applied for each consecutive group of five winners until all 100 winners were drawn. This rule thus determined not only which hunt, but which hunt characteristics a hunter was allotted by the DNPWLM lottery system's allocation procedure. It is impersonal, and arbitrary in the sense that any other rule with hunt proportions of 3:2 for Makuti, and Charara, respectively, could have been applied (eg. a 6:4 or 9:6 rule), each having very different consequences for individual winners.

No applicant was permitted to win more than one hunt, which meant that further draws of tickets belonging to the same winner were invalid (tickets remained inside the barrel), and the drawing procedure continued.

Due to these redundant draws[1], the allocation by hand was time consuming to complete for the 100 hunts (Booth, personal communication).

The resulting 100 individual winners were then notified by the DNPWLM of their successful draw, their allotted hunt number and its pre-determined characteristics (eg. hunting bag, hunting dates, hunt price) and requested to pay the total hunt price by a due date (30.4.91). After paying, hunters were issued with a hunting licence (non-transferable) from the Harare licensing office and could take up their hunts on the specified hunting dates.

- **Costs of sport hunting trips:**

In addition to paying the DNPWLM for the hunting bag, the hunter incurs transport costs to and within the hunting area, and costs for food, ammunition, servants, and camping equipment. These additional costs are estimated to be about Z$10'000 calculated for a typical hunting trip with distances measured from the city of Harare.[2]

For the following description of the second allocation stage using the DNPWLM first-come-first-served system, refer to the overlay in Figure 3.1, page 65.

- **Reallocation of hunts:**

In 1991, a number of early hunts were not taken up by hunters; some hunters did not pay and collect their hunting licences by the due date (hunt not sold); other hunters paid, but did not register at Marongora or Kariba hunting offices of the DNPWLM to pursue their hunting activity (hunt not hunted). These hunters all forfeited their right to hunt, and any price paid for the hunt. A number of these hunting opportunities were subsequently re-advertised in the press[3] by the DNPWLM. The reallocation to hunters took place on a cash, first-come-first-served basis at the central licensing office in Harare from the 17.7.91 onwards. All these hunts were sold within one day.

The reallocation procedure is depicted as an overlay to the first lottery allocation in the framework (Figure 3.1), indicating that the re-allocation procedure caused additional administrative costs and reduced the efficiency of hunt allocation. By using a second rule (first-come-first-served) rather than probability to allocate hunts, the equality of hunt distribution was affected, the first-come-first-served system favouring applicants living near the DNPWLM licensing office in Harare.

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[1] The computer simulation of the DNPWLM lottery system (see section 4.3.4, page 145, and footnote 2, page 147) subsequently proved this fact, when the number of simulations had to be dramatically increased.

[2] Estimates of hunting costs by C. Grobbelaar included only recurrent expenditures. Not included were investments in equipment, such as weapons or vehicles. The cost of a weapon was taken as the rate to hire it from the ZHA. Details comprising the Z$10'000 estimate are in Appendix 18, page A110.

[3] Zimbabwe Herald, 16.6.91.

At the outset of this research, it was not foreseen that the DNPWLM lottery system for Charara/Makuti would fail to allocate all hunts, nor that a second allocation system would be used. Consequently a detailed analysis of the DNPWLM lottery system was undertaken to determine the extent and reasons for the unsuccessful hunt allocation in 1991. The research is presented in Chapter 4.

- **Hunting facilities and rules:**

Once hunting parties arrived at Marongora or Kariba hunting offices to registered and take up their hunt, they were able to choose which camping site they wanted. Information in map form defining the boundaries of the Charara/Makuti hunting areas was not made available to hunters, who relied instead on the information and guidance of the DNPWLM trackers who accompanied each hunting party for the hunt's duration.

Hunting facilities offered in the camp sites were basic, and included a pit latrine, a cleared area to camp, a water point, although this was not reliable (Chenaux-Repond, personal communication), in spite of numerous boreholes available in the area with permanent water (see map, Appendix 20, page A113). Hunting camps in Charara/Makuti lacked water storage facilities, slaughter blocks, and meat drying racks - a severe limitation for hunters to process larger big game species such as elephant and buffalo.

3.2.1.4. Summary of DNPWLM lottery system: Purpose in this research

In Chapter 4, the extent of the allocation problems mentioned in this section for the DNPWLM lottery system will be assessed objectively using this allocation system as a case study. Criteria are defined for an efficient and equitable hunt allocation. These criteria are then quantified using application data for 1991.

In Chapter 5, the opportunity costs of using the DNPWLM lottery system are assessed using this allocation system in a comparative study. The DNPWLM lottery system is compared with other Zimbabwean allocation systems for sport hunting that rely on lotteries, tenders, auctions and a commercial marketing system.

Descriptions of further Zimbabwean licensing systems follow. The next licensing system is a fix-priced lottery system that differs from the DNPWLM lottery system for Charara/Makuti in two important aspects: Each applicant is allowed a single ticket rather than multiple tickets in the draw procedure, and the hunt allocation procedure does accommodate hunters' personal preferences for specific hunts. In addition, the system allows considerable numbers of non-hunters to derive important non-hunting benefits from the protected areas.

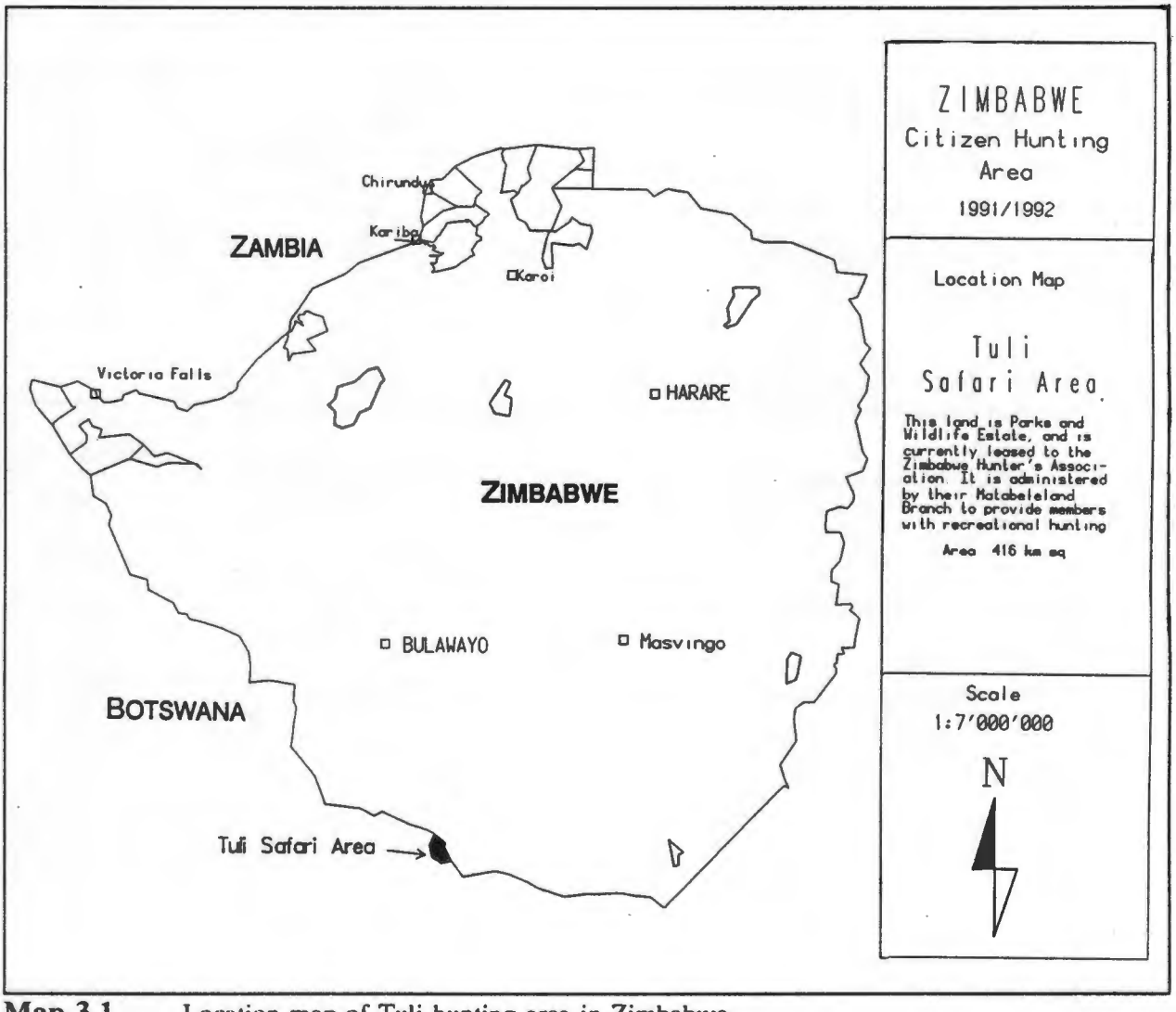
3.2.2. The ZHA lottery system for Tuli/Doma/Rifa

This section reviews citizen hunting allocated by the Zimbabwe Hunters' Association (ZHA) in three hunting areas: Tuli Safari Area, Doma Safari Area, and Rifa section of the Hurungwe Safari Area. In each area, the DNPWLM sets the total species quotas for sport hunting. All other components of the licensing system are planned and administered by a provincial branch of the ZHA for the benefit of members. Educational activities funded by two branches of the ZHA provides Zimbabwe school children with important non-hunting benefits.

First, a map shows each hunting area's location in Zimbabwe. Any details specific to that area or its administration are highlighted. The hunt allocations by each branch of the ZHA are identical, so that the ZHA lottery system for Tuli/Doma/Rifa is described once for all areas (section 3.2.2.4, page 81).

3.2.2.1. The Tuli hunting area

The Tuli Safari Area is located on Zimbabwe's southwestern border with Botswana (see Map 3.1, page 71).



Map 3.1 Location map of Tuli hunting area in Zimbabwe

Source: Digitized maps, Appendix 17, page A110.

The Matabeleland branch of the ZHA makes citizen hunting available to all members. The lottery system is administered from the Mashonaland branch office, in Harare, from where all hunting records for the area were obtained. The area's varied landscape and a diverse flora and fauna attract both hunting and non-hunting visitors alike, making this the second most favoured of the three hunting areas available to ZHA members (see hunting applications for Rifa in Table 3.7, page 80).

- **Quota allocation to hunts:**

The total species quota available for hunting in Tuli is well balanced with big game and plains game species, and has a more species on quota than either Doma or Rifa hunting areas.

In 1991, the branch packaged the total species quota in Tuli into 26 individual hunts, each lasting 11 hunting days. (For details of hunt allocations, see Appendix 2.3, page A13).

- **Pricing of hunts:**

The Matabeleland branch does not pay the DNPWLM a lease fee for the rights to use the area.[1] The total species quota for the hunting area is valued at fixed prices set for each species and sex in the government schedule for local hunters (Appendix 8, page A77), and is then sold by the DNPWLM at a discount of 25% to the Matabeleland branch. In return, the branch maintains certain services in the hunting area. The Matabeleland branch then charges members a levy, in addition to the full prices in the government schedule, for each animal in the hunting bag. The levy set by ZHA members in 1991 was 70% of the scheduled prices. The price difference finances the branch and the ZHA.[2]

Table 3.3 Maximum and minimum hunt prices in Tuli hunting area: 1991

in Z$	Maximum Price	Minimum Price
Total hunt price	12'949[a]	4'442[b]
Average hunt price per hunter	3'237	1'110
Average hunt price per hunter per hunting day	294	101

a) Hunt N1, 11 hunting days.
b) Hunt S26, 11 hunting days.

Source: Tuli hunt prices calculated in Appendix 7.3, page A57.

Table 3.3 shows the maximum and minimum range of trophy prices for the 26 hunts available to members of the ZHA in 1991 as their total hunt price. By allowing for a maximum of four

[1] The Rifa, Tuli and Doma hunting areas are not "leased" to the ZHA in the strict, contractual and economic sense of the word. This fact was confirmed by the author in the DNPWLM lease register, and by Grobbelaar (personal communication), contrary statements by Cumming (1988): 152 and Price Waterhouse (1992b): Volume 4: 36.

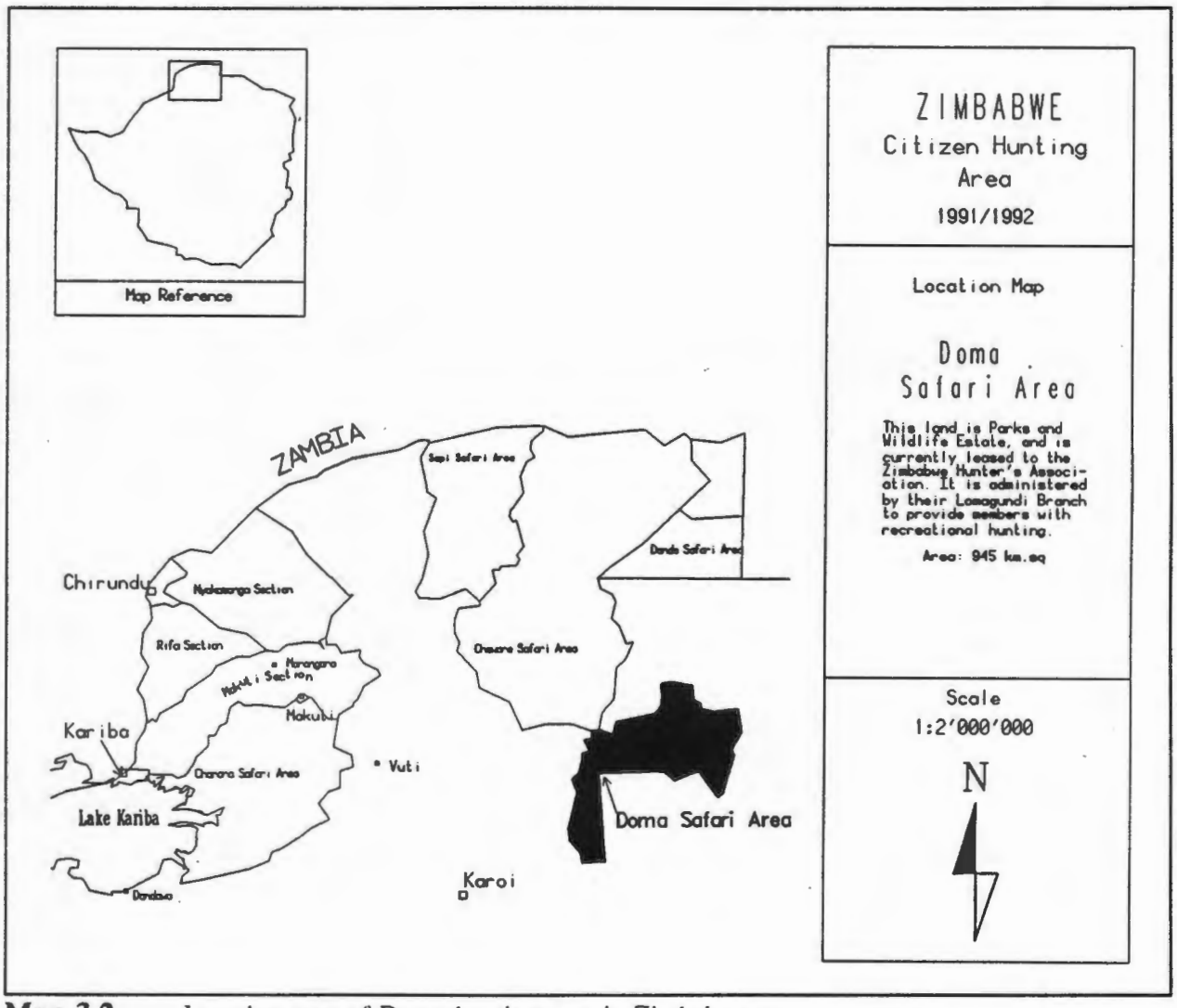
[2] In 1991, due to poor trophy quality, male elephant were excluded from the additional levy.

hunters who can share a hunt (1 hunter and 3 co-hunters), each hunter's average contribution towards the hunt price, and towards the hunt price per hunting day, is shown.

The trophy price is only one part of the total cost of a hunting trip. In addition, hunters incur transport costs to and within the hunting area, and costs for food, ammunition and camping equipment for the 11-day hunting period. These additional costs are estimated at Z$10'000 as a minimum (see Appendix 18, page A110).

3.2.2.2. The Doma hunting area

The Doma Safari area is located in very rugged terrain to the north-east of Karoi (see Map 3.2, page 73). It borders on the Zambezi valley escarpment to the north. The area is allocated by the DNPWLM to the Lomagundi branch of the ZHA, and is administered from Mhangura where hunting records were sourced.



Map 3.2 Location map of Doma hunting area in Zimbabwe

Source: Digitized maps, Appendix 17, page A110.

The Doma hunting area is the hunting area least frequented by members of the ZHA (see Table 3.7, page 80), due partly to the difficult terrain encountered for hunting by members,

but also due to the limited recreational activities available to non-hunting members of the hunting party (the area lacks a major waterbody).

- **Quota allocation to hunts:**

The total species quota available for hunting in Doma is limited (small numbers of animals), and the composition lacks balance between the numbers of dangerous game and plains game as the quota comprises large numbers of trophy and non-trophy elephant (see Appendix 2.4, page A15). As a result, only ten hunts, each lasting 12 hunting days, are made available to members for allocation by lottery. In contrast to the application rules which apply to the next hunting area in Rifa, applicants for Doma hunts are not limited to only one trophy elephant hunt every fifth year.

- **Pricing of hunts:**

No lease fee is paid by the Lomagundi branch to the DNPWLM for the rights to use the hunting area.[1] The total species quota is valued at fixed prices set for each species and sex in the government schedule for local hunters (Appendix 8, page A77), and is then sold by the DNPWLM at a discount of 25% to the Lomagundi branch. In return, the branch maintains certain services in the hunting area. In 1991, prices charged to members hunting in the Doma area were: the full government schedule price plus a 20% levy payable to the ZHA for administration.[2]

Table 3.4 Maximum and minimum hunt prices in Doma hunting area: 1991

in Z$	Maximum Price	Minimum Price
Total hunt price	10'824[a]	5'054[b]
Average hunt price per hunter	2'706	1'264
Average hunt price per hunter per hunting day	226	105

a) Hunt 2, 12 hunting days.
b) Hunt 10, 12 hunting days.

Source: Doma hunt prices calculated in Appendix 7.4, page A59.

Table 3.4 shows the maximum and minimum range of trophy prices for the 10 hunts available to members in Doma hunting area during 1991 as their total hunt price. By allowing for a maximum of four hunters who can share a hunt (1 hunter and 3 co-hunters), each hunter's average contribution towards the hunt price and towards the hunt price per hunting day is shown. These hunt prices reflect the larger proportion of elephant on quota in the Doma area.

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[1] The Rifa, Tuli and Doma hunting areas are not "leased" to the ZHA in the strict, contractual and economic sense of the word. This fact was confirmed by the author in the DNPWLM lease register, and by Grobbelaar (personal communication), contrary statements by Cumming (1988): 152 and Price Waterhouse (1992b): Volume 4: 36.

[2] In 1991, due to poor trophy quality, male elephant were excluded from the additional levy. It should be noted that in 1992 members were charged the full government schedule price plus 70%. Of the 70%, 20% was a levy payable to the ZHA for administration and 50% remained with the Lomagundi branch for education. Thus, in 1992, all hunting within the ZHA was sold to members at the same end price.

■ **Education facilities:**

In addition to providing hunting opportunities to its members, the Lomagundi branch has financed and built an educational facility, located in the Charara non-hunting area of the Kuburi Wilderness (see map in Appendix 20, page A113). The facility is sited near the Lake Kariba shoreline in an area that provides maximum diversity of habitats and experiences for education.

Members and volunteers have designed and conducted an environmental education programme during the school holidays, aimed primarily at groups of primary school children and their teachers. Table 3.5, page 75, shows schools and clubs that benefited from the education programme in 1991. There were ten education camps organised during the year, each with a group of thirty pupils taking part for an average of 7 days.

Table 3.5 Schools on ZHA (Lomagundi branch) school education camps: 1991

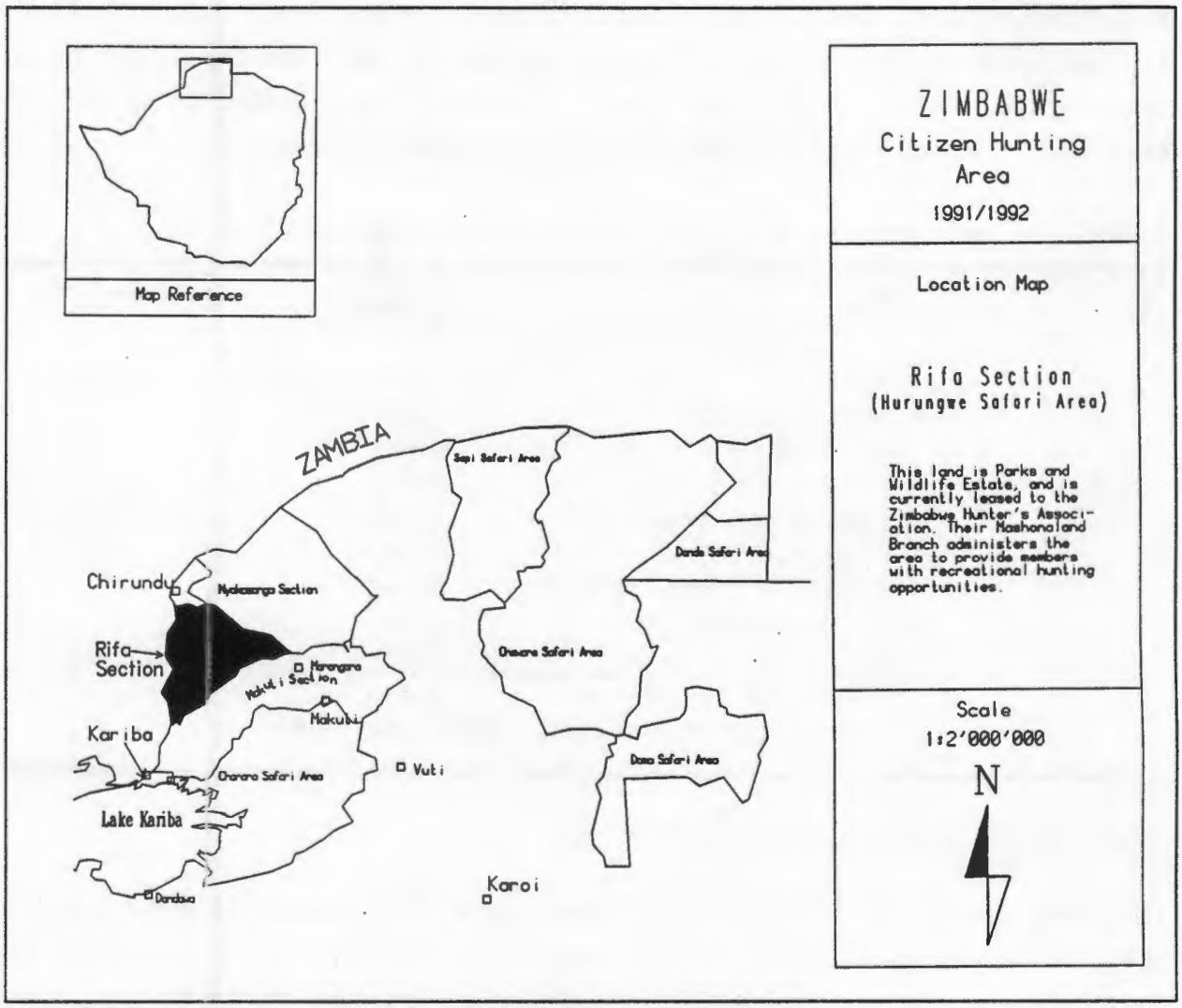
School	Period spent
Banket Primary School	7 days
Barwick School	7 days
Bryden country School	7 days
Chinhoyi High School	7 days
Doma Primary School	7 days
Lomagundi College Primary	7 days
Lomagundi College Senior	7 days
Nyamhunga Conservation Club (Kariba)	7 days
Prince Edward Natural History Club	7 days
Rydings School	10 days
Total educational camp days	73 camp days
Total educational pupil days	**2'190 pupil days**

Source: Thomas, Lomagundi branch of ZHA, Mhangura.

The facility can also be booked by schools outside this time. Conservation topics, set in their natural environment, are the main theme during the educational camps. Up to 1991, all transport and accommodation costs for participating schools were met by the Lomagundi branch. Between 1988 and 1991, the Lomagundi branch has invested revenue from hunting and membership fees in facilities worth a total of Z$162'603, including: an A-frame house, two ablution blocks, and four equipped canoes.

3.2.2.3. The Rifa hunting area

The Rifa section, part of the Hurungwe Safari Area, is located in the floodplain of the Zambezi valley with the Zambezi river as its western boundary (see Map 3.3, page 76). The river frontage of all three hunting camps presents ideal recreational opportunities, and accounts for the greater popularity of this hunting area amongst hunting and non-hunting members of a party. This area can be considered a prime area of the Parks and Wild Life Estate.



Map 3.3 Location map of Rifa hunting area in Zimbabwe

Source: Digitized maps, Appendix 17, page A110.

The Rifa section is allocated by the DNPWLM to the Mashonaland branch of the ZHA for citizen hunting. The lottery system is administered by the branch from their Harare office, from where data was sourced.

■ **Quota allocation to hunts:**

In 1991, the total species quota for the Rifa hunting area was packaged into 39 quality trophy hunts, each lasting 11 hunting days (see Appendix 2.5, page A17). Each hunts was allocated at least one significant trophy animal (eg. elephant, leopard, hippopotamus, kudu, waterbuck).

To package hunting area's species quota into hunts, administrators of the ZHA observe certain principles to enhance hunt quality and revenue for the ZHA, namely:

- **Species allocated for bait**: All cat hunts with lion or leopard allocated are hunted using certain animals for bait.[1] For lion hunts hippopotamus or non-trophy kudu are allocated to the hunting bag as bait animals; for leopard hunts warthog, non-trophy buffalo or baboon are used as bait animals.
- **Species requiring longer hunting periods or smaller bags**: A hunter needs more time to secure a quality trophy (hunts which have trophy elephant, lion and leopard allocated to them) than to hunt other species (eg. hunts with impala or kudu). Hunts which have trophy elephant allocated to them consequently are not allocated trophy buffalo in addition.
- **Species with lower hunter success**: The most valuable, high quality species of dangerous game (eg. trophy elephant, trophy buffalo, trophy lion, and leopard) are allocated to hunts with low hunt numbers that are hunted early in the hunting season. Should these trophy animals remain unshot after a hunt, they can be re-allocated by the Mashonaland branch administration to any hunter who has bought a hunt in Rifa later in the season, on a first-come-first-served basis. This allows the hunter to benefit from having additional hunting opportunities (hunters derive hunting and recreational value from hunting trips even if animals remain unshot). The ZHA benefits by maximizing its revenue from unshot animals that are resold.[2]
- **Species for easier, cheaper hunts**: Added variety is achieved with three of the hunts in the allocation (1A, 2B and 3C, see Appendix 2.5, page A17). Because they take place during the school holiday periods, they are assigned plains game animals, rather than dangerous game. These hunts are easier to hunt, and hunt prices are lower, making them ideally suited as "beginners hunts" and "father and son hunts".
- **Allocations for full quota utilization**: The last four hunts of the season in Rifa (hunt numbers 36C, 37A, 38B, and 39C) serve as "unshot game hunts". The hunts have few animals allocated to the hunting bag initially, but are allotted any animals that remain unshot by the end of the hunting season. The ZHA benefits

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[1] The practice of baiting to hunt trophy lion and leopard is common, and legal in Zimbabwe. Questions of how acceptable this practice is morally, and in relation to the sport hunter's code of conduct which require him to hunt whilst giving animals "fair chase", will not be discussed here. The quality of the hunting experience could, however, arguably be increased by not resorting to baiting, but relying on personal bushcraft skills.

[2] The ZHA member pays for the animals in the hunting bag regardless of whether the animal is shot, or remains unshot. He is only refunded 50% of the trophy price for unshot leopard or lion. By contrast, safari operators charge their foreign hunting clients only for the animals shot, that is killed or wounded.

by utilizing the species quota fully and maximizing revenue. Members benefit from additional hunting opportunities.

■ **Application rules for hunters:**

To limit the number of applicants who qualify for this, the association's most popular hunting area, the Mashonaland branch applies the following additional rules to the lottery for Rifa applicants:

- **To reduce applicants for trophy elephant hunts:** irrespective of hunting success, any hunter who wins a trophy elephant hunt in the lottery system for Rifa is excluded from applying for a further trophy elephant hunt for five years.
- **To reduce applicants for hunts in the Zambezi valley:** hunters of the ZHA (the winner of a hunt in the lottery system for Rifa) may only hunt once in the Zambezi valley in any year (Grobbelaar, personal communication). The citizen hunting areas in the Zambezi valley include: Charara/Makuti, Nyakasanga/Sapi, and Rifa. Winners of the lottery for Rifa are excluded from the application procedures of these hunting areas.[1] To enforce this rule, the application procedures for these hunting areas needs to be coordinated for different licensing systems between the DNPWLM and the ZHA.
- **To reduce applicants for hunts with "big four":** To ration hunting out further amongst applicants in Rifa, successful hunters, their nominated co-hunters and any other hunters shooting one of the "big four" (elephant, buffalo, lion, leopard) are excluded from participating in the draw for Rifa hunts the following year.

■ **Pricing of hunts:**

The Mashonaland branch does not pay the DNPWLM a lease fee for the rights to use the Rifa hunting area.[2] The total species quota available for hunting in Rifa is valued at fixed prices set by the government trophy fee schedule for local hunters (see Appendix 8, page A77), and is then sold by the DNPWLM at a discount of 25% to the Mashonaland branch. In return, the Mashonaland branch renders certain services in the hunting area. The branch then charges members the following price for a hunt in the Rifa area: The full government schedule price plus 70% for each animal. Of the 70%, 20% is a levy payable to the ZHA for administration and 50% remains with the Mashonaland branch to finance the educational programme in the Rifa hunting area.

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[1] The names and addresses of hunt winners in the Rifa lottery go to the DNPWLM licensing office, Harare for control purposes.

[2] The Rifa, Tuli and Doma hunting areas are not "leased" to the ZHA in the strict, contractual and economic sense of the word. This fact was confirmed by the author in the DNPWLM lease register, and by Grobbelaar (personal communication), contrary statements by Cumming (1988): 152 and Price Waterhouse (1992b): Volume 4: 36.

Table 3.6 Maximum and minimum hunt prices in Rifa hunting area: 1991

in Z$	Maximum Price	Minimum Price
Total hunt price	17'811[a]	2'764[b]
Average hunt price per hunter	4'453	691
Average hunt price per hunter per hunting day	405	63

a) Hunt B6, 11 hunting days.
b) Hunts B36 and C26, 11 hunting days.

Source: Rifa hunt prices calculated in Appendix 7.5, page 7.5.

Table 3.6 shows the maximum and minimum range of total hunt prices for the 39 hunts available to ZHA members in Rifa hunting area during 1991. By allowing for a maximum of four hunters who can share a hunt (1 hunter and 3 co-hunters), each hunter's average contribution towards the hunt price, and towards the hunt price per hunting day, is shown. These hunt prices reflect the higher levy charged by the Mashonaland branch for all hunts in this prime hunting area. The large difference between the maximum and minimum hunt prices reflects the varied hunting bags that were on offer to members in this hunting area.

- **Demand by hunting applicants:**

DNPWLM records of visitor entry to five hunting areas in the Zambezi Valley[1] have shown that over the last three years, the hunting camps in Rifa have had a higher proportion of non-hunting visitors (including camp staff) to hunters, than the other hunting areas. For many hunters and non-hunters the opportunity of taking a holiday in the Zambezi valley during a hunting trip serves as a strong motive to become members of the ZHA.

[1] Zimbabwe Government, (1988a); Zimbabwe Government (1989a); Zimbabwe Government (1990a).

Table 3.7 shows branch membership, numbers of hunting and non-hunting members, and numbers of applicants in each hunting area used by the ZHA.

Table 3.7 Zimbabwe Hunters' Association: Branch membership and applications: 1991

Branch (Hunting Area)	Full Hunting Members 1991	Non-Hunting Members 1991	Applications[a] for Hunting 1991	% of Total
Mashonaland Branch (Rifa Section)	393	300	300	55%
Lomagundi Branch (Doma Safari Area)	150	25	56	10%
Manicaland Branch	29	6	0	0
Matabeleland Branch (Tuli Safari Area)	85	3	182	35%
Midlands Branch	45	0	0	0
Totals	**702**	**334**	**538**	**100%**

a) Some applicants applied in more than one hunting area; a total of 362 individual applicants applied in 1991 (personal observation).

Source: Grobbelaar, ZHA, Harare.

The table shows that the Mashonaland branch has the largest numbers of hunting and non-hunting members. In 1991, over half (55%) the association's hunting members applied to hunt in the Rifa hunting area, indicating the area's popularity. In the same year, it was also estimated that some 133 member of the ZHA applied to hunt in the DNPWLM lottery system for Charara/Makuti (see section 4.3.5, page 148).

- **Education facilities:**

In addition to providing hunting benefits to members, the Mashonaland branch has financed and built an educational facility in a non-hunting area of Rifa. The facility caters for 30 school pupils at a time. During school holidays in 1991 nine education camps of senior school pupils took place, each lasting six days. Since the facility was built, a total of 1'500 pupils have benefitted from the educational programme and instruction (Grobbelaar, personal communication). Pupils are not charged a fee to attend, but provide their own food and transport. The activity of hunting is integrated into the learning programme. Between 1987 and 1990, about Z$230'000 has been invested in the project, including: accommodation facilities, water and electricity, museum and library facilities, and caretaker accommodation.

3.2.2.4. The ZHA lottery system for Tuli/Doma/Rifa

This section reviews the lottery procedure used to allocate hunts in the three hunting areas used by the ZHA. Of particular interest is the way this lottery system accommodates individual hunter's preferences, and the type of "fairness", or equality of hunt allocation, it achieves.

■ **Hunt characteristics made known to applicants:**

All members of the ZHA receive a copy of the hunts that are planned for the three hunting areas by branch administrators.[1] Full details of every hunt's characteristics are available to hunters for them to choose their preferred hunts, which include:

- the hunt number;
- the hunting dates;
- the species, and number of animals in the hunting bag;
- the trophy price of the hunt;
- any additional animals that may bought.

■ **Application procedure:**

Each applicant then applies for those hunts he prefers in each hunting area, ranking the preferred hunt numbers according to his personal value judgements, his hunting experience, and his willingness to pay the hunt price. For each hunting area, the number of preferences available is equal to the total number of packaged hunts. In Tuli, for example, each applicant has a maximum of 26 preferences available, although few people made use of the full number when applying. Data on hunter's preferences for 1991 are included as appendices for each hunting area.[2] On receipt of the hunt preferences, each application is checked and given an application number. Applicants are aware that if they win a hunt in the draw, they are obliged to take the hunt up and pay the hunt price.

To promote a professional attitude towards sport hunting, the ZHA has introduced a system of grading all hunters in the association according their experience in hunting big game and dangerous game species. The hunts are likewise graded according to difficulty, and hunters who win a hunt with a species for which they are not yet qualified, are required to hunt accompanied by a suitably graded hunter as their co-hunter. The grading ensures that hunters who are inexperienced in hunting any of the big game or dangerous game species - these are not unduly so-named - are taught by hunters more experienced than themselves, and can be assisted during the shooting to prevent incidents of wounded animals from endangering anyone's life. However, neither the DNPWLM nor the ZHA require hunters to sight their weapons or to undertake a mandatory shooting test prior to the hunt (compare requirements for South African citizen hunters: by NPB, see page 106, by Ciskei Safaris, see page 109).

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[1] For Tuli, see Appendix 7.3, page A57; for Doma, see Appendix 7.4, page A59; for Rifa see Appendix 7.5, page A61.

[2] For hunter's preference lists in Tuli, see Appendix 6.1, page A39; for Doma, see Appendix 6.2, page A43; and for Rifa, see Appendix 6.3, page A45.

■ **Hunt allocation procedure:**

Draw procedures for the individual lotteries of Tuli, Doma and Rifa are identical. Lotteries are drawn in the order Rifa, then Tuli, and finally Doma. The draws take place prior to the DNPWLM hunt allocations for Charara/Makuti and Dandawa, to allow unsuccessful members time to apply for other hunting opportunities.

The preference allocation procedure can be followed in Figure 3.5, page 83. Each lottery is drawn by hand, and in public. When an applicant's number is drawn, he wins the first available hunt on his individual preference list (*Next Hunt Preference*). The drawing procedure continues with the next applicant number, until all hunts in a particular hunting area are allocated. If every preference on a winner's list has already been allocated, this winner is not awarded a hunt, and the drawing procedure continues as before.[1] Winners must pay the full hunt price before being issued with the hunting licence to enter the state hunting area. If hunters forfeit a hunt, they are only refunded if another hunter is found to take up the hunt.

■ **Hunt preference allocation procedure and equality:**

The ZHA lottery system takes account of hunter's individual preferences that have been expressed as a ranked list of most, to least preferred hunt numbers per hunting area. The draw determines which particular hunt a drawee wins - irrespective of how high or low this hunt was ranked by the applicant on his preference list. In terms of equality, those persons with longer preference lists will be more likely to be assigned a hunt at all, than those with shorter lists.

There is a further implication for equality by allocating every applicant's highest available preference at each step during the draw.

The earlier an applicant is drawn in the lottery, the more likely he will be allocated a hunt he prefers more, whereas the later the applicant is drawn, the more likely he will be allocated a hunt he prefers less. Although the ZHA lottery procedure appears to be fair for all applicants because it applies one rule to everyone, it benefits applicants who are drawn earlier over those who are drawn later because their preferences are given more weight. The reason for the unequal preference weighting this lies in the manual draw procedure, which **ranks winners** according to their draw order **as they are drawn**. As winners are drawn, the draw order - seen in retrospect - also ranks the preference lists of the winners of a hunt. Undrawn applicants and their preference lists remain unranked.

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[1] In practice, if the applicant is present in person at the draw, he is asked if a hitherto unallocated hunt is preferred (which was not indicated on the preference list), and this hunt is then allocated. If the hunter is absent from the draw, the applicant does not draw a hunt. Since this practice represents an exception to the rule, and is arbitrary, it was not considered further, despite being a source of inequality amongst applicants.

```
For Applicants = 1...n
For Preferences = 1...m

START ALLOCATION OF HUNTS WITH UN-EQUALLY WEIGHTED PREFERENCES

 If HUNTS to allocate = none, goto END
    Do 1st Applicant
       Is First Hunt Preference available?
          Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 1st Applicant
          No:   try next Preference
          Is Second Hunt Preference available?
             Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 1st Applicant
             No:   try next Preference
             Is Third Hunt Preference available?
                Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 1st Applicant
                No:   try next Preference
                   ...
                      Is Mth Hunt Preference available?
                         Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 1st Applicant
                         No:   Else Applicant unsuccessful
    END Do 1st Applicant, new Applicant draw follows


If HUNTS to allocate = none, goto END
    Do 2nd Applicant
       Is First Hunt Preference available?
          Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 2nd Applicant
          No:   try next Hunt Preference
          Is Second Hunt Preference available?
             Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 2nd Applicant
             No:   try next Preference
             Is Third Hunt Preference available?
                Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 2nd Applicant
                No:   try next Preference
                   ...
                      Is Mth Hunt Preference available?
                         Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do 2nd Applicant
                         No:   Else Applicant unsuccessful
    END Do 2nd Applicant, new Applicant draw follows
...
...
...
If HUNTS to allocate = none, goto END
    Do nth Applicant
       Is First Hunt Preference available?
          Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do nth Applicant
          No:   try next Preference
          Is Second Hunt Preference available?
             Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do nth Applicant
             No:   try next Preference
             Is Third Hunt Preference available?
                Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do nth Applicant
                No:   try next Preference
                   ...
                      Is Mth Hunt Preference available?
                         Yes:  allocate to Applicant, and remove from HUNTS to allocate: goto END Do nth Applicant
                         No:   Else Applicant unsuccessful
    END Do nth Applicant, new Applicant draw follows

If HUNTS to allocate = none, or Applicants = 0, goto END

END Allocation of Hunts is finished
```

Figure 3.5 ZHA lottery system: Preference allocation with unequally weighted hunt preferences for applicants

Source: ZHA licensing office, Harare.

This result may appear trivial, but the preference allocation procedure used by the Wyoming lottery system accords each applicant's preferences an equal weighting whether they are winners or not. All applicants are ranked before they are drawn. The draw order is determined **once only, prior to the assignment of preferences, for all applicants simultaneously** (see section 3.3.1, page 98) using a computer programme.

In conclusion, since the drawing procedure used by the ZHA is done by hand, a simultaneous ranking of all applicants is hardly feasible.[1] It appears that no manual method can be suggested to make all applicant's preference rankings equivalent, in order that no winner is allocated his *Second Hunt Preference* before all other applicants have had the opportunity of winning their *First Hunt Preference* (see Figure 3.5, page 83).

The licensing system described next allocates citizen hunting of plains game using price, rather than chance, as the deciding criterion. Applicants determine the maximum hunt prices they are willing to pay for each hunt themselves. The tender system does accommodate hunter's personal preferences, but raises two problems due to the fixed tender prices.

3.2.3. The DNPWLM tender system for Dandawa

The Dandawa hunts take place within the Nyakasanga section of Hurungwe Safari Area. The single hunting camp is situated on the bank of the Zambezi river, in attractive surroundings, which lend themselves to recreational activities. The tender system is administered by the DNPWLM from their Harare licensing office. During interviews of hunting administrators in Harare, Chinhoyi, Marongora and Kariba, the objective of this licensing system was variously indicated as being:

- to appeal to the occasional Zimbabwean hunter;
- to suit "father and son hunts";
- to provide hunts for less wealthy citizen hunters;
- to help reduce the impala population on the Zambezi river frontage.

In contrast to all other opportunities for citizen hunting in protected areas, the Dandawa hunts involve only impala - one of Zimbabwe's most abundant plains game species. Impala are not a scarce hunting resource; consequently, impala are less valued by trophy hunters than big game hunts. Because the government controlled trophy fee for impala is low, the species is ideally suited to promote the first three objectives mentioned above, that is non-trophy citizen hunting for hunters who emphasize the venison motive, at government subsidized prices.[2]

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[1] A manual ranking is possible by drawing each applicant (for a total of 362 individual applicants), but hardly feasible in terms of time used to establish the rank order. Also, this procedure destroys the essence of a lottery conducted in public, before an audience of expectant winners.

[2] The minimum value of a species for sport hunting on state land must exceed the market value of its raw products (meat and hide) according to DNPWLM policy (Zimbabwe Government, 1992: 17). The market value of wildlife is difficult to establish, as it depends on many factors, including the location of the "market place", eg. urban or rural. It is unlikely that there is a market where the animal is shot. A private landowner in a rural farming area sells impala venison (dressed weight 20kg) at Z$160 each from the farm butchery (Travers, personal communication). The value of the hide depends on quality, but a minimum estimate is Z$12 (Wessels, personal communication; Touguinha,

The fourth stated objective conflicts with DNPWLM policy (Zimbabwe Government, 1992: 17) to separate quotas set for ecological population reductions (comprising large numbers of immature and female animals) and quotas for trophy hunting (small numbers of mature, male animals). But using tender prices to allocate potentially "cheap" impala hunts to citizen hunters conflicts with the third objective above, should policy-maker's intention be to make impala hunts available to Zimbabwe citizens below their market clearing price.

- **Quota allocation to hunts:**

As the total species quota comprises only impala, all 30 Dandawa hunting bags are identical, with 4 male, and 2 female impala to be hunted in 7 hunting days between specified dates. Details of the quota allocation to hunts are included in Appendix 2.6, page A19.

The objective and nature of these sport hunting quotas is unclear. Trophy hunts by definition, refers only to the hunting of male trophy-bearing animals, yet these quotas specifically include non-trophy female animals. As indicated above, these non-trophy hunting quotas conflict with DNPWLM policy on sport hunting (Zimbabwe Government, 1992: 17). The conflict between policy and practice merely is documented here for decision-makers, but will not be resolved in this dissertation.

- **Minimum pricing of hunts:**

The DNPWLM tender system for Dandawa prices each of the thirty hunts at the highest tender price offered by each applicant. Had fixed prices set by government for this species been used, then Dandawa hunts would have been priced at Z$320 each. Instead, the DNPWLM required a minimum hunt price of Z$400 to be tendered for all hunts. The maximum tender prices actually exceeded the minimum price considerably for all thirty Dandawa hunts (see item on hunt prices resulting from the tender system, page 87).

- **Hunt characteristics made known to applicants:**

Applicants knew each hunt's hunting bag and hunting dates before tendering. The hunting area boundaries, the location of the hunting camp and the hunting regulations were not made known to applicants.

- **Application procedure/Tender rules for applicants:**

The Dandawa hunts were advertised in the press, and hunters could choose which hunts they tendered for. Each applicant could tender for several hunts at once on the application form, but could not win more than one hunt in his name. The hunt numbers were not ranked in

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personal communication). Thus the minimum market value of an impala's venison and hide is Z$172. The same private landowner sells impala for sport hunting by Zimbabwe citizen hunters at Z$500 per impala. The 1991 trophy price for a male impala of Z$60 set by government is thus between 12% and 35% of the animal's market value in 1991.

order of preference by the applicants on the application form, causing problems during the allocation of hunt preferences (see item on hunt preference allocation, page 86).

- **Demand by hunting applicants:**

The number of hunters in the hunting party was limited to two (1 hunter, and his co-hunter). No data or records of the Dandawa applications for 1991 or any previous years were kept (Tavona, personal communication), so that the number of applicants in total (demand), the number of hunt preferences per applicant, and the distribution of price offers amongst all applicants could not be established for this system. Consequently, the popularity of the Dandawa impala hunts amongst citizen hunters remains to be assessed quantitatively. The present lack of data limits objective and efficient resource management decisions being taken by the DNPWLM for this allocation system.

- **Hunt allocation procedure:**

The applicants who tendered the highest price for each of the Dandawa impala hunts, or time slots, was awarded that hunt. Two difficulties arose concerning the hunt preference allocation procedure, due to the fixed tender prices. How did the allocation problems occur?

- **Hunt preference allocation procedure:**

The first problem encountered was due to the fact that several applicants tendered the same (fixed) tender price for a specific hunt, as confirmed by Tavona (personal communication). This problem had also occurred prior to 1991 according to the hunting records consulted at the Harare licensing office (personal observation). In such cases, administrators of the DNPWLM used a separate lottery to decide which of the hunters whose tenders tied for the same hunt was declared the winner.

The second problem encountered was due to the tender price of any applicant exceeding all other applicant's tenders **for several hunts at once**. Since the DNPWLM restricts each hunter to one hunt, the agency solved the new allocation problem by deciding administratively which hunt such hunters were allocated - without consulting personally with the tenderer. The hunter was thus not given a choice of hunting dates; the winning tenderers were probably not aware of this fact at any stage, since the hunt allocation procedure was not conducted in public or documented by the DNPWLM. Had tenderers instead been required to rank the multiple hunts on the application forms, this would not solve the first allocation problem of tied tender prices for a single hunt.

Once each winner and his hunt number are determined in the above tender allocation procedure, the DNPWLM notifies hunters that their offers have been accepted, and requests payment for the hunt.

Each hunter must pay the tender price before being issued with his hunting licence. Data from 1991 indicates that at least 2 hunters who had been allocated a hunt later declined to pay the

hunt price.[1] These hunters lacked commitment to take up their hunt because no pre-payment was made and hunters could forfeit the hunting opportunity at no financial cost to themselves. Due to legal formalities and cost, it is unlikely that the DNPWLM would sue these hunters to effect payment of the hunt; the available hunts went unused and the tender system thus did not benefit the maximum possible number citizen hunters. The design of this DNPWLM tender system resulted in a partially unsuccessful allocation due to hunter's lack of commitment during the application stage and the fixed tender prices.

- **Hunt prices resulting from the tender system:**

Data gathered for 1991 showed that the maximum tender prices for the 30 Dandawa hunts ranged from Z$2'000 to Z$600, considerably exceeding the required minimum hunt price of Z$400 in all instances (see Table 3.8). This indicates that there is a strong demand for plains game sport hunting by Zimbabwe citizen hunters with a hunting camp located on the Zambezi river.

Table 3.8 Maximum and minimum Dandawa hunt prices in Nyakasanga hunting area: 1991

in Z$	Maximum Price	Minimum Price
Total hunt price	2'000[a]	600[b]
Average hunt price per hunter	1'000	300
Average hunt price per hunter per hunting day	143	43

[a] Hunts D18 and D20, 7 hunting days.
[b] Hunts D26 and D28, 7 hunting days.

Source: Dandawa hunt prices calculated in Appendix 7.6, page A65.

Table 3.8 shows the maximum and minimum range of total hunt prices for the thirty Dandawa impala hunts. By allowing for a maximum of two hunters who can share a hunt (1 hunter and 1 co-hunter), Table 3.8 also shows each hunter's average contribution towards the hunt price, and towards the hunt price per hunting day.

As impala are a common species throughout Zimbabwe, the high prices tendered for the Dandawa impala hunts indicate that some citizen hunters could value the hunts for other hunt characteristics than merely their trophy value, or their venison meat value.

[1] Hunts D13 an D26 (Tavona, personal communication) based on data corroborated per 15.8.91 in Marongora and Kariba.

A Dandawa impala hunt gives hunters and any accompanying visitors access to the following benefits and scarce resources:

- **Non-consumptive benefit and resource due to access:** A prime wildlife resource area in the Parks and Wild Life Estate (Nyakasanga section of the Hurungwe Safari Area). The Zambezi river frontage for the campsite location is highly valued by visitors[1]y;
- **Non-consumptive benefit and resource due to access:** A diversity of wildlife, natural resources, and possibilities for their non-consumptive enjoyment. These might include walking, viewing, photography, and canoeing;
- **Non-consumptive benefit and resource due to access:** The exclusive use of a campsite in the protected area for a 7-day period for two hunters, and the option of inviting a maximum of up to 28 further persons as non-hunting visitors to their campsite for this period;
- **Consumptive benefit and resource due to quota:** The right to hunt and shoot a hunting bag of six impala during seven days. It should be noted that hunters are not obliged to shoot, or undertake any hunting activities as such, when purchasing a hunt.

The topography, resources, and recreational opportunities available to hunters of a Dandawa impala hunt are equivalent to the benefits available to non-hunting visitors in other prime areas of the Parks and Wild Life Estate (eg. Mana Pools National Park).

It is not surprising, therefore, that some persons who tendered and won a Dandawa impala hunt appear to have done so in order to gain access to the wildlife resource area exclusively for non-hunting recreational motives. In support, the following evidence was found on the field trip to the Charara/Makuti hunting areas. For one Dandawa impala hunt (Hunt D14) in 1991, both hunters arrived to book in at the Marongora control office without hunting rifles, stating that they did not like to kill animals. A staff member of the DNPWLM confirmed that these so-called "citizen hunters" intended to make use of their right of access to the hunting area solely for non-hunting recreational purposes during the seven day access period (Mashori, personal communication). The entire quota for this particular hunt remained unshot according to the hunting licence returned by both "citizen hunters" (personal observation).

The incident suggests that some Zimbabweans value the right of access to a prime protected area offered by a Dandawa hunt more highly than hunters. Zimbabwe non-hunters are also prepared to pay Z$710 - more than citizen hunters - for seven days of exclusive access and recreation at a prime Zambezi river campsite. The incident suggests further, that managers of wildlife resource areas should treat access and time spent by hunters and visitors in a

[1] See item on demand by ZHA members in 1991, page 79, for the popularity of the three campsites on the Zambezi river in the Rifa section, lying upstream from the Nyakasanga section, in Hurungwe Safari Area.

protected area as a scarce resource[1], and that it should be price accordingly[2]. For hunters, the price charged for the hunting bag as the consumptive resource should be in addition to the price of access. Table 3.9 calculates the price for access time per person, and per person per day, based on the single Dandawa hunt bought by non-hunters.

Table 3.9 Prices for access time and recreational value of a Dandawa camping site on the Zambezi river-frontage: 1991

in Z$	Tender Price
Total price paid for access time and recreational value of hunt	710[a]
Average price per person	355
Average price per person per access/recreation day	51

a Hunt D14, 7 'hunting' days, 2 persons.

Source: Mashori, Marongora (personal communication). Dandawa hunt prices in Appendix 7.6, page A65.

The system described next is a competitively priced allocation system. Prices for the wildlife resource are determined by Zimbabwean and foreign hunters who bid at a public auction for the hunting opportunities supplied. The allocation mechanism accommodates hunters' preferences, according to their willingness to pay market prices.

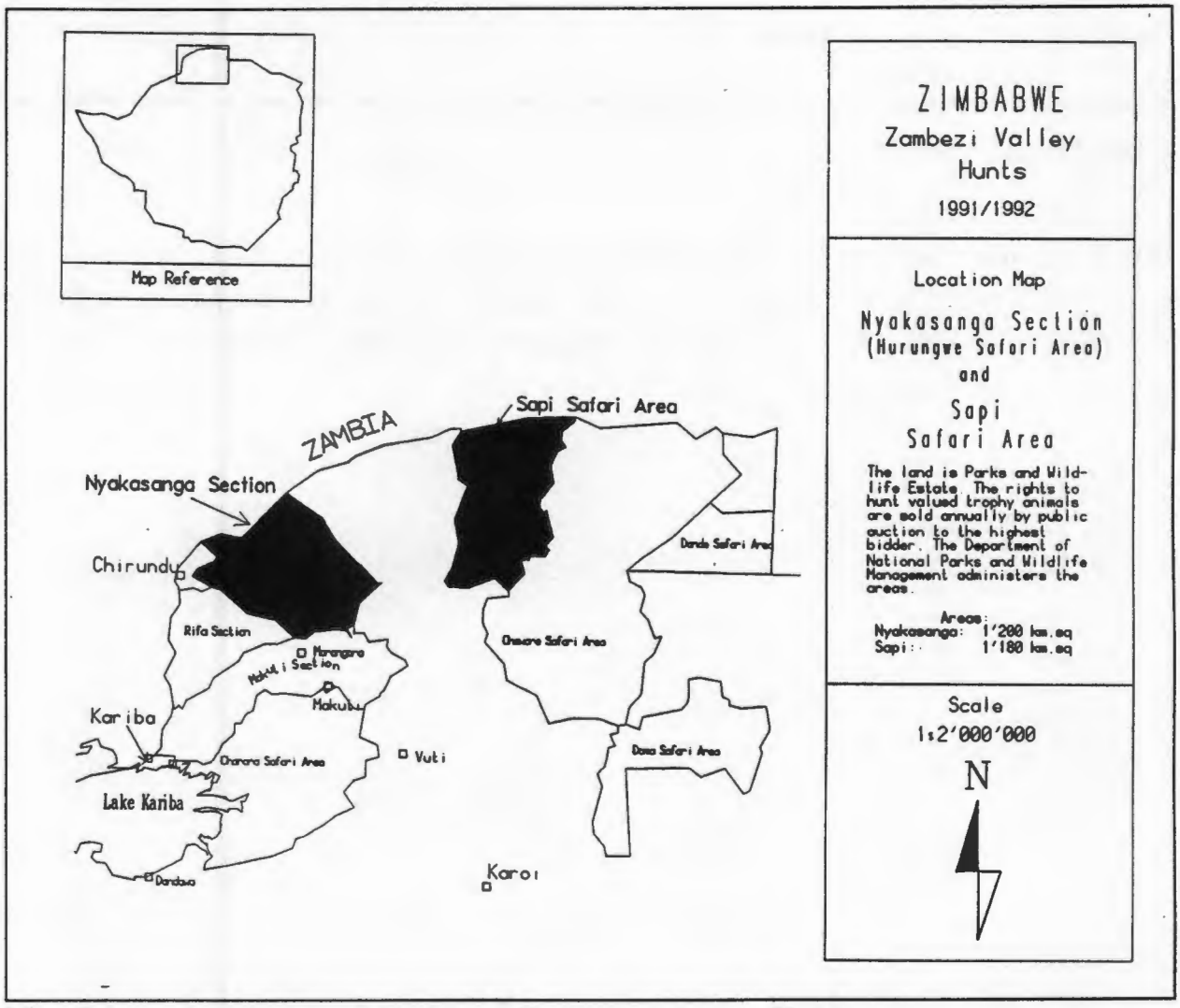
[1] For safari operators, financial success depends on the efficient planning and use made of time spent in the resource area, and each wildlife species available on quota. Safari operators charge their foreign clients a daily hunting fee that is related to the trophy animal species, and a trophy fee for each species shot. See Child, B., (1988) for an account of the Zimbabwe hunting industry. For an example of an allocation for safari hunting, see Appendix 16, page A109. In Ciskei, plains game hunts are also packaged and sold with a daily hunting fee by a commercial enterprise, Ciskei Safaris (Wilmot, personal communication). For an example of an allocation system that prices time and the quota for citizen hunting, see Appendix 15.2, page A107.

[2] McNeely (1988): 114 lists points to consider when determining entry fees for protected areas. The basic question is whether resources should be priced using market mechanisms to cover full costs of setting aside a protected area, or whether non-market mechanisms are to be used and protected areas are to be subsidized in some way.

3.2.4. The DNPWLM auction system for Nyakasanga/Sapi

3.2.4.1. The Nyakasanga/Sapi hunting areas

The sport hunting activities allocated by the auction system take place in the mid-Zambezi valley in two protected areas: The Nyakasanga section of Hurungwe Safari Area, and the Sapi Safari Area (see Map 3.4, page 90). Both areas offer trophy hunting of prime African big game and dangerous game to Zimbabwean and foreign hunters. The sport hunting activities are termed citizen/safari hunting in this dissertation. The hunts are sold by private auctioneers for the DNPWLM on a commission basis. The DNPWLM administers the system from their Harare licensing office, and the Marongora office controls the system in the field.



Map 3.4 Location map of Nyakasanga/Sapi hunting areas in Zimbabwe

Source: Digitized maps, Appendix 17, page A110.

3.2.4.2. The DNPWLM auction system for Nyakasanga/Sapi

The auction system's objective is to offer quality big game trophy hunting to foreign and Zimbabwean hunters at the highest market price. The auction system is now well established, and (nominal) prices have risen substantially each year since its introduction in 1986.

The auction achieves the three allocation functions simultaneously at the fall of the auctioneer's baton:

- Hunters are allocated a specific hunt of their preference;
- Applicants demanding any hunt are limited to a single bidder, by raising the price;
- Hunts and individual trophy animals are valued at market prices using hunter's final bids.

The final auction price expresses how highly the hunter values the hunt, based on his personal preferences and his willingness to pay (measured in money). By using the highest auction price to decide who hunts, the auction system ensures that each hunt is bought by the bidder who values that particular hunt most out of all applicants. By allocating hunts purposefully (efficiently) to applicants who value the benefits most distinguishes the auction systems from the random distribution of hunts amongst applicants as achieved by lottery systems. (The randomly allocated hunts in lottery systems according to chance disregard the real value of hunting opportunities to applicants.)

■ **Quota allocation to hunts:**

The total species quotas available for citizen/safari hunting in Nyakasanga/Sapi areas are well balanced with big game and plains game species. The DNPWLM packaged the species quotas in both areas into a total of 72 hunts for both areas, each with a basic hunting bag of 10 or 14 hunting days. In 1991, the DNPWLM auction system supplied 42 basic bags in Nyakasanga, and 30 basic bags in Sapi.

The most valued trophy animals of species such as elephant, buffalo, lion, nyala, hippopotamus were auctioned off singly to any hunter who had purchased a basic hunt. Full details of the 1991 hunt allocation - known only once the auction was over - are included in Appendices.[1]

■ **Minimum pricing of auction hunts:**

The DNPWLM required each auction lot to be priced at the previous year's final auction price, as a minimum.

■ **Hunt characteristics made known to applicants:**

The opportunities available in each hunting area are published in a catalogue (ABC Auctions, 1991), which is distributed to prospective hunters. Published hunt characteristics include:

- Hunt numbers, identifying each hunt;
- Hunting dates, and periods (10-day and 14-day hunts are offered);
- Species, sex and number of animals in each basic hunting bag;
- Additional, individually auctioned trophy animals;

[1] For the hunt allocation tables in Nyakasanga, see Appendix 2.7.1, page A21, for those in Sapi, see Appendix 2.7.2, page A25.

- The previous year's auction prices (in Z$), as DNPWLM reserve prices;
- A map of the hunting areas, which indicates the location of hunting camps and delimits hunting and no-hunting areas;
- Auction procedure, payment requirements, and hunting regulations.

■ **Application procedure:**

Applicants can be foreign hunters, their Zimbabwean agents, Zimbabwe citizen hunters, or Zimbabwe safari operators. The DNPWLM uses a rigorous and bureaucratic application and screening procedure to qualify participants as bidders at the auction (ABC Auctions, 1991). Hunts are not transferable between hunters once they have been auctioned, and safari operators are limited to two hunts each. These measures limit competition and free market forces, and increase administrative costs of the auction system.

Based on full details of each hunt's characteristics in the prospectus, prospective bidders then choose the basic hunts or individual trophy species they prefer, and decide the highest price they are were willing to pay at the auction.

■ **Auction rules for applicants:**

On winning an auction lot, all hunters must effect immediate payment of the final auction price to secure their hunt and any additional trophy animals they bid for. Foreign hunters or their agents must pay in foreign exchange currencies.

■ **Demand by hunters/Hunt allocation procedure/Pricing of hunts:**

Bidding for Zimbabwean citizens and foreign hunters is in the Zimbabwe dollar currency. The price is systematically raised, until there is only one final bidder, who is allocated that auction lot. Final prices paid by the hunters varied markedly depending on the hunting area, the campsite assigned to the hunt (those near water were higher), the composition of the basic bag, any additional single species bought, and the hunter's status as foreigner or Zimbabwean.

■ **Hunt prices resulting from the auction system:**

Strong demand by market participants (foreign hunters, citizen hunters and safari operators) is reflected by the high prices paid for basic hunts and single trophy animals. For example, prices for basic hunts in 1991, ranged from Z$4'500 to Z$24'000 depending on the species composition of the hunting bag. A single trophy elephant bull fetched Z$34'000, and a single female impala (non-trophy) sold for just Z$40, equal to the government controlled trophy fee (see Appendix 8, page A77).

Of a total of 72 hunts offered for Nyakasanga/Sapi in 1991, 51 basic hunts (70%) were bought by foreign hunters, and the remaining 21 basic hunts (30%) went to Zimbabwe citizens. Of the 104 single trophy animals on offer, two thirds of the animals (70 lots) were sold to foreign hunters, and the remaining third (34 lots) were sold to Zimbabweans.

All final bid prices for Nyakasanga/Sapi hunting areas are included in appendices.[1] For comparative purposes, each bidder's individual trophy animals were added to his basic hunt and then totalled, using a tabular format similar to that of previous systems.[2]

Table 3.10 presents a summary of the maximum and minimum price range of the final Nyakasanga/Sapi hunting packages, ie. the basic hunt and any other single trophy species bought by the hunter.

Table 3.10 Maximum and minimum hunt prices in Nyakasanga/Sapi hunting areas: 1991

in Z$	Maximum Price	Minimum Price
Total hunt price	73'600[a]	5'000[b]
Average hunt price per hunter	3'800	2'500
Average hunt price per hunter per hunting day	2'629	250

a) Hunt N2, 14 hunting days
b) Hunt N33, 10 hunting days

Source: Nyakasanga/Sapi hunt prices calculated in Appendix 7.7.3 (page A71), and Appendix 7.7.4 (page A75).

By allowing for a maximum of two hunters who can share a hunt (1 hunter and 1 co-hunter), each hunter's average contribution towards the hunt price, and towards the hunt price per hunting day, is shown. The wide range of hunt prices reflects the variety of hunts bought by participants and the auction system's flexibility for the hunter. The auction system allows hunters to package their own hunts by buying as many individual species as they prefer and are willing to pay for. The high auction prices also reflect the market-priced valuation achieved by auctioning hunting resources incrementally as single auction lots, allowing the seller (the DNPWLM in this instance) to capture the consumer surplus[3] in the final auction price.

The next licensing system described is a competitively packaged and priced system used by safari operators to market safari hunting to foreign hunters. The prices are determined by international supply of, and demand for, big game trophy hunting and by business principles (financial sustainability).

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[1] For auction values of basic hunts for Nyakasanga/Sapi, see Appendix 7.7.1, page A67, and for auction values of single trophy animals for these hunts, see Appendix 7.7.2, page A69.

[2] For total auction values for Nyakasanga, see Appendix 7.7.3, page A71; for Sapi see Appendix 7.7.4, page A75.

[3] The consumer surplus is the difference between the actual price a person is willing to pay and the competitive market price (marginal price) that all consumers are asked to pay on "average".

3.2.5. The safari operator marketing system for Charara/Makuti

3.2.5.1. Introduction

The wildlife resources available in Charara/Makuti are ideally suited to offer quality big game and dangerous game trophy hunting to foreign clients. This type of sport hunting has been termed safari hunting for purposes of this dissertation. It forms the basis of Zimbabwe's viable commercial safari hunting industry.

This section estimates the 1991 hunting quota for Charara/Makuti as though it were marketed for safari hunting by a safari operator. This safari hunting value of the Charara/Makuti sport hunting quota represents the opportunity cost of using the area for citizen hunting - its present land-use. In the following, the method of marketing and pricing the resources of wildlife and access time for safari hunting are described. A minimum value for the Charara/Makuti sport hunting quota as safari hunting is estimated. The estimation was done by an experienced professional hunter and safari operator[1]. Full details of the quota allocation to hunts and their price calculations are given in Appendix 16, page A109.

3.2.5.2. The safari operator system of marketing Charara/Makuti

State hunting areas where sustainable hunting quotas[2] of African big game and dangerous game species occur are normally leased by the DNPWLM to commercial safari operators. The DNPWLM sets the total species quotas for sport hunting. Safari operators bid competitively to acquire the hunting concession. Successful operators pay a concession fee for exclusive access to the resource area and the right to hunt the quota. The safari operator then packages this quota into a number of different types of hunts, depending on the demand by his international safari hunting clients and their specific hunting preferences. This packaging is market-related and involves almost exclusively the hunting of male trophy animals.

- **Hunts in demand by safari hunting clients:**

The following hunts are internationally in high demand by foreign safari hunters, and typify how commercial safari operators allocate the scarce resources of wildlife species and access time in the hunting area (in hunting days) to specific hunts, in order to achieve a market-related quota allocation.

- 21-day trophy bull elephant hunt
- 5-day trophy buffalo hunt
- 15-day cat hunt (trophy lion or leopard)

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[1] The information is based on Seymour-Smith (personal communications) from 1991, whose invaluable assistance is gratefully acknowledged. Valuable insights were also gained in personal communications with: Travers, Booth, Grobbelaar (see Acknowledgements, page 250).

[2] Sustainable quotas for sport hunting are different to sustainable quotas for other management objectives, and have different implications for population management. Sustainable sport hunting quotas imply that populations are managed for the maximum yield of trophy animal numbers *of a particular trophy quality* (eg. ivory tusk size for quality trophy hunting of elephant). See Martin (1990). Populations can also be managed for maximum yield of animal numbers *of average or random trophy quality* (eg. for meat production or maximum population growth for breeding endangered species, such as white or black rhinoceros). See Giles (1978); T'Sas Rolfes (n.d.).

The trophy species elephant, buffalo, and lion or leopard form the basis for the hunting package, acting as so-called "draw cards" for clients to buy the hunt. The number and species of other animals (big game or plains game, trophy or non-trophy) included in the bag depends on a variety of factors. Ultimately, an operator includes the minimum hunting bag that, together with his personal services, is necessary to market the hunting package to a safari hunting client. Often, the relationship between a safari operator and his hunting clients is a personal one. A client's wishes are accommodated by the safari operator (within the quota limitations) and influence the final hunting bag. Alternatively, the hunting bag may also vary due to the composition of the sport hunting quota in each hunting area, and the safari operator's professional experience and skill at utilizing the hunting quotas (Booth, personal communication). In the end, the packaged hunt must be commercially viable, and saleable.

- **Pricing of hunts:**

The hunt's total price comprises two parts: the daily-rate for each hunting day, and the trophy price for each species sold in the hunting bag. In the following, prices given are in US$ - the currency in which most safari hunting is quoted and marketed internationally. Market prices for safari hunting are estimated for 1991.

The US$ was converted to Z$ at a fixed exchange rate of 3.07 Z$ per unit US$ (as per 31.5.91). Readers should note, however, that the Z$ values calculated here for safari hunting are conservative estimates, due to extensive devaluation of Zimbabwe's currency in 1991 by the Reserve Bank of Zimbabwe - and its continuing devaluation whilst this research was being conducted.[1] The fixed exchange rate used here is not to be mistaken as a measure of the market value of foreign exchange in Zimbabwe dollars. The market value of foreign exchange is estimated separately in Chapter 5 (see section 5.5, page 213).

- **Quota allocation to hunts:**

The following information is based on estimations by an experienced professional hunter and safari operator (Seymour-Smith, personal communication). The method packages the total quota available in Charara/Makuti into marketable hunts, and then values these hunts at actual market prices per species and hunting day.[2]

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[1] The Z$ currency is weak when compared to the US$ and German D-Mark, the two main hard currencies that Zimbabwe earns from safari hunters. The Z$ has been devalued continuously since this research was undertaken. The exchange rate was Z$2.67 per unit US$ (per 31.1.91), having been devalued by 13% to Z$3.07 per unit US$ per unit Z$ as used in this report (per 31.5.91), and being devalued still further to Z$5.05 per unit US$ (per 31.12.91); Reserve Bank of Zimbabwe, 1991.

[2] For Zimbabwe, Jansen (1989) and Child, B. (personal communication): 15-20, and for Botswana Cumming and Taylor (Botswana Government, 1989) have used another method that is based average trophy prices per species *actually sold*, calculated by analyzing data from many safari operator returns. Each safari operator's total revenue is based on different quotas, in different areas. The average trophy prices per species are then multiplied with species on an unpackaged quota to yield the total trophy revenue according to "market values". This method takes no account of the species composition or the relative species abundance of that quota. Daily rates are then added to this revenue as an average % of the total. The method appears questionable, as it does not guarantee the marketability of such a hunting quota. Actual (gross) hunting revenues may easily be over-estimated by this method. It is therefore not surprising that profitability and hunter-days are not correlated, nor that (gross) revenue per hunter-day varies greatly between individual safari operators, since the number of hunter-days does not determine the cost structure of a

The most efficient (revenue maximizing) way to package the Charara/Makuti quota into hunts, is to start with the most valuable trophy species and hunt types (in terms of daily rates and hunt length) and to allocate these so-called "draw cards" to hunts first. Taylor (1984) documents the safari operator packaging method. For the Charara/Makuti study area, the 1991 total species quota was estimated to support the following quality big game trophy hunts:

- Five 21-day trophy bull elephant hunts, each valued at a daily-rate of US$900 per day, with trophy prices totalling US$13'460 for each hunting bag.
- Ten 5-day trophy buffalo hunts, in high demand by safari hunters due to the scarcity of the buffalo species, each valued at a daily-rate of US$500, with trophy prices totalling US$1'960 for each hunting bag.
- Five 15-day "cat" hunts (draw cards are trophy lion or leopard), each valued at a daily-rate of US$700 per day, with trophy prices totalling US$4'550 for animals in each hunting bag.

Full details of the quota allocation to hunts are in Appendix 16, page A109.

■ **Hunt prices resulting from the marketing system:**

The total price for these hunting packages is then calculated by multiplying daily-rates with hunt length, and adding in the total trophy prices for this hunt type.

Table 3.11 Maximum and minimum hunt prices of safari operator marketing Charara/Makuti hunting areas: 1991

in Z$	Maximum Price	Minimum Price
Total hunt price	99'345[a]	12'692[b]
Average hunt price per hunter	49'673	6'346
Average hunt price per hunter per hunting day	2'365	1'269

a) 21-day trophy elephant hunt, US$32'360 (3.07 Z$/1 US$ per 31.5.91)
b) 5-day trophy buffalo hunt, US$4'460

Source: Safari operator marketing hunt prices calculated in Appendix 16, page A109.

Table 3.11 shows a summary of the maximum and minimum range of prices for the hunting packages marketed by a safari operator. Allowing for a maximum of two foreign hunters who can share a hunt (1 hunter and 1 co-hunter), each hunter's average contribution towards the hunt price and towards the hunt price per hunting day is shown. Calculations of hunt prices are shown in Appendix 16, page A109.

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business enterprise (see Jansen, 1989: 15-16).

■ **Estimated market value of Charara/Makuti as safari hunting:**

The total value of the hunting resources in Charara/Makuti hunting area if sold as safari hunting by a safari operator comes to US$281'650, or the equivalent of Z$859'039 using the exchange rate of 3.07 Z$/ 1 US$ (per 31.5.91). Allocated as citizen hunting using the DNPWLM lottery system, The same quota earned a revenue of Z$171'627[1] from citizen hunting using the DNPWLM lottery system. **The safari operator's gross revenue from safari hunting is five times less than that earned by the DNPWLM from citizen hunting.**

This calculation is based on the assumptions:

- Only those animals on quota in the Charara/Makuti hunting area were available to the safari operator.
- The value of animals on quota that remained un-utilized, consisting mainly of trophy and non-trophy buffalo, impala, and sable (see Appendix 16) were not included. The marketability of the hunts and the quota utilization could be improved, if additional plains game animals were available to the safari operator on other land.[2]
- Foreign exchange is valued at the official controlled (non-market) exchange rate, which does not reflect its true opportunity costs to the economy. This point will be considered further in the comparative study in Chapter 5.

These initial estimates strongly suggest that by allocating valuable big game and land in protected areas exclusively to citizen hunting in Charara/Makuti, these resources are being grossly undervalued by the present allocation system.

Chapter 5 assesses some opportunity costs of the DNPWLM lottery system with other Zimbabwean licensing systems.

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[1] Revenue from the quota at fixed prices was Z$128'567 (see calculations in Appendix 7.1, page A49), but also included Z$43'060 in ticket revenue from the lottery system (see item on demand by hunting applicants, page 68).

[2] Two options are made use of by safari operators in Zimbabwe. Additional plains game species may be available on other state land to which the operator has access for clients, or the operator may combine predominantly big game and dangerous game animal species in Charara/Makuti with additional plains game animal species situated elsewhere in Zimbabwe on private ranch land, increasing the latter's market value for sport hunting many times over. For details, see Child, B. (1988): especially pages 99, 280-282, 327-333; for a case study account involving Charara Safari Area to supplement plains game quotas on a ranch (1982-1987), see Child, B., (1988): 468-481.

3.3. Review of other licensing systems

The three foreign licensing systems sketched in this section contrast in some important points with the previous systems reviewed for Zimbabwe. These points are: the quality of services provided to sport hunters; the requirements for proof of a hunter's marksmanship prior to his entry into a hunting area; the use of a sophisticated computerized lottery and preference allocation procedure by the Wyoming lottery system to achieve a particular equality[1] - understood as a type of "fairness" in the distribution of hunts amongst applicants. This point is of particular interest for comparison with the equality of hunt allocation achieved by the ZHA lottery system in Zimbabwe (section 3.2.2.4, page 81).

The foreign allocation systems are excluded from the comparative assessment of Zimbabwean alternatives conducted in Chapter 5, for two reasons: Data requirements exceeded the time available for their collection, and the hunting revenues in several foreign currencies would have to be converted into Zimbabwe dollars, placing limits on their interpretation for comparative purposes.

3.3.1. The Wyoming lottery system

The description is based on the account of the American "Single license (*sic*) draw system" in a report issued by the Wyoming Game & Fish Department (1988). Additional licensing documents (Wyoming Game & Fish Commission, 1990; Wyoming Game & Fish Department, 1991) that were received in personal communications with Crowe were also consulted. The licensing system is called the "Wyoming lottery system" here for purposes of comparison with lottery systems in Zimbabwe. General descriptions of wildlife management for sport hunting in Wyoming and other American states were found in Crowe (1987) and Payne (1988).

- **Quota allocation to hunts:**

The Wyoming lottery system was designed for use in the state of Wyoming, U.S.A. by the Wyoming Game and Fish Department. In response to public demand for hunting licences, the system was fully computerized in 1988. The system allocates one single licence for each animal and species hunted on all land (state and private land) throughout Wyoming. In Wyoming, hunters undertake their hunt unaccompanied by staff of the Wyoming Game & Fish Department.

In both these points, sport hunting activity in Wyoming differs significantly to that practised by sport hunters in an African context. In Zimbabwe, a hunt involves a hunting bag with multiple animals and mixed species. Furthermore, all hunting parties are individually accompanied for control purposes by DNPWLM staff. Hunting trips in Wyoming are generally not restricted to a specific number of hunting days, such as they are in Zimbabwe

[1] On the meaning of equality, and equalities, see footnote 1, page 101.

or South Africa. For these reasons, the functions of planning, administering, and controlling hunting in Wyoming are fundamentally different to those of Zimbabwe's licensing systems, and demand significantly more detailed ecological and financial data than is available for African wildlife in Zimbabwe (see also Cumming, 1988). Further aspects of resource planning and management for the Wyoming system are not included here; they have been well documented by Crowe (1987).

Instead, the focus here is on the lottery, and specifically on the preference allocation procedure used by the Wyoming lottery system to allocate specific individual hunting preferences to applicants.

- **Pricing of hunts:**

The Wyoming lottery system caters for resident and non-resident hunting applicants. It is a fix-priced allocation system, which means that at fixed hunt prices a lottery is used to limit demand, rather than higher prices and applicant's willingness to pay. The prices paid for licence fees and application fees for most species are nominal compared to trophy fees for Zimbabwe citizen hunters. Licence fees in Wyoming range from US$15 (about Z$45) for a general deer licence, to US$200 (about Z$600) for a wild bison licence. Non-residents pay slightly higher fees than residents. (The administrative costs of allocating hunts by this system are planned in such a way that they are covered by licence fee revenue.)

- **Hunt characteristics and information made known to applicants:**

All applicants are only allowed one application for each species offered. Each species is made available to hunters using distinct licence types, according to the characteristics of hunting area, restrictions on hunting periods during the year, and other criteria. Non-resident hunters who applied the previous year for a licence, and applicants in the current year, are posted detailed application brochures. This information provides applicants with complete details of hunt characteristics, including:

- the hunting areas and their geographical boundaries, indicated on maps for each species;
- the hunting seasons;
- the numerous licence types for each species;
- the licence fees;
- the complete hunting regulations for every species;
- the detailed application procedure, with examples on sample application forms.

- **Application procedure:**

After studying the information brochures, applicants have a choice of five preferences for each species. For each preference, applicants indicate the hunting area and the licence type for that species on the application form.

- **Application rules for hunters:**

For certain of the rarer species (eg. moose, big horn sheep and mountain goat), each applicant is limited to one application every fifth year. This rule limits the demand for these species prior to the lottery, effectively increasing each applicant's probability of being drawn in the lottery for these hunt types.

Another important feature of the Wyoming lottery system is that at all stages, a clear distinction is made between applications submitted by single individuals for hunting licences, and applications submitted by groups of individuals (hunting parties) who intend hunting together. Both individual hunters and hunting parties are issued a single licence to hunt, so that **group applications count as single applications.** Hunters in a group are individually identified as belonging to a group application, and no group applicant can gain an advantage over a single applicant in the lottery draw because applicants are not permitted to apply as individual hunters and as members of a group - a rule enforced by rigorous controls of application data using a computer database. Consequently, hunting parties and individual hunters are equally weighted for the lottery draw. This rule has implications for the equality achieved during the hunt allocation procedure (see item on hunt preference allocation procedure, page 101).

- **Demand by hunting applicants:**

In 1988, the agency received about 300'000 applications[1] for 19 licence types and 11 species in Wyoming.

- **Hunt allocation procedure:**

Application data, licence types, area hunting quotas and licence fees are computerized. As licence applications are processed for the computer, they are cross-checked using manual and mechanical controls. Faulty applications are identified and returned to their applicants together with their application fees and a letter of explanation. If the deadlines permit, these hunters can then re-apply.

Due to the large number of hunts supplied to hunters in Wyoming, the number of applications (hunting parties and individuals) does not always exceed the number of licences supplied for each licence type. In 1988 for example, 131'000 applications by hunters were allocated licences directly without recourse to a lottery (Wyoming Game & Fish Department, 1988: p. 4 and p. 21).

In the majority of cases, however, the number of applications exceeds the available number of licences. A computerized random lottery draw is then used to allocate the remaining 101'109 available licences amongst the 169'000 applications (Wyoming Game & Fish

[1] Applications are not the same as applicants; a group application can include more than one hunter in this system. See previous item.

Department, 1988: p. 4 and p. 21). A procedure then determines which hunter's preferences can be accommodated. The lottery seeks to "**...assure absolute fairness** for all applicants..." (Wyoming Game & Fish Department, 1991: 3. Emphasis in the original.).

The meaning of equality, or "fairness", in the Wyoming hunt preference allocation procedure is now explored. It may be contrasted to the procedure used in the ZHA lottery system for Tuli/Doma/Rifa (section 3.2.2.4, page 81).

- **Hunt preference allocation procedure and equality:**

To commence the procedure, a computer programme assigns each individual or party application a random number using a tested algorithm. The applications are now sorted from smallest to highest random number, in descending order. The list of applications, ordered by random number, represents a single simultaneous ranking of all applicants prior to considering their actual hunt preferences. The actual lottery, or draw, in this computerized system thus takes place only once. (Lotteries drawn by hand achieve a step-by-step ranking of all winners at each draw, but not of all applicants.) The number of licences available in any hunting area determines how many random numbers will now be allocated a hunt.

The preference allocation procedure then assigns hunts to applications in a specific order, according hunt preferences. It is this order that determines the equality, or fairness[1] achieved by the system, and can be followed in Figure 3.6, page 103.

The first preferences **of all applicants** are considered according to their priority in the ranked, random number list. If an applicant's first preference is not available, the applicant is assigned to a temporary waiting list by the computer, until the first choices of the lower order applicants (those with larger random numbers) have been processed, or until there are no more hunts available.

Only once all applicants have had a chance to be assigned their first preference, are the second preferences **of all applicants** by the allocation procedure (see Figure 3.6, page 103). The computer retrieves the applications from the temporary waiting list (applicants with unfulfilled first preferences), and goes through the same procedure for the second preferences in order of their ranked, assigned random numbers. Thereafter, should there be any remaining applicants or hunts, the procedure attempts to assign their third, fourth and mth preferences. If, at any stage the quota limit for a species and licence type is reached, or no applicants remain in the waiting list, the procedure is ended (see Figure 3.6, page 103). In this procedure, each applicant's first choice is accorded an identical weighting, disregarding the draw order he was assigned in the ranked random number list.

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[1] Equality, or fairness, is used here as a concept that describes the distribution pattern of some benefit (or cost) amongst a number of individuals. Equality, in this sense, does not imply a value judgement of the distribution pattern(s) as being right, or wrong; the distribution(s) is (are) merely different. Since many distribution patterns may be achieved, there is no equality or fairness *per se*, but there are always a number of equalities. Rae, *et al.*, (1981) define the concept of equalities succinctly in their book.

■ **Example illustrating Wyoming's preference allocation procedure:**

The outcome of this procedure is best illustrated with an example, by adopting the notation:

A_1, A_2, ... A_5 for applicant A's preferences 1, 2, through to 5, who is ranked first on the random number list;
Z_1, Z_2, ... Z_5 for applicant Z's preferences 1, 2, through to 5, who is ranked last on the list.

Then, according to the Wyoming preference allocation procedure, applicant A's second preference A_2 would not be allocated before applicant Z's first preference Z_1, if this was available; similarly applicant A's third, fourth and fifth preferences A_3, A_4 and A_5 would similarly not be allocated before applicant Z's second preference Z_2, if this option was still available. The same logic holds true for every applicant in the Wyoming lottery system.

By assigning **all applicants a ranking** prior to the preference allocation using the random number, the Wyoming lottery system achieves an equal weighting of all applicants' and winners' preferences. The ZHA lottery system, by contrast, assigns **each winning applicant at a time a rank** whilst continuously allocating preferences using a manual draw. The ZHA lottery allocation thus achieves an unequal weighting of the winner's preferences (see section 3.2.2.4, page 81).

Once the Wyoming preference allocation is finished, the system uses the stored application data to print and address the hunting licences which are then mailed to all successful applicants. A report of unsuccessful applicants is produced, and the amount submitted in application fees is returned to the unsuccessful applicants within 48 hours of the draw. In the Wyoming lottery system, unsuccessful applicants are thus financially no worse-off after the draw than they were before it. (In the DNPWLM lottery system for Charara/Makuti, by contrast (see section 3.2.1.3, page 64), tickets are a significant form of revenue but unsuccessful applicants gain no benefit.)

The reviews of the next two allocation systems for hunting is on the facilities and services offered to South African citizen hunters, on the diversity of hunting packages offered, and on the clear distinction drawn between quotas sold strictly as trophy hunts, and those sold as non-trophy (venison) hunts.

```
For Applicants  = 1...n
For Preferences = 1...m

START ALLOCATION OF HUNTS WITH EQUALLY WEIGHTED PREFERENCES

If HUNTS to allocate = none, goto END
        Do First Hunt Preferences
                1st Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
                2nd Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
                ...
                nth Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
        End Do First Hunt Preferences

If HUNTS to allocate = none, or APPLICANTS in waiting list = 0, goto END
        Do Second Hunt Preferences
                1st Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
                2nd Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
                ...
                nth Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
        End Do Second Hunt Preferences
...
...
...
If HUNTS  to allocate = none, or APPLICANTS in waiting list = 0, goto END
        Do Mth Hunt Preferences
                1st Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
                2nd Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
                ...
                nth Applicant
                        Is Preference Hunt available?
                        Yes: allocate to Applicant, remove from HUNTS to allocate
                        No:  put Applicant into waiting list
        End Do Mth Hunt Preferences

If HUNTS to allocate = none, or APPLICANTS in waiting list = 0, goto END

END Allocation of Hunts is finished
```

Figure 3.6 Wyoming lottery system: Preference allocation with equally weighted hunt preferences for applicants

Source: Wyoming Game & Fish Department (1988).

3.3.2. The NPB lottery system for Mkuzi/Spioenkop

The Natal Parks Board (NPB) in South Africa offers hunting packages to foreign safari hunters and to South African citizen hunters in the controlled hunting areas of the Mkuzi Game Reserve and the Spioenkop Reserve. Data for the 1991 hunting season is based on correspondence with the NPB hunting administrator for the area (Davies, personal communication) in 1991. The NPB lottery system allocates hunts at fixed prices to applicants using a lottery system in two separate hunting areas.

In the Mkuzi Game Reserve, citizen hunters were offered 14 hunts in 1991, all exclusively with plains game species:

- 3 trophy hunts;
- 7 venison hunts;
- 4 mixed trophy/venison hunts.

■ **Quota allocation to hunts:**

For trophy hunts, the NPB allocates only male trophy-bearing animals to the hunting bags whereas for venison hunts, the bags comprise only female non-trophy-bearing animals, and for trophy/venison hunts, the bags comprise both male (trophy) and female (non-trophy or venison) animals (see Appendix 15.1, page A105). Quality and price diversity of the hunts on offer to prospective hunters is thereby increased, allowing hunters a variety of choice.

The size of the hunting bags, ie. the number of animals included in the hunting bag, for each of the 14 hunts, was small. Six animals from amongst four to six species of plains game were allocated to each bag. All hunts were for a 5-day hunting period, with one additional non-hunting day. A maximum of 4 hunters may comprise each hunting party; they must be accompanied by two game guards for control and guiding purposes inside the hunting area.

■ **Pricing of hunts:**

For the NPB lottery system, hunt prices include a trophy fee for animal species and a small licence fee that varies according to the species. The access time for hunting in the resource area is not priced separately in this licensing system (compare Ciskei system, section 3.3.3, page 107).

Table 3.12 Hunt prices of NPB lottery system for Mkuzi hunting area: 1991

in Z$	Price for Trophy Hunt	Price for Venison Hunt	Price for Mixed Trophy/Venison
Total hunt price	10'477[a]	11'350[b]	10'007[c]
Average hunt price per hunter	2'619	2'838	2'502
Average hunt price per hunter per hunting day	524	568	500

[a] 5-day trophy hunt, Rand5'890 (1.8413 Z$/1 Rand, per 31.12.91).
[b] 5-day venison hunt, Rand5'184.
[c] 5-day mixed trophy/venison hunt, Rand5'434.

Source: NPB lottery system hunt prices calculated in Appendix 15.1, page A105. Exchange rate taken from: Reserve Bank of Zimbabwe (1991).

Table 3.12 shows a summary of the range of prices for the trophy, venison and mixed trophy/venison hunting options sold by the NPB in 1991 in Mkuzi Game Reserve. Allowing for a maximum of four hunters who can share a hunt (1 hunter and 3 co-hunter), and an average of five hunting days per hunt, each hunter's average contribution towards the hunt price and towards the hunt price per hunting day are shown for each option. These prices excluded the accommodation of the hunting party in a comfortable bush camp (see item on hunting facilities and rules, page 106).

In the Spioenkop Reserve a pilot hunting programme for the controlled hunting area was planned in conjunction with the Natal Hunters' Association, and approved by the Natal Parks Board in mid 1991. For that year, two 3-day hunts took place, generating a total revenue of Z$11'050 (Rand6'000; Davies, personal communication). The prices at which Zimbabwean hunters can purchase qualitatively superior big game hunting are, by comparison, much lower to these plains game hunting prices.[1]

- **Application procedure/Demand by applicants:**

In 1991, there were 600 applications for the 14 hunts in Mkuzi. To apply, a hunter submits a maximum of three applications for any three hunts of his choice, at a cost of Rand10 per application. Hunters who were drawn were required to pay half the hunt's value in trophy fees as a deposit in order to secure the hunting rights, with the balance being paid prior to entering the hunting area. This rule ensures that applicants have a financial commitment to take their hunt up once they have been allocated one in the draw procedure.

[1] For hunt prices in the DNPWLM lottery system, see Table 3.2 (page 64); for those in the ZHA lottery system, see Table 3.3 (page 72) Table 3.4 (page 74) and Table 3.6 (page 79).

■ **Hunt allocation procedure:**

Hunts are allocated to applicants by a lottery draw using a computer. The procedure is not described further here.

■ **Hunting facilities and rules:**

On arrival at the hunting area, hunters are given the opportunity to test and sight their rifles, after which each hunter is required to undertake and pass a shooting test.[1] Those who fail the test are not allowed to hunt, and forfeit their hunting rights and deposit. This requirement ensures that high standards of marksmanship and hunting apply to all participants without favour, and increases hunter commitment to go and hunt once they have secured a hunt in the draw, quite apart from issues of safety and humane killing for human, and animal life respectively.

To provide accommodation, the Umkumbi bush camp was built in the hunting area of Mkuzi Game Reserve after its fourth successive hunting season. The facilities are well appointed, being designed to be available to hunters during the hunting season and to tourists during the non-hunting season. The facilities and services cost Z$940 a night (Rand480) for eight persons, and include:

- Tented accommodation sleeping eight persons, with toilet, shower and washbasin in each of the 4 tents. Bedding, towels and soap are provided;
- A fully furnished thatched rustic lounge/dining- room/bar, overlooking a natural water pan;
- A fully equipped kitchen. A deep-freeze and a fridge are included;
- An abattoir, a hoist under cover, working tables, and hanging beams, drying racks, a salting area and a brine bath;
- A cold room for meat is available at the Warden's camp, situated 30 kilometres from the hunting camp;
- The camp accommodation and kitchen facilities are fully serviced by staff;
- Laundry services are provided, and the camp is powered by electricity, and water is provided from a dam.

Strict precautions are taken to ensure that visible signs of hunting activity (eg. blood, or firearms) are minimized during transport of hunter's game carcases to the cold room facilities, located at the Warden's camp in the main tourist area.

In reports received by the NPB, hunters have commented favourably on the accommodation facilities offered at the hunting camps of both reserves (Davies, personal communication). This should not be interpreted as being the only standard of accommodation and facilities sought after by South African citizen hunters, as shown by the survey conducted by Reilly

[1] Hunters test and zero their rifles at 25, 50 or 100 metres. The shooting test required 3 out of 4 shots to be placed in a 150 millimetre square target from 100 metres, using a bench rest.

(1987) amongst Transvaal hunters. Their answers to a question on the standard of facilities required for hunting on private game farms ranged from rustic, to full board facilities.

3.3.3. The Ciskei first-come-first-served system

Ciskei Safaris, a private safari operator, leases four areas[1] of state land in the Ciskei, South Africa. The operator offers safari hunting to foreign clients, and citizen hunting to South African residents on a commercial basis using a first-come-first-served system based on market prices.

■ **Quota allocation to hunts:**

For citizen hunters, venison hunts (non-trophy animals) are offered with short hunting periods that include a hunting bag of African and non-African plains game. One type of hunt is designed as a trophy hunt, its bag including trophy animals of various species. Depending on the number of animals in each bag, the hunting periods of venison hunts varied as follows:

- 1-day (two female springbok);
- 2-days (4 animals, two species);
- 3-days (7 animals, two species);
- 5-days (13 animals, seven species).

Details of the hunt's individual animal and species allocations are in Appendix 15.2, page A107.

■ **Pricing of hunts:**

In 1991, an estimated 100 such hunts were offered to South African venison hunters (Donaldson, personal communication). Hunting parties for these hunts comprised a maximum of 4 hunters, and could include a number of non-hunting observers. The hunts were priced using a daily rate of Rand125 per hunter, and Rand50 per observer for each day's hunting, in addition to the trophy fee for any animals in the hunting bag that the hunter shot (killed or wounded).

Apart from the safari operator marketing system (see section 3.2.5, page 94), **this is the only other allocation system which was reviewed which treats access time in the resource area as a scarce resource, and places an economic price on it,** both for the hunter and the recreational observer who benefit in different ways from the access time. No Zimbabwe citizen hunting allocation system explicitly values and prices access time by hunters, co-hunters or visitors in the hunting party (at cost or what the market will pay) in the manner that the Ciskei first-come-first-served system does.

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[1] These areas are: Tsolwana Game Park, Hinana Tribal Resource Area, Mpofu Game Park, and L.L. Sebe Game Reserve.

What implications would a daily rate charged per person have for hunter's behaviour? To minimize his hunting costs per person, a hunter will have an economic incentive to form a hunting party with a maximum number of hunters (and contributing visitors) who will share the costs of the hunting trip. Consequently more hunters participate from the same consumptive (quota) and non-consumptive resources (access time and space) - improving efficiency for the resource owner (Ciskei Safaris in this instance) and the public (sport hunters and accompanying visitors).

Table 3.13 Hunt prices of Ciskei first-come-first-served system: 1991

	Venison Hunts				Trophy Hunt
in Z$	1-day	2-day	3-day	5-day	5-day
Total hunt price	562[a]	1'390[b]	2'955[c]	6'776[d]	7'826[e]
Average hunt price per hunter	140	347	739	1'694	1'957
Average hunt price per hunter per hunting day	140	174	246	339	391

a) 1-day venison hunt, Rand306 (1.8413 Z$/1 Rand, per 31.12.91)
b) 2-day venison hunt, Rand755
c) 3-day venison hunt, Rand1'605
d) 5-day venison hunt, Rand6'776
e) 5-day trophy hunt, Rand7'626

Source: Ciskei lottery system hunt prices calculated in Appendix 15.2, page A107. Exchange rate taken from: Reserve Bank of Zimbabwe (1991).

Table 3.13 shows a summary of the range of prices for the trophy, venison and mixed trophy/venison hunting options sold by Ciskei Safaris in 1991. Allowing for a maximum of four hunters who can share a hunt (1 hunter and 3 co-hunter), each hunter's average contribution towards the hunt price, and towards the hunt price per hunting day, are shown for each option. These prices included the accommodation of the hunting party in well appointed facilities (see item on hunting facilities and rules, page 109).

For South African citizen hunters, the Ciskei first-come-first-served system offers a significantly wider range of hunt, prices, and choice of hunting periods than the DNPWLM tender system supplies to Zimbabweans (see Table 3.8, page 87). In the Ciskei, plains game hunting is sold at three times the price of similar hunting in Zimbabwe, and offers a higher standard of services and accommodation.

- **Application procedure/Demand by hunting applicants:**

The hunts are advertised by Ciskei Safaris with full details of the hunt characteristics supplied to applicants on request. Applications are accepted by telephone on a first-come- first-served basis. In order to confirm an initial application and secure a hunt, hunters must pay a deposit. No data on demand was obtained.

- **Hunting facilities and rules:**

The prices in Table 3.13 for hunting packages offered to South African venison hunters include the following services (Donaldson, personal communication):

- accommodation in fully furnished and serviced lodges;
- catering by trained staff;
- hunting accompanied by trackers;
- slaughtering and meat preparation by experienced staff in an equipped abattoir;
- daily laundering.

All hunters are required to undertake and pass a shooting test on arrival at the hunting area, before they are permitted to hunt. Should hunters fail the test, they forfeit their right to hunt, and the deposit. This rule ensures that sport hunters who access the area are accomplished marksmen, practice regularly, and cause minimal wounding of the wildlife during the pursuit of their sport. It promotes and maintains a professional attitude amongst hunters practising their sport.

3.4. Summary: Zimbabwe and Wyoming licensing systems

The five Zimbabwean licensing systems and the Wyoming licensing system are summarized below. Particular emphasis is placed on how hunts are allocated to applicants at fixed and market prices using different mechanisms.

The economic equilibrium model for the hunting market introduced in Chapter 2 (see Figure 2.4, page 27) to illustrate the allocation functions of licensing systems, is applied in turn to each alternative. The interpretation of each licensing system alternative with the model reveals how each system fulfils its allocative functions. The three main allocation functions of licensing systems are:

- To limit the number of applicants demanding hunts to the fixed supply of hunts, ensuring that supply equals demand and that the market clears.
- To distribute the available supply of hunts according to some rule;

A further important function that is not obvious from the models, but is vital for a successful hunt allocation is:

- To ensure that hunts are allocated to those hunters who value them most, that means to those persons willing to give up most to obtain a hunt (in terms of money, time in a queue, or distance travelled). rather than to hunters who do not value them, or who value them less than other persons.

3.4.1. DNPWLM lottery system for Charara/Makuti

The DNPWLM lottery system for Charara/Makuti is interpreted in Figure 3.7 in terms of the equilibrium model for the hunting market (introduced in Chapter 2 with Figure 2.4, page 27). The figure shows the demand for hunts in Charara/Makuti as a typical negatively sloping demand curve D, indicating that more hunts are demanded at lower hunt prices. The fixed supply of hunts is shown by the vertical line S, indicating that supply does not increase at higher hunt prices (over the short term). Also shown in Figure 3.7 are the fixed hunt prices at $\bar{P}_1$, set according to the trophy prices in the government price schedule.

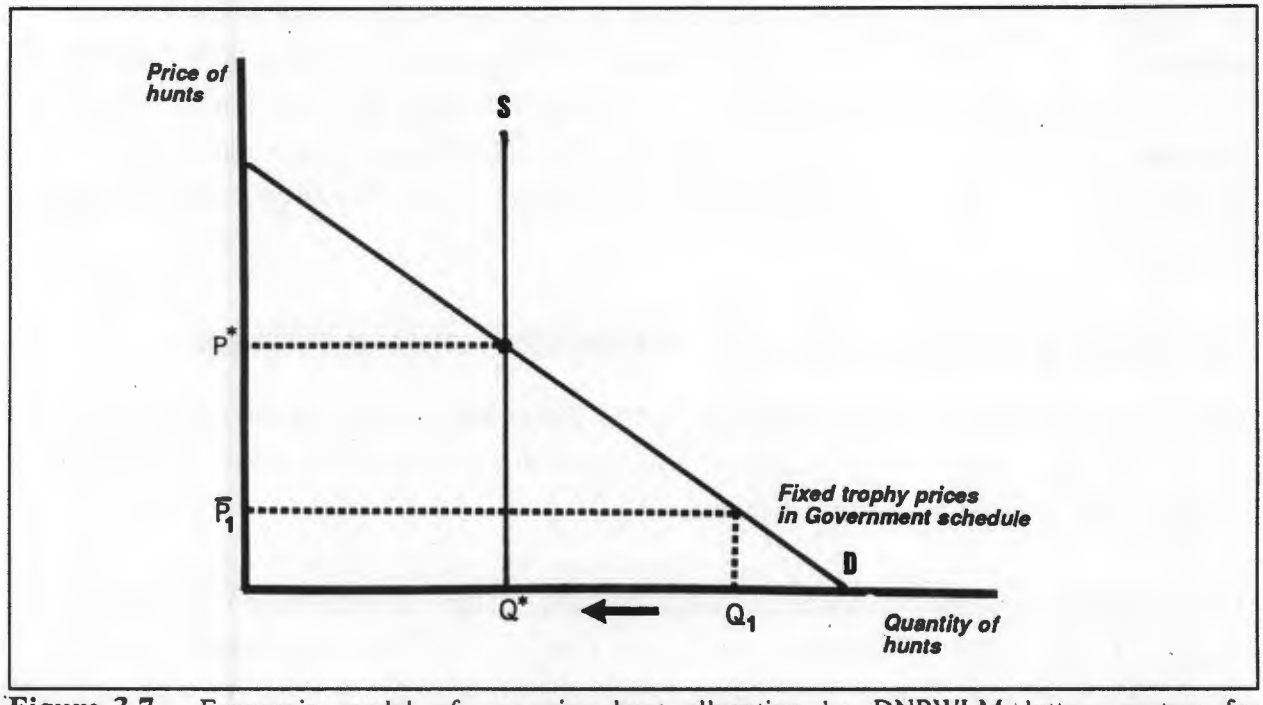

Figure 3.7 Economic model of non-price hunt allocation by DNPWLM lottery system for Charara/Makuti:
Allocating a given hunt supply amongst hunting applicants using fixed prices and a lottery
Source: Adapted from market equilibrium model, Lindsay (1984).

Figure 3.7 illustrates the allocation problem for the DNPWLM lottery system. At the fixed price $\bar{P}_1$, the number of applicants was Q_1, almost twice Q^* - the number of hunts available for allocation. Instead of using a higher market clearing price P^* to balance the supply of hunts (100 hunts) with the demand (196 applicants) the DNPWLM lottery system attempted to limit the number of applicants demanding hunts at the lower fixed trophy price ($\bar{P}_1$) using a lottery system.

The actual allocation of hunting for Charara/Makuti hunting area in 1991 took place in two stages, and made use of two different allocation mechanisms.

The first stage DNPWLM lottery system can be characterized by:

- Access to hunts was determined by a lottery draw. Each applicant was able to buy an unlimited number of priced lottery tickets, according to his willingness to pay. Applicants had unequal probabilities of winning a hunt, due to the varying number of priced tickets each applicant bought, and his draw order.
- Lottery tickets gave hunting applicants an option to win any of the hunts available in Charara or Makuti hunting areas (*Any Hunt*). Applicants did not know any features of hunts available to them.
- Winners of the lottery were allotted *Any Hunt* according to an arbitrary rule determined by the DNPWLM. The rule did not take account of applicant's personal hunting preferences, their willingness or ability to pay for the option to hunt, the number of tickets purchased, the fixed trophy price of the hunt, or the hunt's personal value for the winner.
- Hunts were priced using fixed prices set by the government trophy fee schedule for Zimbabwean hunters. The trophy prices are the lowest prices for hunting big game species available in Zimbabwe.
- Some winners who were allotted a hunt chose not to pay the hunt's fixed trophy price, thereby forfeiting the use and value of the hunting opportunity.
- Many other winners paid for their allotted hunt, but chose then not to take up their hunt on the designated hunting dates, thereby forfeiting the use and value of their hunting opportunity.[1]

The second stage DNPWLM first-come-first-served system

Hunts that were not sold, or not taken up by hunters during the first stage DNPWLM lottery system described above, were re-allocated to applicants in Harare during a second stage allocation on a cash first-come-first-served basis.

This system can be characterized by:

- Hunters who arrived first at the Harare licensing office had first choice of the number of hunts they wanted to purchase, and which left-over hunts they were willing to pay for.
- Hunts were priced the same as under the DNPWLM lottery system using fixed prices set by the government trophy fee schedule for Zimbabwean hunters.
- All these left-over hunts were quickly bought by applicants, with one applicant purchasing four hunts in his own name.

[1] Hunting licences issued by the DNPWLM to hunt on state land may not be transferred between persons according to Zimbabwe's hunting regulations. Trading, or swopping of unwanted hunts is thus not possible.

3.4.2. ZHA lottery system for Tuli/Rifa/Doma

The ZHA lottery system for Tuli/Doma/Rifa is interpreted in Figure 3.8 in terms of the equilibrium model for the hunting market (introduced in Chapter 2 with Figure 2.4, page 27). The figure shows the demand for hunts by members of the ZHA as a demand curve D, with the fixed supply of hunts shown by the vertical line S. Also shown in Figure 3.8 are the fixed hunt prices set according to the government price schedule at P_1, and the fixed hunt prices set by the ZHA to include a levy at $\bar{P}_2$.

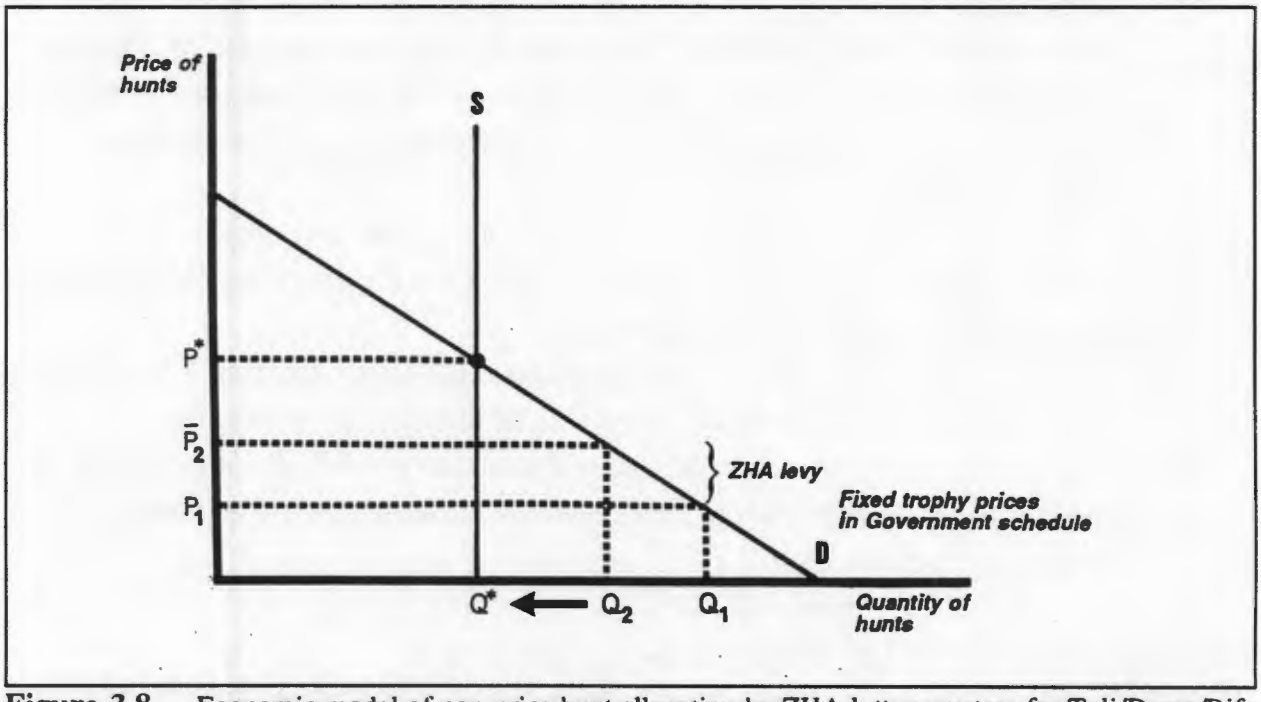

Figure 3.8 Economic model of non-price hunt allocation by ZHA lottery system for Tuli/Doma/Rifa
Rationing a given hunt supply amongst hunting applicants using fixed prices, a levy, and a lottery
Source: Adapted from market equilibrium model, Lindsay (1984).

Figure 3.8 illustrates the allocation problem for the ZHA lottery system. Since the ZHA raises a levy for all hunts on top of the fixed trophy price in the government schedule indicated by P_1 in Figure 3.8, hunts were sold at a fixed hunt price $\bar{P}_2$. The number of hunts demanded by members at this higher price was Q_2, still exceeding the number of hunts (Q^*) available for allocation. Instead of using an even higher market clearing price such as P^* to balance the supply of hunts with demand, the ZHA lottery system limited the number of members demanding hunts at the combined fixed trophy price and levy of $\bar{P}_2$ using a lottery system.

The ZHA lottery system can be characterized by:

- All hunting and non-hunting members of the Zimbabwe Hunters' Association (ZHA) pay a membership fee to benefit from the hunting opportunities and other services offered by the ZHA. Hunting members have a choice of three wildlife resource areas with big game hunting quotas on Parks and Wild Life Estate, each with a variety of predefined hunts.
- Access to the hunts for each hunting area was determined by a lottery draw. Applicants were each limited to one hunt in any of the three hunting areas. Each

applicant had an unequal probability of winning a hunt: probability was influenced by the number of areas an applicant applied for; the number of hunt preferences an applicant submitted, and his draw order.

- Applicants were fully documented and informed of the characteristics of all hunting options.
- Hunts were priced using fixed prices for each animal on quota in the hunting bag. Trophy fee prices were set by the ZHA at between 120% and 170% of the fixed prices for these species set in the government trophy fee schedule for Zimbabwean hunters, depending on the branch of the ZHA administering the hunting area.
- Applications for the lottery draw included a ranked list of each applicant's hunt preferences for a particular hunting area. The lotteries for each of the three hunting areas were conducted separately.
- As each winner was drawn in the lottery, he was awarded the first hunt available on his personal preference list (*Next Hunt Preference*).
- The ZHA draw procedure results in winners who are drawn early on in the lottery always receiving their higher ranked hunt preferences, and in other winners generally receiving lower ranked hunt preferences.
- Winners paid the ZHA the appropriate trophy fee for the hunt, and were issued a hunting licence. If winners did not want to take up the hunt they had been allocated, then they had two options: If the hunt was able to be resold within the association before the predefined hunting dates, the hunter incurred no cost for his decision to forfeit his hunting option. If, however, the hunt was not able to be resold before the designated hunting dates, the hunter was obliged to pay the hunt's full trophy price.

3.4.3. DNPWLM tender system for Dandawa

The DNPWLM tender system for Dandawa is interpreted in Figure 3.9 in terms of the equilibrium model for the hunting market (introduced in Chapter 2 with Figure 2.4, page 27). The figure shows the demand for hunts by Zimbabwe citizen hunters as a demand curve D, with the fixed supply of hunts shown by the vertical line S. Also shown in Figure 3.9 are the hunt prices set according to the government price schedule at P_1 (for reference only), the minimum reserve price set for all Dandawa hunts by the DNPWLM at P_2, and the highest fixed price tendered by applicants for a hunt at $\bar{P}_3$. It should be noted, that because tender prices are fixed, the tender prices submitted by hunting applicants need not necessarily be as high as the market clearing price of P^* if several persons tender the same fixed price for any particular hunt.

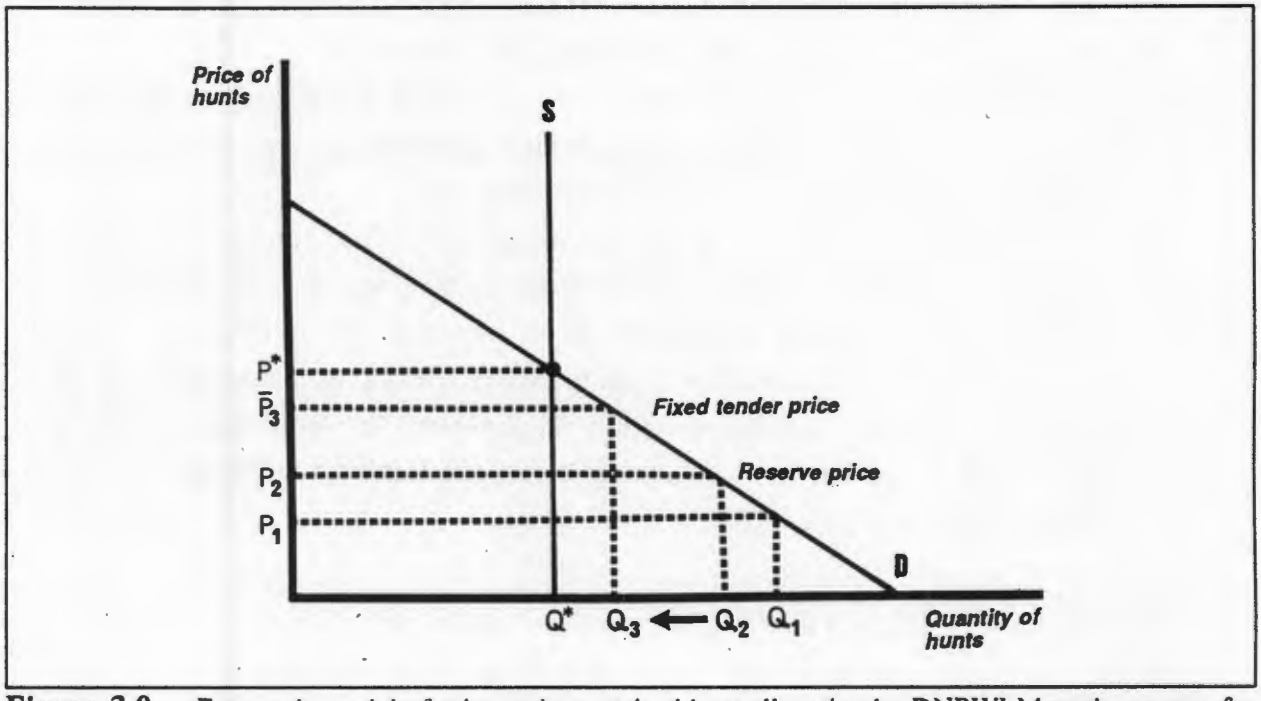

Figure 3.9 Economic model of price and non-priced hunt allocation by DNPWLM tender system for Dandawa
Allocating a given hunt supply amongst hunting applicants using fixed tender prices and selected lotteries
Source: Adapted from market equilibrium model, Lindsay (1984).

Figure 3.9 illustrates the allocation problem for the DNPWLM tender system. Since the DNPWLM allocated hunts based on the highest fixed price tendered for any hunt, in those instances where no persons submitted the same tender price for any hunt, the highest tender price was also the market clearing price P^*, as shown in Figure 3.9. At this price only a single person still demanded a particular hunt, so that the number of hunts demanded equalled the supply of hunts at Q^*.

If, however, several persons tendered the same fixed price for any particular hunt, as indicated by the fixed tender price $\bar{P}_3$, then the number of persons demanding hunts at Q_3 still exceeded the available supply at Q^*. In these instances, the DNPWLM used a lottery draw

to determine which of the tied applicants was to be allocated the particular hunt randomly. The DNPWLM tender system can be characterised as follows:

- Applicants were informed of the characteristics of all predefined hunts, which differed only in their hunting dates during the hunting season.
- Applicants then submitted fixed price tenders for each hunt according to their willingness to pay. Some hunting applicants tendered the same fixed amount for a number of hunts. No pre-payment by applicants was necessary.
- Hunters with the highest tender for each individual hunting opportunity were awarded that hunt, and the DNPWLM requested winners to pay the hunt price they had tendered.
- Having not committed any money during the tendering application, winners now had a choice of either paying for the hunt, or not paying for the hunt.
- Most hunters paid the fixed tender price, and most hunters took up their hunting opportunity.
- Some winners of the DNPWLM tender system refused to pay; these hunts remained allocated in the formal sense, but were unsold and did not benefit the DNPWLM or hunters.

Two further allocation problems arose due to the fixed nature of the price offers made by hunting applicants.

- The first problem experienced by the DNPWLM was that the price tenders made by several applicants tied for the same hunt. In these cases, the DNPWLM drew a separate lottery to decide which of the tied applicants was awarded the particular hunt.
- A second problem occurred because if the an applicant's tender price exceeded those of other applicants for several hunts at once; in such instances, the applicant had won several hunts - which contravened the allocation rules. In these cases, the DNPWLM once again used a lottery to decide which hunt was awarded to the winning tenderer. The hunter was not given the choice of personally choosing which hunt he valued most.

3.4.4. DNPWLM auction system for Nyakasanga/Sapi

The DNPWLM auction system for Nyakasanga/Sapi is interpreted in Figure 3.10 in terms of the equilibrium model for the hunting market (introduced in Chapter 2 with Figure 2.4, page 27). The figure shows the demand for hunts (or individual trophy animals) by Zimbabwe citizen hunters and foreign hunters as a demand curve D, with the fixed supply of hunts shown by the vertical line S. Also shown in Figure 3.10 is the minimum reserve price set for auctioned hunts (or individual trophy animals) by the DNPWLM at P_1. The hunt price P^* indicates the highest auction price for any hunt (or individual trophy animal) bid at the auction floor. This auction price was necessarily always the market clearing price.

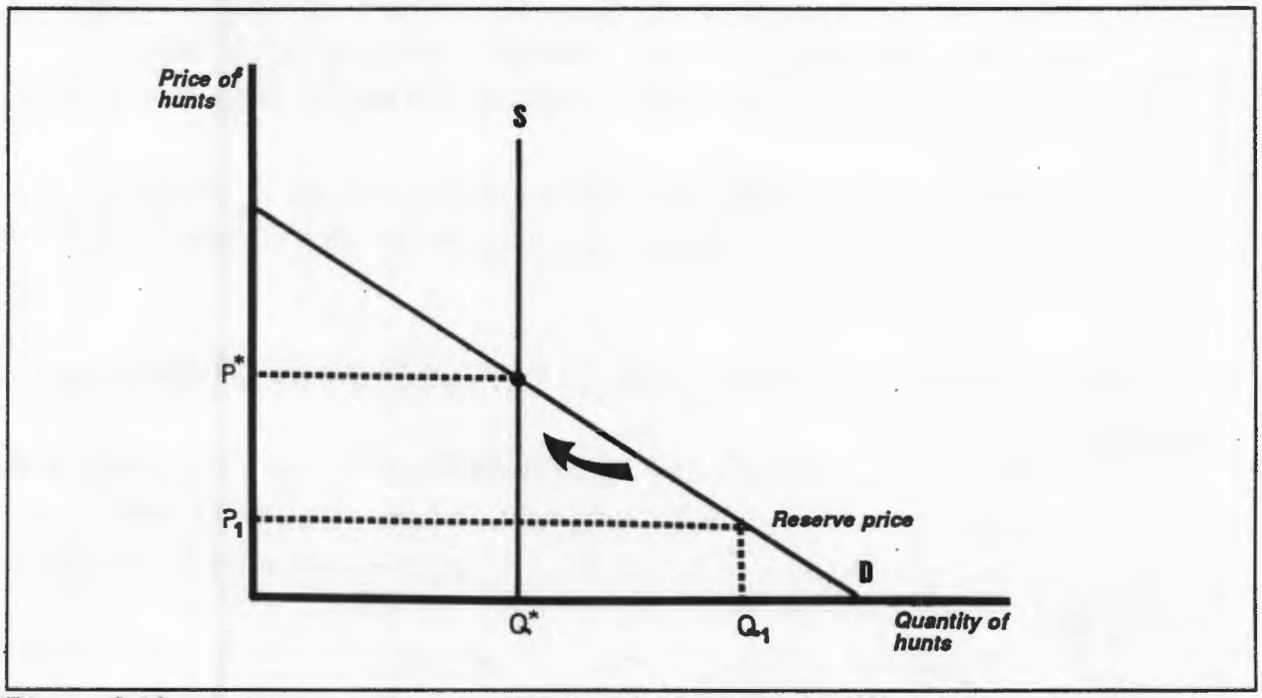

Figure 3.10 Economic model of price hunt allocation by DNPWLM auction system for Nyakasanga/Sapi
Allocating a given supply of hunts (or individual trophy animals) amongst hunting applicants using market prices
Source: Adapted from market equilibrium model, Lindsay (1984).

Figure 3.10 illustrates the allocation problem for the DNPWLM auction system that was solved using each applicant's maximum willingness to pay as the allocation criterion. Since the DNPWLM allocated hunts based on the highest auction price bid for any auctioned lot, the quantity of hunts demanded at the market clearing price P^* was always equal to Q^* - the quantity available. As the auctioneer raised the hunt's auction price, only those hunters who valued the hunting opportunity more than this price continued to bid, reducing the number of persons who demanded any hunt until only one bidder remained as the successful hunter.

This licensing system allocated big game hunts to Zimbabwean hunters and foreign hunters using a public auction that takes place once a year in Harare. The DNPWLM auction system can be characterized as follows:

- Each auction "lot" (auction lots were either basic hunting bags, or individual trophy animals) was auctioned individually to the highest bidder. Bidding was conducted in the Zimbabwe dollar, allowing both Zimbabwean and foreign hunters to compete according to each person's willingness to pay market prices.
- The auction was advertised locally and internationally by the auctioneer. Prospective bidders were provided with an auction catalogue giving full details of the hunt's features, the auction procedure and the payment details.
- The DNPWLM set a minimum (reserve) price for each auction lot that matched the lot's final auction price the previous year.
- A hunt gives successful bidders access to the hunting area for a number of hunting days, and licences him to hunt a quota of trophy animals as a basic hunting bag.
- Once a hunter has secured a basic hunting bag in the auction, he may bid for additional trophy animals of selected species.
- Winners were requested to pay the auctioneers before the auction was concluded, otherwise they forfeited their hunt.

3.4.5. Safari operator system of marketing Charara/Makuti

This licensing system alternative is based on the author's personal communication with a safari operator and an estimation of the option of utilizing the big game quota in Charara/Makuti for safari hunting, rather than for its present use of citizen hunting.

The economic principles for hunt allocation by the Safari Operator marketing system are essentially based on a competitive international market for big game trophy hunting. The model of the hunting market is similar to that depicted in Figure 3.10, page 116 for the DNPWLM auction system. The competitive market price for safari hunts determine both quantity and quality of hunting supplied by the safari operator, and the demand for hunts exhibited by foreign safari hunting clients. By adjusting the price at which the safari operator offers his client a hunting package, he ensures that demand equals supply within the constraints of his safari operating business.

A Safari Operator marketing system can be characterized by:

- A commercial business that operates in a competitive international market for foreign big game and specialist trophy hunts.
- Hunters are usually foreign hunting clients who are offered hunting packages by the safari operator priced in foreign exchange (normally US$).
- Safari operators are licensed business enterprises registered and recognized as a profession by the DNPWLM and the Zimbabwe Professional Hunter's and Guides Association.
- The exact packaging of the trophy animal species on quota into hunts - complete with personalized services, the pricing of the hunts using a species trophy fee and a daily hunting rate (related to the hunt's length) all depend on the safari operator's skill, marketing, and hunting experience, competition from other operators, and finally the wishes of his foreign hunting clients.
- The hunts are priced competitively using market prices, and are marketed in the commercial sense, rather than allocated in the strictly economic sense. Both price and reputation of the safari operator influence supply and demand.

3.4.6. Wyoming lottery system

In contrast to the Zimbabwean ZHA lottery system alternatives for hunt allocation, the Wyoming lottery system can be characterized by:

- Applicants applied and purchased licences to hunt individual animals of one species, rather than hunting packages with a hunting bag of mixed species. Hunts were priced at fixed prices set by the government which are low, if they are compared with prices for African big game hunts.
- Access to hunts was limited by a lottery conducted by the Wyoming Game and Fish Department for all hunting opportunities available in the state of Wyoming, which includes hunting opportunities on private land and state land.

- Hunters who apply as individuals, and hunters who applied as members of a hunting party were treated equally as single applications during the lottery allocation procedure.
- Each hunter (or member of a hunting party) was allowed only one application for each hunt type.
- Each application consisted of a ranked list of five possible hunt preferences; preferences were for hunts in different hunting areas, and for hunts at different times during the hunting season.
- Applicants are successively awarded their first preference, if available (*First Hunt Preference*); no applicant was considered for his second hunt preference until all applicants' first hunt preferences had at least been considered by the Wyoming preference allocation procedure.
- The order in which the applicants were considered for the hunt allocation procedure (equivalent to the lottery draw order) was determined using a random number to rank each applicant.
- The Wyoming lottery allocation procedure ensured that winners of the hunts on offer are always randomly chosen from amongst those applicants with the highest ranking for every hunting option.
- Each applicant was assured of an equal probability of winning his *First Hunt Preference* for each hunt type.
- Applicants who did not draw a hunt were refunded their application fees in full, so that they were financially no worse off after their application, than before it.

CHAPTER 4

CASE STUDY OF THE DNPWLM LOTTERY SYSTEM FOR THE CHARARA/MAKUTI STUDY AREA: A MICROECONOMIC ASSESSMENT

4.1. Introduction

The previous chapter presented a systematic overview of licensing systems that are used in Zimbabwe and other countries to allocate hunting resources to hunters. Particular emphasis was placed on how these systems determine who is licensed to hunt, whether and how applicants can express their hunt preferences, and how the scarce resources of wildlife and access time to hunting areas are priced.

A major assumption made by all methods of resource allocation (in economic theory and practice in Zimbabwe) is that once a hunter has been allocated a hunt at a certain price there are no further access costs. The methods all assume that the hunter then automatically pays the hunt price and enjoys (consumes) the hunting benefits. For licensing systems in Zimbabwe, this means that once an auction, tender or lottery system has determined who is licensed to hunt and at what price, all licensed hunters are assumed to actually take up their hunts and go hunting, making use of the diverse hunting and non-hunting benefits in the hunting areas.

The assessment in this chapter shows that in 1991 this assumption did not hold for the DNPWLM lottery system in the Charara/Makuti study area, so that on the one hand hunts were not allocated **efficiently** to hunting applicants, that is at the least economic cost to hunters and the DNPWLM. In the technical review of this licensing system in Chapter 3, it was suggested that the allocation was not efficient for the DNPWLM because hunts were allocated twice, first using a lottery system and then using a first-come-first-served system. The initial citizen hunter interviews reported in Chapter 2, suggested that the hunt allocation was not efficient for citizen hunters, because they were dissatisfied with the lottery system and because applicants could not choose hunts personally, which led to one hunter admitting he had not paid for the hunting licence and the forfeit of his right to hunt.

Equality of access on the other hand, (the same probability of winning a hunt in the draw for Charara/Makuti) did not appear to match a lottery's expected objective, because the DNPWLM lottery system's rules enabled applicants to purchase unlimited numbers of tickets according to their willingness to pay, which led automatically to unequal draw chances.

The purpose of the case study assessment in Chapter 4 is to assess how efficiently and equally the DNPWLM allocated hunts in Charara/Makuti to applicants in 1991. The focus is

on the hunt allocation component in the licensing system framework (see Figure 3.1, page 65), and assesses hunts planned for the Charara/Makuti hunting areas as a case-study. The case-study takes a microeconomic perspective of the problem of allocating hunts to individual hunters according to their personal choices.

The assessment in Chapter 4 is in two parts, each based on an hypothesis that is tested with licence data gathered for the allocation of hunts to Zimbabwe citizens in 1991.

The question asked in the first part (section 4.2) concerns how efficiently the lottery system allocated "hunts", viewed as a complex bundle of scarce resources and valuable benefits: Were all 100 hunts planned for Charara/Makuti allocated successfully to Zimbabwe citizen hunters by the end of the hunting season? **The first hypothesis is that the lottery was not efficient.** The extent of the problem is examined and quantified, and available evidence explaining the causes as far as possible is documented.

The question asked in the second part (section 4.3) concerns how "fairly" the lottery system allocated hunts: Were the 100 hunts planned for Charara/Makuti allocated equitably to Zimbabwe citizen hunters? **The second hypothesis is that the lottery system was not fair, and applicants had different probabilities of winning a hunt.** This hypothesis is fairly obvious from the lottery rules which allow applicants to enter multiple tickets in the lottery draw. Less clear are the extent of the problem, the difficulties of achieving fair hunt allocations using lottery systems and the limitations of lottery systems. But by simulating the lottery, inequality between applicants in the DNPWLM lottery system was quantified to enable the subjective concept of fairness to be assessed objectively. The result has important consequences in turn for allocating hunts to individual hunters efficiently.

The relevance of these results for allocating hunts is discussed in each part separately at the microeconomic level for efficiency and equality. These discussions assume that decision-makers choose principally to allocate hunts randomly using a lottery system, and to value each hunt's resources and benefits arbitrarily at fixed, government controlled, trophy prices.

Conclusions from the preceding sections are drawn (section 4.5). Principle limitations of using lottery systems to allocate scarce, economically valuable wildlife resources are highlighted (section 4.6). Specific recommendations are made (section 4.7.1) to improve efficiency problems of the DNPWLM lottery system for the Charara/Makuti study area. To improve equality problems of the DNPWLM lottery system, specific recommendations are made (section 4.7.2), although this depends entirely on how fairness is defined, the degree of equality that is to be obtained, and the unknown administrative costs of putting such measures into practice. All recommendations in Chapter 4 are made assuming that the administrative costs of lottery systems are, in principle, justified, and are outweighed by the (unknown) benefits of lottery systems for the allocation of scarce hunting resources. But since lottery systems are impersonal, the value of hunting benefits to Zimbabwe citizens is unpriced, and

there is no way of determining net benefits of a lottery system using the microeconomic viewpoint adopted in Chapter 4.

Taking a comparative and macroeconomic viewpoint, the following chapter then investigates the question of size and significance of the opportunity costs of using fix-priced lottery systems, rather market-priced alternatives, for the Charara/Makuti study area. Consequently, an integrated overall justification for adopting any of these recommendations to improve the lottery system in Charara/Makuti is deferred until Chapter 6.

4.2. Efficiency of hunt allocation

The main objective of a lottery system is to allocate a certain number of pre-defined hunts to Zimbabwe citizen hunters and give a maximum number of hunters an equal chance to benefit by hunting in the Charara/Makuti study area (see Figure 3.1, page 65). To maximize hunting experience for hunters involves measuring qualitative and quantitative aspects. The quantitative assessment of the hunting experience is undertaken here by measuring the number of hunts hunters actually took up during the 1991 hunting season in comparison to those that administrators had planned for allocation. The qualitative assessment of the hunting experience is not done directly, but indirectly by looking at the consequences of hunter's personal decision-making process in retrospect from the time he is allocated a hunt to the time he completes his hunt. A hunter's decision-making process begins when he decides to hunt and applies in a system. If he is lucky and wins a hunt in the lottery draw, the hunter may decide to pay for the allocated hunt. Finally, the hunter can decide whether to go hunting and benefit from the right to hunt and access the hunting area, which is determined when he actually books into the DNPWLM licensing offices in Kariba or Marongora for the Charara and Makuti hunting areas respectively. With selected personal interviews of hunters some qualitative data was gathered directly.

No attempt is made here to systematically assess (quantify) the degree of benefit or satisfaction derived by hunters, nor are individuals compared in any way. The quality of the hunt can only be experienced by individual hunters according to their own personal (subjective) value judgements once they have finished their hunting trip. Elsewhere (Crowe, 1987), attempts to obtain such information are made by questioning hunters.

The hypothesis of efficient hunt allocation tested here is that hunters did not benefit fully from the 100 hunts supplied by the Charara/Makuti study area in 1991, due to the design of the DNPWLM lottery system.

The efficiency of hunt allocation in section 4.2 is structured as follows:

- Efficiency criterion for hunt allocation by lottery;
- Data and method used;
- Decision tree results;
- Discussion of results;
- Principle limitations of lotteries for efficient hunt allocation.

4.2.1. Efficiency criterion for hunt allocation by lottery

Efficiency is quantified as: the actual number of hunts that applicants made use of during the 1991 hunting season, in relation to the total number planned (100) by the DNPWLM. Were all the hunts available for allocation in Charara/Makuti in 1991 actually taken up by hunters after that year's lottery allocation? If this question can be answered in the affirmative, then the DNPWLM lottery system would have been 100% efficient.

The review of the DNPWLM lottery system for Charara/Makuti (Chapter 3) showed that hunt allocation in the study area took place in two distinct stages, as the framework and overlay indicated (see Figure 3.1, page 65). The first stage allocated hunts using a lottery system (until the 30.4.91), whilst the second stage used a first-come-first-served system (after the 16.7.91) to re-allocate hunts that were still available. A generous period of two weeks was allowed for administration and planning of the re-allocation by the DNPWLM, so that the 1.7.91 was taken as the cut-off date for hunts (according to their planned hunting dates) that were available for re-allocation. This date is based on information supplied by the DNPWLM offices in Kariba and Marongora to the central licensing office in Harare.[1]

The two stage hunt allocation for the Charara/Makuti during 1991 meant that three efficiencies of actual to planned hunts must be distinguished for the allocation, namely:

- The efficiency of the first stage allocation by the lottery system, for hunts with planned hunting dates and actual licence receipt dates prior to 30.4.91.
- The efficiency of the second stage allocation by the first-come-first-served system, for hunts with planned hunting dates before the 1.7.91.
- The efficiency of the overall allocation in terms of the objective of allocating all planned hunts to benefit the maximum number of hunters in the Charara/Makuti areas.

Any hunts with hunting dates after the 1.7.91 which the allocated hunters did not take up after the first lottery allocation could not, therefore, have been re-allocated by the DNPWLM using the second first-come-first-served allocation system. Hunts with hunting dates after the 1.7.91 that became available constituted "wasted" hunting opportunities and an inefficient resource allocation.

The two stage allocation required data to be collected, analyzed, and presented so that each efficiency could be assessed separately.

4.2.2. Data and method

The efficiency of the hunt allocation was examined using data from hunting licences issued by the DNPWLM central licensing office in Harare for each hunt planned. In total, the DNPWLM planned 100 hunts using the hunting resources available for the Charara/Makuti

[1] The DNPWLM Kariba licensing office informed the central licensing office in Harare by letter of the hunts that had not been taken up by the 1.7.91, (Katuma, personal communication).

study area in 1991: 40 hunts for the Charara hunting area (for quota allocation to hunts, see Appendix 2.1, page A5), and 60 hunts for the Makuti hunting area (for quota allocation to hunts, see Appendix 2.2, page A9).

To trace the history of each hunt, the method required that the hunting licences for all 100 hunts be located and accounted for. The licence originals and carbon copies were consulted at the DNPWLM licensing offices in Harare, Marongora and Kariba. Data was corroborated between these sources a number of times during the hunting season, and on the 26.9.91 for the last time.

For each hunt, identified by a hunting licence and hunt number, data on the licence holder's identity (surname, initials, address), the number and species of animals on quota (hunting bag), the total fixed price of the quota of animals (hunt price), the receipt date on the licence (payment), were noted and entered in a spreadsheet programme. For reasons of confidentiality and volume, the author decided to exclude raw application data, and that the condensed analysis results sufficed (Figure 4.1, page 126). The planned hunting dates were also entered for each hunt.

The data was then analyzed using a decision tree technique to trace each hunting licence from its first allocation by the lottery system (receipt date before 30.4.91), through its possible second re-allocation by the first-come-first-served system (hunting dates before 1.7.91).

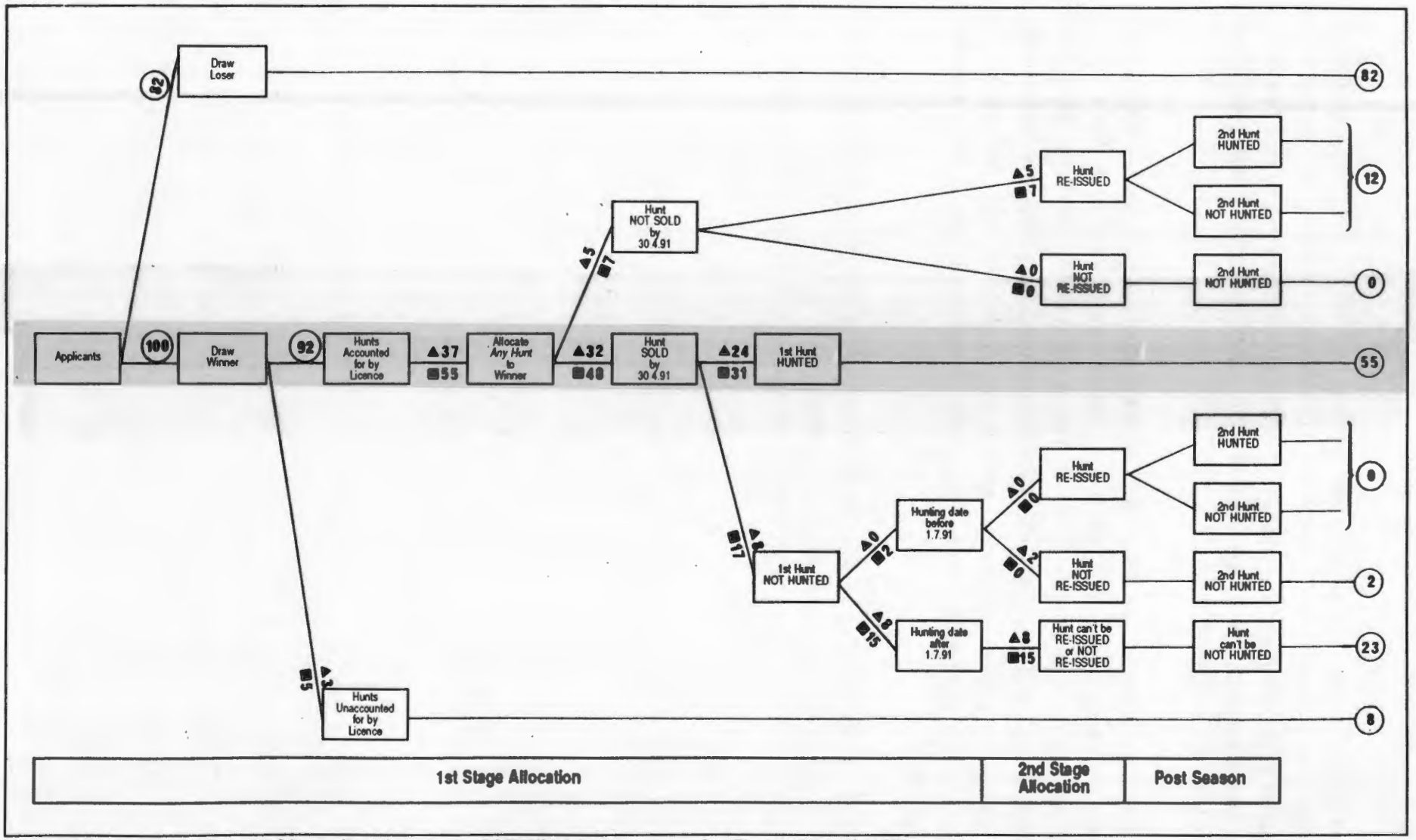

Figure 4.1 Decision tree of hunt allocations in the DNPWLM lottery system for Charara/Makuti: 1991

The number of hunts in each area is denoted next to a symbol for that area. The number and symbol combinations are specific to each branch shown: ■ denotes Makuti; ▲ denotes Charara; ○ denotes the areas totals for the Charara/Makuti study area. For example, 55 indicates a total of 55 hunts on the central stem for Charara/Makuti. The shaded tree-stem denotes the most efficient allocation of hunts.

Source: DNPWLM licensing records. Cartographic assistance by A. Vinnicombe is gratefully acknowledged.

4.2.3. Decision-tree results

The results of the analysis are presented as a decision-tree (Figure 4.1, page 126) to show the number of hunts that benefitted hunters at each allocation stage during the 1991 hunting season. Starting with the first allocation by the lottery system, the total number of applicants that applied (on the left) are followed through to the lottery draw and first allocation stage (in the centre), then on to the second stage re-allocation by the first-come-first-served system (on the right). The number of hunts used by hunters at each stage is marked on every branch of the decision-tree using triangular symbols for hunts in Charara, square symbols for hunts in Makuti. Hunt totals in Charara/Makuti by the end of the hunting season (26.9.91) are marked using circles on the far right of Figure 4.1.

The stem of the decision-tree is highlighted. It represents the most efficient overall hunt allocation possible. The licensing system would have been 100% efficient if all 100 hunts planned for Charara/Makuti had been sold by the 30.4.91, and subsequently all 100 hunts had been taken up and hunted by these hunters during the hunting season on their specified hunting dates.

The actual results of the hunt allocations (Figure 4.1) differ markedly from the 100% efficient results. The results in Figure 4.1 for the 40 hunts in Charara and 60 hunts in Makuti are summarized as follows. The notation (▲40/■60) is adopted, where ▲40 indicates forty hunts (or licences) in the Charara, and ■60 indicates sixty hunts (or licences) in the Makuti hunting areas, respectively:

After the first hunt allocation stage by the DNPWLM lottery system:

- A total of 55 hunts (▲24/■31) were allocated to hunters who paid, and used the hunting opportunity to their benefit, as shown by the shaded stem in the diagram.
- Of the remaining 45 hunts that were not used during the first stage, a total of 12 hunts (▲7/■5) were allocated, their applicants notified, but the hunts were not paid for by the deadline, as shown by the branches above the efficient shaded stem. These hunters thus forfeited the hunt they had won in the lottery and derived no benefits from hunting.
- A further 25 hunts (▲17/■8) were allocated, paid for by the hunter, but were not taken up, as shown by the branches below the efficient shaded stem. These hunters thus forfeited the hunt after the hunting dates, incurred the cost of the hunt's trophy price, but did not use their option to access the hunting benefits in the resource areas.
- Finally, a total of 8 hunting licences (▲5/■3) could not be traced, despite numerous efforts made by the author to locate licence originals and copies at the Kariba, Marongora and Harare licensing offices. Data was last corroborated on the 26.9.91.

For the analysis, the author assumed that none of these licences had been allocated, paid for, or used by applicants for hunting at any stage[1].

After the second hunt allocation stage by the DNPWLM first-come-first-served system:

- All 12 (▲5/■7) of the previously allocated, but unsold hunts, were re-allocated at the Harare licensing office. Hunters, who may or may not have been applicants in the lottery, derived benefits from hunting.
- Of the 25 hunts (▲8/■17) that were sold after the first stage lottery, but not taken up by hunters, only two hunts in Makuti were able to be re-allocated in the second stage because hunting dates were prior to the re-allocation date. Both the hunts were not re-allocated.
- The balance of 23 hunts (▲8/■15) with hunting dates after the re-allocation date were not re-allocated, or hunted by the end of the year.

Consequently, the efficiency of the hunt allocation for the Charara/Makuti hunting areas in 1991, differentiated according to each allocation stage, was as follows:

- The first stage using the lottery system for hunt allocation was 55% efficient. (The first stage DNPWLM lottery efficiency is calculated as the total of 55 hunts (▲31/■24) out of the 100 hunts (▲40/■60).) These 55 hunts benefited hunters who first applied using the DNPWLM lottery system.
- The second stage using the first-come-first-served system to allocate hunts was, in itself, 85% efficient. (The second stage DNPWLM first-come-first-served efficiency is calculated as the further 12 hunts (▲5/■7) divided by the possible 14 hunts (▲5/■7) that had hunting dates prior to the cut-off date (1.7.91).) These 12 hunts benefitted additional hunters who obtained a hunt using the DNPWLM first-come-first-served re-allocation system.
- Overall, the allocation of hunts in the Charara/Makuti study area was only 67% efficient by the end of the season. (The overall efficiency is calculated as 55 first stage hunts, plus 12 second stage hunts, that benefitted citizen hunters, in total 67 hunts divided by 100 planned hunts for the study area in 1991.) The remaining 33 hunts (▲13/■20) were not allocated or hunted by applicants who had not already obtained a hunt.

4.2.4. Discussion of results

The results presented in the previous section show that the actual number of hunts which benefitted citizen hunters in Charara/Makuti in 1991 (overall 67 hunts) fell markedly short of the planned number (100 hunts), inspite of the re-allocation of unused hunts attempted by the DNPWLM using the first-come-first-served system.

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[1] It is, however, possible and likely that the quotas of unsold hunting bags were sold and hunted by the end of the hunting season (species' quota utilization), since unshot animals are regularly re-allocated to hunters who already have hunts, at the Marongora and Kariba licensing offices. The resale of entire hunting bags as unshot animals does not benefit a larger number of hunters, nor does it achieve the licensing system's objective of allocating all hunts as planned.

To find the reasons that led to these results, and to understand why overall the licensing system in the Charara/Makuti study area was not 100% efficient, further investigation was done and is reported below. Applicant's, winner's, and hunter's motivations are examined. Additional evidence, consisting of hunter interviews, hunter correspondence, DNPWLM administrator interviews and personal observations during field research, is put forward to try to establish why participants behaved the way they did. Inferences from available data are made assuming rational economic behaviour (cost minimization or benefit maximization) on the part of citizen hunters. Concentrating on the first stage allocation by lottery, three questions are pertinent to understanding the efficiency results:

1. Why did some hunters (13 out of 100 planned hunts) buy lottery tickets, but then choose not to pay for hunts allocated by the DNPWLM lottery system for Charara/Makuti?
2. Why did other hunters (25 out of 100 planned hunts) pay for the allocated hunts, but later choose not to go hunting between the specified hunting dates?
3. Were citizen hunters generally, including those who did choose to take up their hunting opportunity, satisfied with the hunts they were allotted?

Some indications answering these questions can be traced back to the problems experienced by the DNPWLM and hunters with versions of the lottery system used for Charara/Makuti prior to 1991 (see review in Chapter 3). The complete lack of choice for hunters to choose any of the hunt characteristics in the 1989-1990 lottery version is still evident in the 1991 version assessed here. Doubling the number of hunts between 1990 and 1991 based on the same sport hunting quota for the area also played a major role by reducing the value of the hunts to hunters.

Further evidence explaining the results presented was found in correspondence between hunting applicants and the hunting administrators at the Harare licensing office of the DNPWLM. In addition, four citizen hunters (listed in Appendix 3, page A27) were interviewed informally in Harare to gain first-hand insights to Zimbabwe citizen hunter's personal motives and expectations. By asking these hunters a number of general questions (see Appendix 4, page A27) on their hunting experience and their previous hunting activity in specific hunting areas, the author first established whether the hunter had any experience of the DNPWLM lottery system in 1991. If so, these hunters were then specifically asked to comment on this system, and to describe how they thought the DNPWLM lottery system worked. The hunters were selected for their experience in sport hunting. Two hunters were chosen because they were also members of the ZHA, and could draw comparisons with the ZHA lottery system.

Key aspects that emerged from hunter correspondence and interviews to explain why the DNPWLM lottery system was not efficient, were:

- The entire absence of personal choice by applicants to choose even the most basic of "hunt characteristics" (see section 2.1.2, page 13), for example: hunting bag, hunt price, hunting dates;
- The miss-match between the hunt's trophy quality and fixed price and the hunter's willingness to pay for a hunting experience (price of lottery tickets) due to the arbitrary procedure (described fully in the review, section 3.2.1.3, page 64) chosen by the DNPWLM to allocate hunts to lottery winners;
- Inadequate variety and value of hunting bags in packaged hunts (quality of animals and quantity of animals);
- The total lack of basic information for applicants on the licensing system and hunt characteristics that prevented applicants them from exercising real choice in their best interests.

The indications and evidence that led to these conclusions will be presented under the headings of the three questions posed at the outset of this discussion section.

4.2.4.1. Why did hunters apply to hunt, win a lottery hunt, but not pay?

■ **Hunting bags were too small (quantity of animals):**

Some of the interviewed hunters said that the hunting bags they had won contained too few animals, or lacked significant trophy animals, to warrant buying the bag and incurring considerable additional expenses to undertake their hunting trip (transport, food, time). By doubling the number of hunts for Charara/Makuti hunting area from 50 hunts 1990 to 100 hunts 1991, the hunting bag specified for each hunt accordingly had fewer animals (based on the same total species quotas for the areas).

The behaviour of citizen hunters can be clarified by considering the choices they face with respect to the different costs and benefits of the hunting trip as a whole (Table 4.1, page 131). Initially, hunters incur the cost of purchasing a number of lottery tickets. The results of the lottery simulation (see section 4.3.6, page 148) show that 90% of all winners who won a hunt each purchased between 10 and 1'980 lottery tickets, costing Z$20 per ticket. Total **ticket costs thus ranged between Z$200 and Z$1'980 per person**. The ticket price was non-refundable and was not subtracted from the hunt's total price for winners of the lottery, so increasing the total hunt price for each winner.

Then winners of a hunt in the lottery draw paid the fixed price for the right to hunt and access the areas, which depended on the composition of the hunting bag allocated to that hunt. Analysis of hunt prices for the quota allocation to hunts in 1991 (see Figure 3.2 and

Figure 3.3, page 66) showed that 85% of all hunts in Charara/Makuti[1] had a hunt price of Z$1'500, or less.

The remaining cost items for hunters who undertook the hunting trip comprised the greatest proportion of the total costs of the hunting trip. Items included transport costs to, within, and back from, the hunting areas, food, equipment, staff, weapons and ammunition. Transport costs for a return trip from Harare to the Charara/Makuti study area are high. They were estimated at Z$1'180 per vehicle and hunting party for a return trip[2], assuming hunters only use one vehicle per hunt. For hunters living further from Charara/Makuti than Harare, the cost item of transport, and therefore the total costs of the hunting trip were even greater. One passenger vehicle (eg. landrover) per hunting party is unlikely. Moreover, a lorry is essential for hunters with elephant and buffalo on quota, in order to transport the carcass to the hunting camp for processing, and the processed products (meat, hide and equipment) from the hunting camp back home, ensuring full utilization of wildlife resources. Other estimates by Grobbelaar (personal communication) put the total cost of a citizen hunting trip conservatively at about Z$10'000, which includes transport costs to, within, and back from the hunting area, food for the hunting party and staff, a figure for hiring weapons and camping equipment, ammunition. Details of the estimate are in Appendix 18, page A110.

Table 4.1 summarizes the costs mentioned above for purchasing a hunt in Charara/Makuti.

Table 4.1 Opportunity costs of purchasing a hunt in Charara/Makuti

	Commitment			
	Minimum, in Z$	%	Maximum, in Z$	%
Cost of tickets purchased[a]	200	2%	1'980	15%
Hunt price (for 85% of hunts)[b]	1'500	13%	1'500	11%
Cost to access hunt[c]	10'000	85%	10'000	74%
Total cost of hunt	11'700	100%	13'480	100%

Sources: a) Results of lottery simulation, in Appendix 5.2.2, page A34; b) Hunt prices calculated: for Charara, in Appendix 7.1, page A49, for Makuti, in Appendix 7.2, page A53; c) Cost estimation rounded from Appendix 18, page A110.

Rational hunters who had been allocated a hunt that cost Z$1'500 thus faced the following choices, before they decided to actually pay any more money: First, do I value the hunting bag that I have been assigned enough to warrant paying Z$1'500 for the hunt price and obtaining the hunting licence? Once the hunter was entitled to hunt, he then had to decide: Do I value the hunting trip enough to warrant paying an additional amount of Z$10'000 for the costs of the hunting trip? Can I share these costs with someone/a hunting party?

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[1] Some 35 hunts in Charara and 50 hunts in Makuti, respectively.

[2] Estimate based on: a return distance from Harare to Marongora of 560km; petrol costs of Z$2.85/litre; a petrol consumption of 10km/litre; vehicle costs of Z$2.00/km.

Valuation of "a hunt's resources and potential benefits" is a personal process, where the hunter assigns worth and - in economic reality - the monetary price he is willing to pay. At the time of application, unless a hunter values the potential benefits of undertaking the entire citizen hunt - which includes the value of the actual hunting bag he was allocated - more than the total costs of undertaking the hunting trip, our rational hunter would not be inclined to pay the hunt price, and be even less inclined to incur the far greater costs of the hunting trip itself. This means that on average, the value of these hunts to the hunter had to exceed Z$12'000 to Z$14'000.

That hunts were not valued that highly by such winners on average is indicated by their low fixed hunt price which means that except for buffalo, none of these hunting bags had been assigned significant other big game trophy species (eg. lion, leopard or elephant). (For details on hunting bags in the study area, see Appendix 2.1 (page A5) for Charara, and Appendix 2.2 (page A9) for Makuti hunting areas, respectively.) The total costs of the hunting trip would be lower for hunters who live closer than Harare to the hunting areas and had to travel less, but otherwise all these average winners would have had no economic incentive to pay for the allotted hunt, consequently leading to hunts having been allocated by the lottery system, but remaining unpaid or paid-up and forfeited.

This cost minimizing behaviour appears to have been a strong reason for 12 out of the 100 winners to have forfeited the hunt they were allocated by the DNPWLM lottery system.

- **Lack of personal choice during the application procedure:**

At no point during the DNPWLM lottery system's procedures for applying or assigning hunts could hunters express their personal hunt preferences or choose a specific hunt. Yet the hunt price hunters pay is related to the hunting bag, and therefore to the specific hunt that was assigned. Consequently, winners of the lottery had no choice about which hunt price they would have to pay - certainly one of the most basic hunt characteristics. A rational hunter will make a decision based on his information, and include his personal judgement of the hunt's trophy value, its venison value, and its recreational value. Because each hunt has a unique combination of characteristics,[1] hunters will value each of the 100 hunts available in the Charara/Makuti study area differently based on this information. This valuation was not possible for applicants prior to the lottery draw.

The hunt value depends on the hunter's expectations, his personal preferences, his willingness to pay, the distance he lives from the hunting area. In Zimbabwe, traditional beliefs about

[1] Each hunt differs not only by the hunt price, the hunting bag (species, sex and number), its hunt duration, the location of the assigned hunting camp, but also by the specified hunting dates for undertaking the hunting trip during the hunting season. The time at which the hunt takes place during the year must firstly suit the hunter personally, and secondly must suit his employer who gives him leave.

totem animals (species that are taboo for family members) amongst certain citizen hunters[1] can also influence the preferred species in the hunting bag.

Written correspondence between hunters and the DNPWLM, showed that:

- One winner declined to pay because the hunting dates were inconvenient (Makuti, hunt number M33).
- Several hunters declined to pay for all species in the hunting bags they had won. Instead, they selected only valuable trophy species (eg. male lion, male kudu), and declined to pay for the plains game or bird species (Makuti hunt numbers M12 and M50).
- One hunter declined to pay because he felt his transport costs to access the Charara/Makuti from his home alone exceeded the hunt's value to him.

■ **Large variation in applicant's and hunter's commitment to hunt:**

With variable hunt characteristics that are unique for every hunt supplied in Charara/Makuti, the price each hunter was willing to pay for the hunt also varied markedly. The variation in hunter's purchasing power is most clearly indicated by the skew distribution in tickets bought per applicant for the option to hunt (see Figure 4.3, page 146).

The large variety of factors that influence the value of a hunting trip, the personal differences between applicants and their hunting motives, and the complexity of the subjective valuation process itself (Sinden and Worrell, 1979), are all factors that argue convincingly for an allocation system which enables applicants to choose hunts personally, rather than one which allocates hunt impersonally according to rule such as the one adopted by the DNPWLM for the DNPWLM lottery system (see review, section 3.2.1.3, page 64). Informed choice requires applicants to be well informed about their options in advance, yet information for applicants was lacking in the DNPWLM lottery system (see item on lack of basic information, page 137).

■ **The hunt allocation procedure caused a miss-match between hunt prices and hunters' willingness to pay:**

As will be shown conclusively by the lottery simulation results (see section 4.3.6, page 148), applicants with more tickets entered for the lottery draw had significantly higher probabilities of being drawn. There is a relationship (the formula for the mean of a geometric progression) between probability and the time waited by any applicant until he wins in a lottery. This relationship means that probability of winning and draw sequence (time waited) are linked. Put simply, this linkage means that the higher the ticket holding of a person, the more likely he will, on average, be drawn earlier on in the procedure than the person holding fewer tickets. (For formula details and an example, see Appendix 19, page A111.)

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[1] The custom of totem animals in African cultures is documented for Zimbabwe by Bourdillon, (1976); Bullock, [1927]; Bullock, (1950). Despite being a sensitive issue, personal interviews confirmed that the custom is still respected, and important for the choice of the hunting bag (Tavona; Rogers; Nelson, personal communications).

The draw order determined the hunt, and therefore also the hunt characteristics, that winners were allocated by the DNPWLM lottery system. On being drawn, winners were allocated specific hunts according to the 3:2 allocation rule for hunts in Makuti, and Charara hunting areas, respectively (for details of the rule, see item on hunt allocation procedure with no preferences in review of DNPWLM lottery system, page 68). The quota allocation to hunts for both areas by the DNPWLM administrators distributed most valuable trophy species to the final 15 hunts in each area.

The consequences of the lottery draw order and hunt allocation procedure for citizen hunters were as follows: Hunters drawn at the start who had paid most for the option to hunt were allocated hunts with a trophy or non-trophy buffalo, but without the other big game species such as elephant, lion, or leopard, and asked to pay average hunt prices (less than Z$1'500). The last 20 or so hunters drawn towards the end of the procedure who had paid least for the option to hunt were allocated hunts with the most valuable trophy species which cost the most. These hunters were expected to pay the highest hunt prices, although they had demonstrated the lowest willingness (and presumably also ability) to pay by purchasing fewer lottery tickets for the option to hunt.

The hunts with elephant allocated to them had hunt prices that were seven times higher than the average hunt of about Z$1'000, because citizen hunters pay Z$7'500 for a single elephant (valued at government controlled trophy prices). Those hunters who were allotted a hunt with an elephant on quota by the 3:2 allocation rule chosen by the DNPWLM were not necessarily able, or willing, to pay for the most expensive hunts in Charara/Makuti. Despite having a high trophy value, an elephant hunt that is not chosen by the hunter personally may be worthless for the lottery winner, because the hunt's price exceeds his budget for hunting.

Therefore, by ignoring personal preferences of applicants during the hunt allocating the DNPWLM lottery system's 3:2 rule resulted in hunts with very different trophy species and prices being allocated to those applicants who wanted a hunt with very different characteristics. Alternatively, it results in hunts being allocated to those applicants who were least willing to pay high prices for hunting, as inferred from their purchase of lottery tickets.

The miss-match between hunt price and willingness to pay due to the use of an arbitrary rule which ignored hunter's personal hunt preferences is judged by the author to be the most important cause of the inefficient hunt allocation of the DNPWLM lottery system in 1991. Interviewed hunters expressed their surprise at realizing that the system had not given them freedom of choice to decide the hunt price, or any other hunt characteristics.

As further evidence showed, even those hunters who did pay for their allotted hunt were not satisfied with its hunt characteristics, which led to paid-up hunts being forfeited by many people.

4.2.4.2. Why did hunters apply to hunt, win a lottery hunt, pay for the hunt, yet not take it up?

- **Hunters valued their hunt insufficiently:**

One hunter who won a hunt in Makuti hunting area (M12) did not pay for the pre-defined hunting bag, but chose instead only to pay for the most valuable big game species that he preferred most. The hunting licence showed, however, that despite this choice, the hunter forfeited the hunting trip by not booking in at Marongora or Kariba control offices on the planned hunting dates (personal observation). This hunter, apparently, valued the alternatives to hunting (other ways to spend his time and money) more than even the money and price he had spent on securing the right to hunt and benefit from this big game hunting trip in the study area. In other words, the hunter was willing to forego all the money he had paid, rather than undertake the hunt, although other citizen hunters were available who would have gone hunting at this price.

The case study licence data presented shows that 25 of the 100 winners of the DNPWLM lottery (25%) behaved similarly to the above hunter. They paid for their hunt after the lottery allocation but then forfeited the hunt. This behaviour indicates a lack of commitment on the part of these hunters. The initial lack of choice for hunters to select their most preferred and valued hunts during the application procedure is inferred to have played a major role in reducing hunter's commitment to the arbitrarily allotted hunt.

Nevertheless, this behaviour is very surprising since by forfeiting their hunt after paying for the hunting licence, these hunters also forfeited a substantial amount of money (between Z$1'400 and Z$3'000) for the tickets and hunt price. Attempts were made to interview these hunters by telephone to find out their reasons for this inconsistent behaviour. Due to severe difficulties in the telephone communications system at the time of research (1991) the author was unable to contact any hunters for telephone interviews. Other survey methods (postal and personal) were ruled due to the time and financial constraints. Nevertheless, in the author's opinion, defaulting by 25 of 100 lottery winners is an unsatisfactory and unacceptable allocation result, which is due to the lottery allocation procedure not determining which hunters were committed to hunting (valued a particular hunt most), and which were not committed.

The other alternative for uncommitted hunters with "unwanted hunts", instead of defaulting, is to trade (swop or sell) their hunt to another hunter and recoup the hunt price so that they are at least be no worse off by not going hunting themselves. In Zimbabwe, this option has not been possible to date. Hunting regulations at present prohibit the legal transfer of hunting licences issued by the DNPWLM in protected areas, presumably to prevent private individuals from making a personal profit from the transaction. Consequently, the DNPWLM has no option but bear the costs of the inefficient hunt allocation that had allocated valuable big game hunts to Zimbabwe citizen hunters who did not actually want to go and hunt. In an attempt to prevent these hunting opportunities from being wasted in 1991, the DNPWLM re-

allocated 12 of the 14 available hunts (with hunting dates prior to 1.7.91) to hunters who did want to hunt using the first-come-first-served system (as depicted in Figure 4.1, page 126).

Additional evidence below suggested there were further shortcomings in the planning of hunts by DNPWLM hunting administrators, because not even those hunters who finally did go hunting were fully satisfied with the hunt they had been assigned in 1991 by the DNPWLM lottery system.

4.2.4.3. Why did the lottery system not satisfy citizen hunters fully?

There were several indications that the manner in which the species quotas for Charara/Makuti hunting areas were packaged into (allocated to) hunts during the planning of the licensing system did not take account of hunter's preferences adequately, ie. that it was not consumer orientated.

- **The hunting bags were to small for single hunts, or hunt duration was too long for the hunting bags:**

This is indicated by the numerous citizen hunters who asked the Harare licensing office of the DNPWLM for permission to alter their hunting dates and combine their hunt venue with that of another hunter. The following hunt numbers were combined in the Charara hunting area: (C2, C5, C6, C29, and C32), (C18 and C40); the following were combined in the Makuti hunting area: (M1 and M54), (M18 and M34). In their correspondence requesting the Director's permission to combine hunts, these hunters cited as reasons the low hunt values of their individual hunting bags, or high transport costs of undertaking a hunting trip on their own.

During the first-come-first-served re-allocation of hunts on citizen hunter was recorded by the DNPWLM licensing office as having bought a hunt with a substantially larger hunting bag and high trophy values. He purchased five of the Charara hunts (C2, C5, C6, C29 and C32) that were re-allocated by the DNPWLM in Harare, and paid a total of Z$4'112 (personal observation, Harare licensing office). This incident indicates that larger bags are sought after by citizen hunters to make their hunting trip worthwhile. Although there were only 14 hunts in total available to allocate on a first-come-first-served basis, the system appears to have been more efficient than the lottery system (85% compared to 55%), and more flexible for applicants than the lottery system because it gave hunters who arrived early in the queue choice. At the cost of wasting hunter's time and money travelling to the Harare licensing office, the queuing system is better at selecting hunters who are committed to go and hunt and who will not default once they have bought a hunt.

- **The hunting bag composition (quality of animals) was inadequate for some hunters:**

The following indications were recorded from correspondence between hunters and the DNPWLM licensing office in Harare. In one instance, two hunts were combined because one of the hunters lacked a suitable animal on quota to use as bait for hunting the trophy lion he had drawn. The other hunter was willing to combine his hunting bag with that of his colleague, and form a new hunting party (Makuti, hunts 18 and 34).

A further indication was the lack of any significant trophy animal in two hunting bags (Charara hunt numbers C36 and C39). Table 4.2 lists the species, sex and number of animals in the hunting bags for both these hunts. One citizen hunter who was interviewed stated that once he knew what animals had been included in his hunting bag, he had forfeited the hunt for this reason alone (Sifeku, personal communication).

Table 4.2 Hunting bag and hunt price for Charara hunt numbers C36 and C39: 1991

Charara hunt number C36	
Number	Species (sex)
1	Bushbuck (male)
1	Impala (male)
1	Impala (female)
1	Grysbok
1	Baboon
3	Guinea Fowl
3	Francolin
7	Pigeons/Doves
Hunt price:	**Z$316**

Charara hunt number C39	
Number	Species (sex)
1	Bushbuck (male)
1	Impala (male)
1	Impala (female)
1	Baboon
3	Guinea Fowl
3	Francolin
7	Pigeons/Doves
Hunt price:	**Z$281**

Source: Quota allocation to hunts for Charara, Appendix 2.1, page A5; and Value of allocated quota for Charara, Appendix 7.1, page A49.

- **Applicants lacked basic information on the licensing system:**

During personal interviews, none of the hunters interviewed (see Appendix 3, page A27) were aware that the DNPWLM lottery system had been altered in 1991. Interviewees were surprised to learn that the allocation procedure had not been designed to give hunters any choice of hunt, or hunt characteristics, since the hunters considered a personal choice vital to their hunting satisfaction and decision-making.

Information available to hunters prior to their application for the DNPWLM lottery appeared as an advertisement in the national newspaper (Zimbabwe Herald, 15.1.91). The text did not inform applicants on the licensing system (see review, Figure 3.4, page 67) and from the author's own research experience, the DNPWLM lottery system was not documented in written form and made available to the public. Repeated interviews were required to make the system transparent.

The response time of one month for enquiries and applications to be made may be adequate in countries where the postal system requires days to send a letter from one part of the country to another and where telephone system works, but is prohibitive for postal application by people in Zimbabwe's more remote areas. In addition, application forms were only available through the DNPWLM central licensing office in Harare, not at the agency's branch offices in major centres. The greater the number of characteristics determining the value of a product or service (eg. a hunting package), and the less homogenous this product (eg. a trophy elephant hunt compared to a non-trophy buffalo hunt), and the greater the personal differences between individuals who are to benefit from the product (eg. beginner hunter might prefer plains game, compared to experienced big game trophy hunters), the better it is to allow individuals to choose the hunt according to its characteristics and their expectations. It has been shown in the literature that personal choice results in the greatest benefit, or satisfaction for the hunter[1]. For the complex product of "a hunt" with its many characteristics and combinations personal choice by the hunter is arguably essential.

4.2.4.4. Principle limitations of lotteries for efficient hunt allocation

Thus far in the assessment of hunt allocation efficiency for the DNPWLM lottery system, it has been argued that personal informed choice of hunt preferences by applicants is required.

At this point it is important to note, that **even if** hunters are able to express their preferences for hunts according to a ranked preference list[2], and a procedure is used that accommodates preferences (eg. the hunt preference allocation procedures of the ZHA, or Wyoming lottery systems), **lottery systems in general cannot ensure that only those hunters who value a particular hunt the most (for whatever reason), are assigned exact this hunt.** Why not?

The lottery system, whether it accommodates applicants' personal hunt preferences or not, cannot distinguish between persons who all prefer the same particular hunt to ascertain exactly which applicant values this hunt the most. If hunters do not value it highly, they will be less committed to take the hunt up and will be more likely to default during the hunting season. Lottery allocation systems, by definition, are an impersonal and not a personal method of equalizing the opportunity to win a hunt amongst all applicants. This conclusion applies to all lottery systems that allocate scarce resources, whether they are valued at fixed prices (eg. all lottery systems allocating hunting in reviewed in Chapter 3 for Zimbabwe, South Africa and Wyoming), or whether they are not priced in monetary terms and allocated free of charge to people (eg. Lindsay's example of queuing for free tickets to a football match, see Lindsay (1984): 45-47. For zero-priced hunt allocation, see section 2.2.3, page 26).

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[1] See Lancaster, 1979: 5-6, who sees personal choice as being vital in the context of consumer sovereignty for efficiency, and Rae, *et al.*, 1981: 92-103, who see personal choice as being vital for person-regarding equality, in the sense that such choice takes account of persons and their differences.

[2] See examples of ZHA lottery system in Appendices 6.1 (page A39) to 6.3 (page A45).

The reason that preference lists cannot be used to discriminate between different valuations placed on a hunt by several hunters, is that **applicants' preference rankings represent ordinal data, not interval or ratio data** (see Stevens, 1946). That is, preference lists express an intra-personal ranking of hunt values for a single person alone, but not inter-personal rankings of hunt values between people because there are no intervals between preference rankings and no zero point is defined for the preference scales (eg. for the scale first, second, third hunt preference).

The difference can be clarified by asking what type of allocation questions lottery systems in principle can, and cannot, answer.

As ordinal data, preference lists allow the intra-personal questions:

a) Which hunt does Ms. Y personally prefer the most, hunt C1 or hunt C2? if one person is involved; or

b) Which hunt does Ms. Y personally prefer compared to Mr. X? if Ms. Y prefers hunt C1 and Mr. X prefers hunt C2.

But as ordinal data, preference lists disallow the inter-personal questions:

c) Does Ms. Y personally prefer hunt C2 **more than** Mr. X prefers hunt C1? if Ms. Y and Mr. X prefer different hunts; or

d) Does Ms. Y personally prefer C2 **more than** Mr. X prefers C2? if both Ms. Y and Mr. X prefer the same hunt.

Lottery systems can distinguish between different hunter's preferences when the allocation involves answering questions a) and b), because no inter-personal comparisons are necessary. Questions a), b), and c) do not pose an allocation problem of scarcity for lotteries or resource managers, should they occur because not more than one person requested the hunts C1 or C2. (Question a) is a choice between two hunts for one person, and questions b) and c) involve two persons who prefer separate hunts.)

Question d) represents the normal scarcity problem of economics (Samuelson, 1973: 3; 17-23) and real life, because several people prefer the same hunt. This is the allocation problem that lottery systems are faced with but fail to solve efficiently because lottery systems cannot distinguish different hunters or their preference intensity.

If lottery systems cannot allocate by answering question d), how do they allocate? Lottery systems assume that all applicants in the draw value a particular hunt identically, or equally. They then allocate by choosing randomly amongst all those applicants who prefer the same hunt (Ms. Y and Mr. X in the above example), disregarding personal preference differences. Impersonal allocation and the ability to apply the same probability to all persons who prefer the same hunt, are the very properties of lottery systems which lead people to think that all lotteries allocate scarce resources "fairly", or "equally", amongst participants. (Impersonal

allocation using the rule of randomness is not identical to arbitrary allocation using the 3:2 rule, because although this rule is impersonal, it affects hunters differently depending on which version is adopted.)

Allocating according to the non-economic principle of fairness using lotteries to achieve equality of hunt allocation is not without costs: Costs of efficiency as wasted opportunities for citizen hunters by the end of the hunting season; costs for applicants at not being assigned the hunt they prefer, or the frustration at not being assigned a hunt at all by the lottery; and costs for the allocating agency who must administer the lottery system and forgoes revenue.

The costs for efficiency manifest themselves most when the allocation is only done irregularly (eg. once a year) and it must be guaranteed that all hunters who are allocated a hunt are committed enough to take it up. The later in the hunting season that a person decides to forgo his right to hunt, the more difficult it is for resource managers to re-allocate the hunts efficiently, and at the same time "fairly" using a lottery system[1]. This is the reason for the 33 out of 100 hunts that the DNPWLM was not able to be re-allocate after the 1.7.91 using the first-come-first-served system (see results of hunt allocation in Figure 4.1, page 126, and section 4.2.3, page 127).

The ZHA, being a private membership organisation, can re-allocate hunts that become "unwanted" in this way more easily and flexibly amongst its members, since information is easily communicated and members are known personally. In addition, a waiting list is drawn at the original lottery draw, preparatory to such occurrences.

As a government agency, the DNPWLM is less flexible to re-allocate unwanted hunts during the hunting season to additional hunters, and questions of fairness and efficiency of the original allocation procedure arise more easily.

The Wyoming lottery system accommodates licensed hunters who default during the planning stage using known hunter success rates for each species (Crowe, 1987). Hunter success rate is defined as: The number of animals actually shot (killed and wounded) by hunters by the end of the hunting seasons, of those on quota. (In Zimbabwe, lion, leopard and grysbok are known to have lower hunter success rates.) To harvest a specific number of animals by the close of the hunting season, the Wyoming lottery system increases actual number of licences issued for each species by the factor (1 - average hunter success rate), thus more licences for single animals than in total on quota are actually issued by this system. Should administrators in any year overestimate hunter success (ie. fewer hunters than expected take up their hunt, or fewer hunters than expected harvest an animal), then the Wyoming agency also makes

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[1] A conflict exits here between efficient and equitable hunt allocation: For efficient allocation, the agency requires a method to tell apart those hunters who will go and hunt and those who will not go and hunt (eg. using each hunter's maximum willingness to pay or willingness to wait in a queue). For equitable hunt allocation, the agency requires a method that precisely does not differentiate between hunters, but treats all preferences and hunters alike (eg. with equal probability for all to win a *First Hunt Preference*). This is a "difficult" trade-off.

additional licences available on a first-come-first-served cash basis by press advertisement (Wyoming Game & Fish Department, 1991) to try and harvest the total quota by the close of the hunting season.

As shown by the rapid re-allocation of 12 out of a possible 14 hunts for Charara/Makuti at the Harare licensing office, the DNPWLM first-come-first-served system was efficient in the sense that hunters who were genuinely committed to going hunting did secure a hunt by arriving early enough at the DNPWLM central licensing office in Harare; the system also caused inequality of hunt allocation by favouring Zimbabwe citizens who live close to Harare and who are delivered the Zimbabwe Herald containing the advertisement the same day of issue. By placing one advertisement on the 16.1.91 announcing the re-allocation of hunts beginning the following day, Zimbabwe citizens outside Harare and in rural areas were disadvantaged. (Due to the present poor state of telephone communications and the limited number of persons with access to a telephone, bookings by telephone or facsimile-machine are not considered by the author to be practical or "fair".) The trade-off between efficiency and equality for the DNPWLM first-come-first-served system resembles that described by the analogy used to introduce these concepts in Chapter 2 (see section 2.2.5.1, page 31).

4.3. Equality of hunt allocation

This section tests the hypothesis that the first stage allocation of hunts by the DNPWLM lottery system for Charara/Makuti was not equitable for all applicants. The degree of inequality is assessed empirically with 1991 application data. The lottery draw was simulated using a computer programme to determine probability values of draw success for each applicant. The results are then interpreted in terms of efficiency.

The purpose of simulating the lottery system used by the DNPWLM in solving the allocative functions for hunts in Charara/Makuti, was to quantify and objectively assess the probability of winning a hunt for each applicant thus determining the licensing system's "fairness". The assessment in section 4.3 assumes that the intention of lotteries is to treat individual applicants identically, because personal differences are deemed irrelevant for the allocation.

There were three objectives of simulating the DNPWLM lottery system:

1. To quantify the unequal probability of winning *Any Hunt* for every applicant under the application and draw rules used by the DNPWLM lottery system for Charara/Makuti study area in 1991.
2. To assess the inequality of the DNPWLM lottery system. Distributions of the calculated equal probabilities and the simulated unequal probabilities of winning *Any Hunt* were compared for every applicant.
3. To determine if the probability of winning *Any Hunt* was equal for all applicants who bought the same number of tickets for the lottery draw.

The equality of hunt allocation is structured as follows:

- The equality criterion for hunt allocation by lottery;
- Data and methods used;
- Limitations of the simulation;
- Simulation results;
- An inequality interpretation of results as a Lorenz curve;
- Discussion of results.

4.3.1. Introducing the notion of "fairness" for lotteries as equality

Intuitively, lottery systems are perceived to be a method of allocating scarce resources "fairly", "randomly", or "equally" amongst a number of people, or giving everyone "an equal opportunity to win". These notions imply several things: that no person be favoured during the allocation; that an impartial and impersonal choice of winners and losers amongst applicants is made using random selections in a lottery; that the wealth of applicants and their willingness to pay should not influence the allocation; that each person has the same, equal, probability of winning to access the benefits of the good (eg. hunt) being distributed.

In accordance with the authors Rae, *et al.*, (1981), this dissertation classifies all these notions of "fair distributions" as a class of problem dealing with different patterns of resource and benefit distribution - in our case hunts - amongst individual people. Each specific hunt distribution pattern is termed **an equality**; the many different ways in which hunts can be distributed gives rise to many equalities (or distribution patterns). The distribution pattern achieved by using each hunter's maximum willingness to pay is an example of one type of equality; the pattern achieved by using a lottery system and randomness is another type of equality; yet a third distribution pattern and equality could be achieved by using need as the criterion and defining a way to measure applicant's hunting needs comparatively. The author sees the moral "fairness" or "unfairness" of the different patterns as being a question of definition and agreement amongst people according to accepted decision-making procedures, rather than a question of absolute advantage or disadvantage. (Such a decision should, however, also be based on the relative costs of achieving different equalities in society.)

The review of lotteries for hunt allocation in Chapter 3 identified essentially three designs of lottery system (see Figure 4.2, page 143) that are used to license sport hunting in practice. In Zimbabwe the government conservation agency (DNPWLM) administers an **unequal** lottery system with no hunt preferences for applicants in the Charara/Makuti study area, whilst the private hunters' associations (ZHA) administer an **equal** lottery system with **unequal** hunt preferences for applicants in the hunting areas of Tuli/Doma/Rifa. In the state of Wyoming, the Wyoming conservation agency administers an **equal** lottery with **equal** hunt preferences for applicants on all land in Wyoming. (Figure 4.2 shows these lottery systems according to their different types of equality, with details of their hunt preferences, their application procedures and their drawing procedures.)

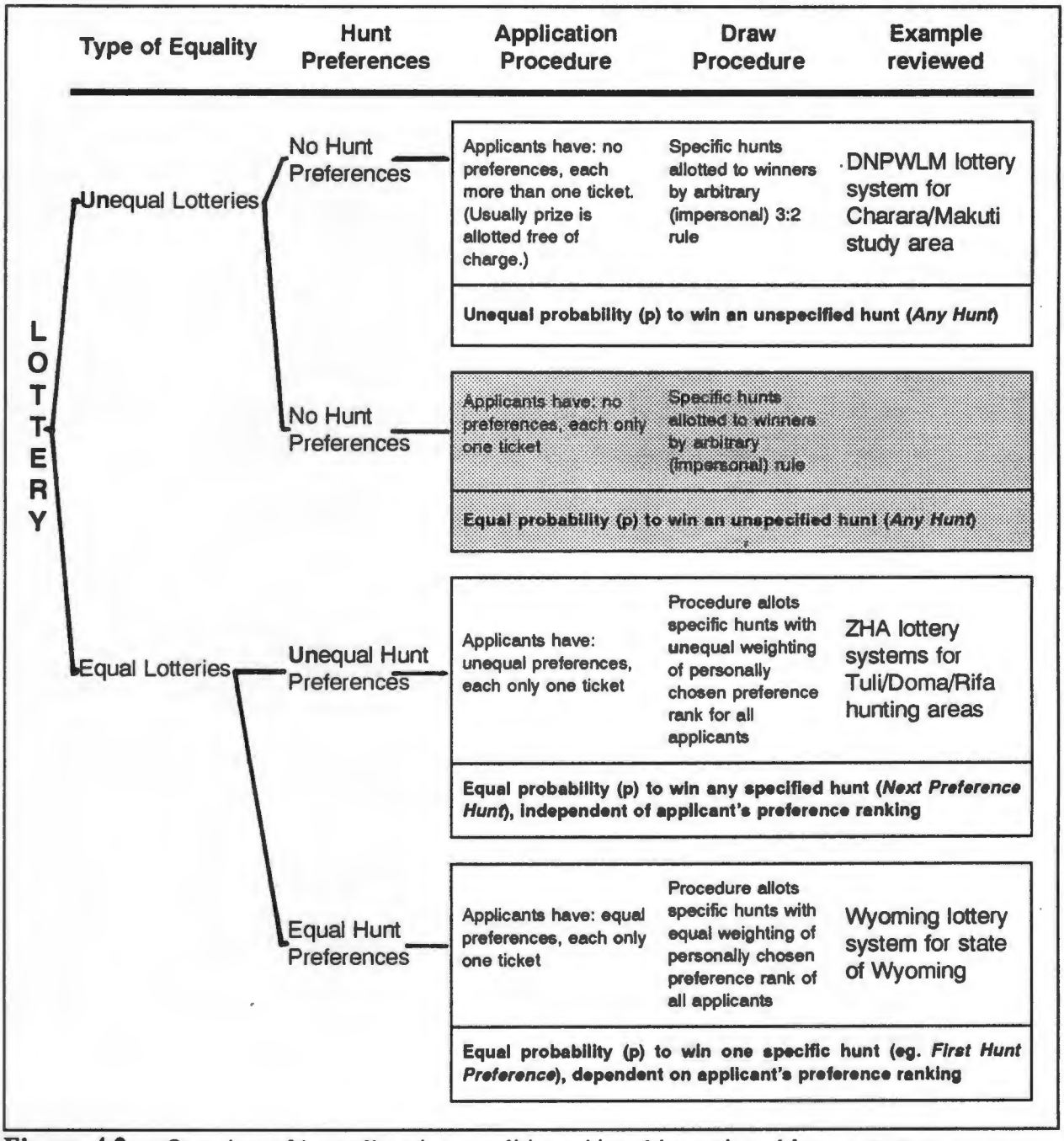

Figure 4.2 Overview of hunt allocation equalities achieved by reviewed lottery systems

In general, with hunts valued at fixed prices, a hunt allocation by lottery must perform two allocative functions:

(1) The number of applicants applying for hunts at a certain price (demand) must be limited to the number of hunts available (supply).

(2) The variety of hunts available (supply) must somehow be distributed amongst the selected applicants according to a certain rule whilst accommodating each hunter's preferences for specific hunts (personal choice).

Both functions are solved simultaneously, not sequentially, by any particular lottery system. The techniques used to solve the functions determines the type of equality achieved. To achieve the first function lotteries use a randomized draw procedure to limit applicants. For equal lotteries, each applicant must have the same probability of winning (either *Any Hunt*

or a *First Preference Hunt*), and applicants must each be able to enter only one ticket in the draw-barrel.

If this equal lottery definition is accepted as a reasonable interpretation of the notion of "a fair lottery", and had this equal lottery definition been applied by the DNPWLM lottery system for the Charara/Makuti study area to allocate hunts in 1991, then applicant's equal probability of winning an unspecified hunt would have been:

> The available number of hunts (100), divided by the number of individual ticket holders (196), or p = 0.51 for every hunting applicant.

(Sources and methods for obtaining the data are described in section 4.3.4, page 145). This probability means that all 196 applicants for Charara/Makuti would have an equal chance of being drawn and winning an unspecified option to hunt (ie. *Any Hunt*).

The second allocation function can be achieved in many ways, two of which are relevant here for lottery systems:

- Arbitrarily and impersonally, if some rule is used to allocate each hunt. The rule is linked to the random draw order. A good example of such a rule is the 3:2 allocation rule applied by the unequal DNPWLM lottery system to allot winners specific hunts in the study area (see Figure 4.2).
- Personally, if applicants can personally value the options to hunt and then choose the hunts he wants most, according to his personal preferences, listing them by preference rank.[1] Hunt preferences can be treated equally, or unequally, for all applicants (see Figure 4.2). The ZHA lottery system used a procedure that resulted in hunts being allocated **un**equally amongst applicants who applied for the same hunt and preference, whilst the Wyoming lottery system used a procedure that resulted in hunts being allocated equally amongst applicants who applied for the same hunt and preference.

The rules for the DNPWLM lottery system that is the topic of the present assessment did not allow hunt preferences at all, so because of its design it belongs to the category of unequal lottery systems. According to which standard of equality should the unequal DNPWLM lottery system be assessed in this section? It may be compared to the minimum standard of an equal lottery system with no hunt preferences which achieves equal probabilities for all applicants to draw an undefined hunting option (*Any Hunt*) - as calculated above. This equality standard is used in the following as the criterion for the assessment of the equality of hunt allocation.

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[1] Free choice, in the strictest sense, does not include a random allocation since this outcome is not chosen personally, or deliberated. See Boyle, Grisez, Tollefsen (1976).

4.3.2. The equality achieved by the DNPWLM lottery system

To limit demand by applicants, the DNPWLM lottery system for Charara/Makuti used a **lottery with unequal probabilities of winning for applicants**, because applicants had different numbers of tickets in the draw.[1] With tickets being priced, the DNPWLM lottery system in actual fact used the price mechanism and the applicant's willingness to pay for an option to hunt in order to limit demand by hunting applicants. (Whether this was the intention of the DNPWLM or not remains unclear, due to lack of documented policy, licensing system procedure, and vague or conflicting statements made by various hunting administrators.)

To allot specific hunts in the Charara/Makuti study area amongst applicants who were drawn, the DNPWLM lottery system used an arbitrary rule linked to the winner's draw order. The rule was determined by the DNPWLM, and did not accommodate applicant's personal hunt preferences. (The arbitrary 3:2 rule is described fully in section 3.2.1.3, page 64.)

4.3.3. Equality Criterion for Hunt Allocation by Lottery

The criterion of equality is defined as: An equal probability of winning an undefined hunt by all applicants for Charara/Makuti.[2] Since this probability is related to winning an unspecified, arbitrarily assigned hunt number in either Charara or Makuti hunting area, it is termed the probability of winning *Any Hunt*. (If personal preference lists are used, it is termed the probability of winning a *Next Hunt Preference* for the ZHA lottery system hunt allocation procedure, and the probability of winning a *First Hunt Preference* for the Wyoming lottery system hunt allocation procedure. See definitions in Glossary, page xxi.)

Readers should note, that equal probabilities of winning *Any Hunt* **by all applicants** does not mean that **all hunters** who hunted in the Charara/Makuti hunting area had an equal probability of winning *Any Hunt* (see limitations of simulation, section 4.3.5, page 148).

4.3.4. Data and methods

The computer simulation of the lottery draw procedure used by the DNPWLM for Charara/Makuti is based on 1991 data. Data used included: The application rules; the lottery draw procedure; the number of hunts that were planned for the Charara/Makuti areas; and the frequency distribution of tickets bought by applicants.

The application rules and the lottery draw procedure for this licensing system, termed the 3:2 hunt allocation rule, are described fully in the Chapter 3 (section 3.2.1.3, page 64). In total 100 hunts (*Any Hunts*) were available for allocation in both hunting areas.

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[1] Due to the large number of combinations possible for the order in which winners may be drawn, it was suspected that, for a limited number of draws, the probabilities of winning a hunt might also be unequal *for applicants who had each bought identical numbers of tickets*. This hypothesis was tested as the third objective of the simulation.

[2] The definition conforms to the prospect-regarding equality of opportunity, see Rae, *et al.*, (1981): 64-71.

The frequency distribution of tickets bought by each individual applicant was compiled from application data in the ticket register at the DNPWLM licensing office in Harare. Applicants bought a total of 2'008 tickets.[1] To identify individual applicants, each applicant's surname, first name initials, and address as entered in the DNPWLM ticket register was compared with other entries. This information was, where possible, correlated with the telephone directory entries to establish unique applicants and some consistency of spelling and names.

The author experienced considerable difficulty determining unique applicants, because:

- For some ticket entries in the register, different addresses were entered for the same applicant (eg. both his physical and postal address);
- For other ticket register entries different applicants with the same surname and first name initials could not easily be kept apart (eg. in the case of related family members, or unrelated applicants with similar names);
- Some persons in the ticket register could not be matched to the licence holders, and some licence holders could not be matched to persons in the ticket register.

In future, the above difficulties could be avoided by using a unique identification number for each applicant during the application procedure, such as the Zimbabwe national identification number.

The frequency distribution of applicants' tickets purchased for an option to hunt in Charara/Makuti is depicted as a stem-and-leaf diagram in Figure 4.3, page 146. In total 196 individual applicants were identified as having entered the DNPWLM lottery in 1991.

```
0 1111111111111111111111111111
0 22222222222222233333455555555555555555555555555555555555555555555556677888
1 00000000000000000000000000000000022222222333333345555555559
2 00000000000355566
3 003
4 19
5 0001
6 0
7
8          n =    196 applicants
9 9        Mean =   10 tickets
10         Std dev = 12 tickets
```

Figure 4.3 Frequency distribution of tickets bought by applicants in DNPWLM lottery system for Charara/Makuti: 1991

The column indented to the left gives the ticket numbers in tens, and the main body to the right in units. For example, the minimum of one ticket was bought by 29 applicants, and 99 tickets were bought by one applicant. The number of applicants, the mean ticket numbers with their standard deviation are given. One ticket cost Z$20.

Source: DNPWLM ticket register, DNPWLM licensing office, Harare.

[1] Of the 2'153 ticket numbers sold, and recorded in the DNPWLM ticket register, 145 were invalid numbers for whom no applicant could be identified (ticket numbers 455-499 and 1'900-1'999, inclusive), leaving 2'008 valid ticket numbers (personal observation). Invalid numbers were not considered in the data for the simulation.

Figure 4.3 indicates clearly that in 1991 most Charara/Makuti applicants who applied bought more than one ticket. Zimbabwe citizen hunters evidently are willing to spend considerably more than the price of a single ticket (Z$20) to increase their probability of being drawn and going hunting. Single tickets were bought by 29 persons, 48 applicants each bought the modal number of five tickets (worth Z$100), whilst 34 applicants bought the next most frequent number, namely 10 tickets (worth Z$200). The mean number of tickets bought per applicant was about ten tickets[1]. Unsuccessful applicants were not refunded the amounts spent on ticket purchases, and successful applicants could not deduct the amount from their hunt price.

The simulation programme (see Appendix 5.1, page A29) was written in Fortran by L. McNiell, a statistical consultant, and simulations were run on a VAX computer. The programme used data on the number of hunts supplied and on the ticket frequencies bought by applicants. Each simulation was considered as one draw year, or hunting season. At each simulation 100 winners were drawn, keeping in mind that no applicant could draw a hunt twice in any year. A large number of simulations was conducted to reveal any differences, or inequalities, that might be part of the lottery system. Initially, the simulation was planned to run for 100'000 draws, considered adequate to obtain the probability for each applicant.

For each draw, the programme recorded the applicant's number, and whether he had won a hunt. Finally, however, the lottery programme simulated the draws of 100 winners for the ticket distribution of 196 applicants over a period of one million draw years. For fewer than this number of simulations, it was found that the frequency of wins (ie. the total number of times an applicant won) for applicants with identical numbers of tickets had not yet converged, and could not therefore be considered as the probability of winning.[2] This simulation result confirmed the third hypothesis of the investigation, namely that applicants with the same numbers of tickets had **unequal** probabilities of winning *Any Hunt* in the DNPWLM lottery draw (see objective 3 of this simulation, page 141).

The probability of winning a hunt was then calculated by dividing the frequency of wins, for each applicant, by one million draws. Mean frequencies were calculated for each ticket class.

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[1] In total 2'008 tickets divided by 196 applicants, which equals a mean of 10.2 tickets per applicant.

[2] The frequency of wins for applicants with identical numbers of tickets did not even converge after one million draw attempts, but the number of draw years was not increased further. This result showed the inequality of winning *Any Hunt* for applicants *who had bought identical numbers of tickets* for the DNPWLM lottery system; the third objective of the simulation is thus achieved. Due to these differences between individual applicant's probabilities for the same number of tickets, the remainder of this the analysis is based on *the mean frequency of wins for each class of ticket holders* (included in Appendix 5.2.2, page A34), not on the simulated individual frequency of wins (included in Appendix 5.2.1, page A31).

4.3.5. Limitations of simulation

The following limitations apply to the simulation programme, and the relevance of the lottery simulation results:

- **Hunting applicants cooperate in groups:**

The probability of an applicant "going hunting" is greater than his probability of winning a hunt in the hunting area[1]. The probability of going hunting was not calculated, due to its complexity.

- **Hunting applicants applied in the ZHA lottery system for Tuli/Doma/Rifa:**

Some 133 applicants (52% of the total) for Charara/Makuti in 1991 were estimated to be members of the ZHA.[2] The personal probability of winning a hunt for these applicants is thus greater than for applicants who were not members of the ZHA. This fact was not considered for the simulation, due to its complexity.

4.3.6. Simulation results

Figure 4.4 illustrates the simulation results as the mean probabilities for each ticket class. The figure shows how the probability of winning *Any Hunt* (an undefined hunt) varied according to the number of tickets bought per person. As expected, the greater the number of tickets an applicant bought, the greater was his expected probability of winning *Any Hunt* in the DNPWLM lottery system for Charara/Makuti.

The results show that the 29 applicants who each bought a single ticket could expect to win *Any Hunt* about 9% of the time (p = 0.0987), whereas the 34 applicants who each bought ten tickets could expect to win *Any Hunt* about 65% of the time (p = 0.6480). Applicants with the mean number of five tickets each - the minimum number needed to win a hunt at all - could expect to win *Any Hunt* about 41% of the time (p = 0.4062). Applicants who bought 23 tickets or more, could expect to win *Any Hunt* at least 90% of the time.

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[1] In Zimbabwe, application rules for citizen hunting allow one hunter and up to three co-hunters to actively hunt. Applicants are not at present required to specify their co-hunters when applying. Thus an applicant who applies for, but does not win a hunt, or who does not apply to hunt at all, may still hunt as a co-hunter of a successful applicant. Both versions occur regularly (personal observation). Applicants who cooperate can maximize their personal probability of "going hunting" and need not win a hunt in the lottery. This strategy affects the *equality of hunt allocation* for the DNPWLM case study. It also applies to the ZHA lottery systems for Tuli/Doma/Rifa hunting areas. The Wyoming lottery system is explicitly designed to prevent applicants adopting a probability-maximizing strategy. Application rules require co-hunters to be specified for each application, and control procedures prevent any duplicate applications for the same hunt, so that individual and group applications are equally weighted in the draw (Wyoming Game & Fish Department, 1988).

[2] Individual hunting applicants in 1991 were identified from hunting licences for Charara/Makuti, sourced at the DNPWLM licensing offices in Harare, Marongora and Kariba, and compared with the ZHA's membership address book by surname, initials, and address.

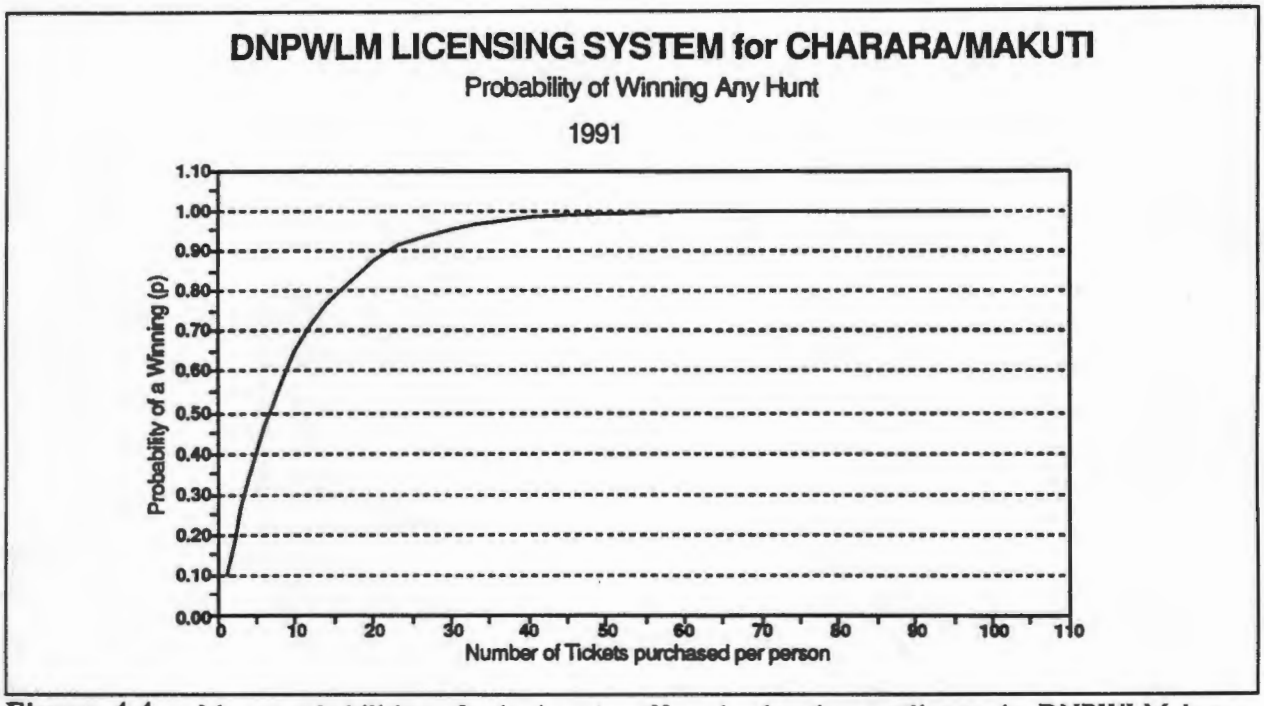

Figure 4.4 Mean probabilities of winning *Any Hunt* by hunting applicants in DNPWLM lottery system in Charara/Makuti: 1991

Source: Mean simulation results of DNPWLM lottery system, Appendix 5.2.2, page A34.

4.3.7. Interpreting the results as inequality

The unequal distribution of the probability of winning *Any Hunt* amongst applicants can be illustrated using a Lorenz curve in Figure 4.5, page 150. The Lorenz curve plots both equal and unequal distributions of some resource amongst a number of persons[1]. On the vertical axis, the diagram plots the cumulative proportions of each winner's probability of winning *Any Hunt*; on the horizontal axis the diagram plots the cumulative proportions of winners, ordered according to their probability.

The line of equality in Figure 4.5 was plotted using the calculated results (equal distribution of probability amongst all applicants). The curve of inequality in Figure 4.5 was plotted based on the simulation results (unequal distribution of probability amongst applicants). Details of the calculation are in Appendix 5.2.3, page A35. The area between the line and the curve shows visually the degree of inequality between applicants who bought different numbers of tickets in the DNPWLM lottery system for Charara/Makuti.

[1] The Lorenz curve is more commonly used to indicate inequality in the distribution patterns of income and wealth amongst persons, see Rae, *et al.*, (1981): 125-127; Samuelson, (1973): 85.

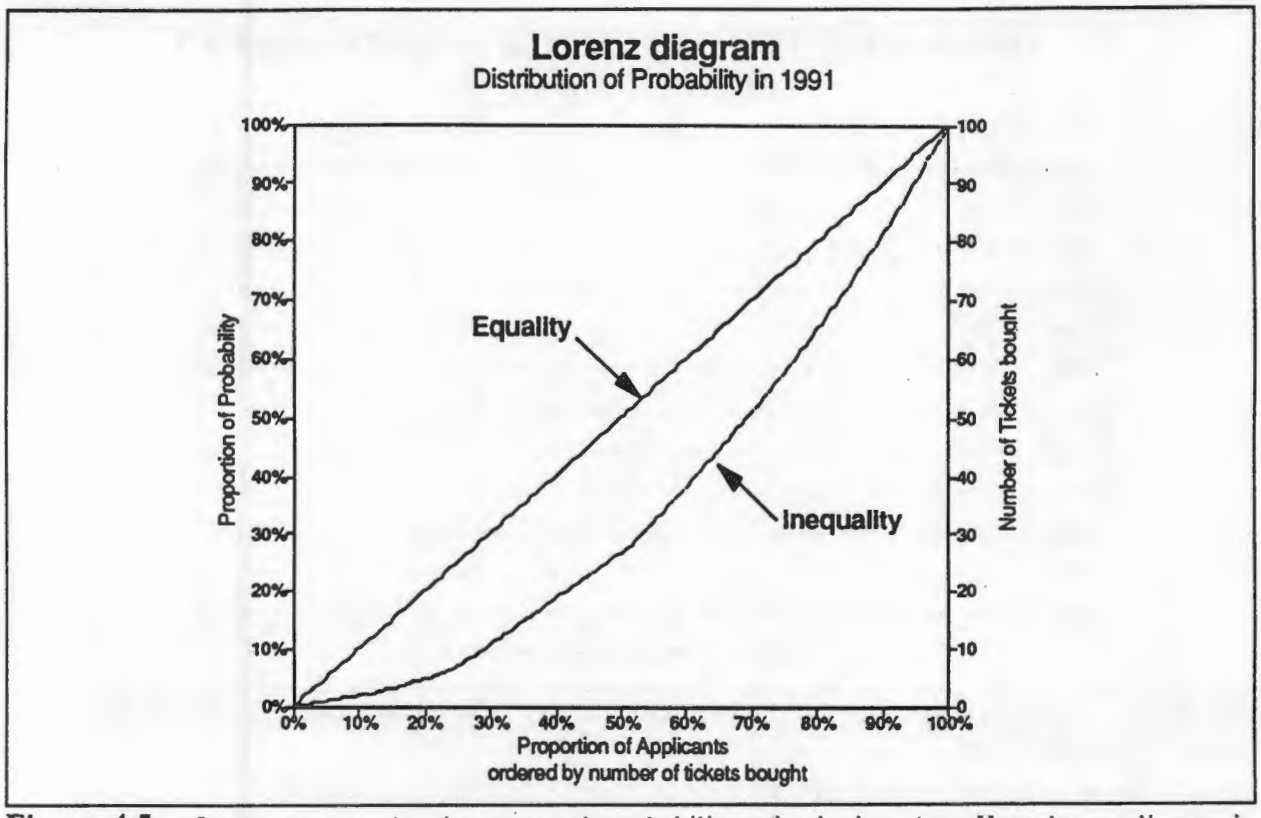

Figure 4.5 Lorenz curve showing unequal probability of winning *Any Hunt* by applicants in DNPWLM lottery system for Charara/Makuti: 1991

Source: Simulation results of DNPWLM lottery system, Appendix 5.2.3, page A35.

The line of equality and curve of inequality in Figure 4.5 can be interpreted as follows:

- **The diagonal line of equality:**

This line shows the equal probability of winning *Any Hunt*, and its distribution amongst applicants, had the rule of equality (1 ticket per person) been applied during the application stage. On this line, the proportion of persons who win to persons who applied is equal for all persons. In other words, on this line, every applicant has an equal probability of winning *Any Hunt* ($p = 0.51$ for all applicants)[1].

- **The curve of inequality:**

This curve shows the unequal probability of winning *Any Hunt*, and its distribution amongst applicants according the simulation results for the DNPWLM lottery system. Probability varies greatly ($99\% > p > 9\%$), depending on the number of tickets each applicant bought. On the curve towards the centre of Figure 4.5, a large proportion of applicants have much less than an equal proportion of the probability of winning ($51\% > p > 9\%$), due to the limited number of tickets they bought. On this curve towards the right of Figure 4.5 it can be seen that a very small proportion of the applicants have by far the greatest proportion of the probability of winning ($99\% > p > 51\%$), due to the large numbers of tickets they each purchased. The more tickets each applicant purchased (and the more each was willing to pay), the better his chance of winning *Any Hunt* in the Charara/Makuti study area

[1] See calculation on page 144.

For applicants to have been certain of winning *Any Hunt* at every draw, or to have been amongst the first 100 persons drawn for every lottery simulation, the simulation results indicate that applicants required a minimum of five tickets (see Appendix 5.2.2, page A34). Further, the sum of these applicant's probability of winning (p = 0.4062) was less for the unequal DNPWLM lottery system than the probability these applicants could have expected (p = 0.5102) had the lottery been equal and allowed each applicant only one ticket. **It may be concluded that even under the DNPWLM lottery system where applicants had unequal chances of winning, there were some winners who were worse off in terms of their probability of winning *Any Hunt* than they might have been had they applied under an equal lottery system by purchasing only one ticket each.**

All applicants who bought five tickets and less under the 1991 DNPWLM lottery system for the Charara/Makuti study area were worse off under this system than they might have been under an equal lottery system.

4.3.8. Discussion of results

To adapt the present unequal DNPWLM lottery system for Charara/Makuti and accommodate hunter's preferences for specific hunts using ranked hunt preferences, at least two procedures are available:

- The unequal hunt preference allocation procedure of the ZHA lottery system; or
- The equal hunt preference allocation procedure of the Wyoming lottery system.

Both procedures were reviewed in detail in Chapter 3 (see section 3.2.2.4, page 81, for the ZHA lottery system; see section 3.3.1, page 98, for the Wyoming lottery system). Here, the implications of each procedure are merely summarized and illustrated in terms of equality and efficiency (hunter's commitment) of hunt allocation.

The ZHA lottery system procedure ranks hunters only according to their draw order. The procedure thereby accords winners unequal rankings of preference order. The Wyoming lottery system procedure ranks hunters according to their draw order **and** their preference order. The system thereby accords each winner and each applicant equal rankings of preference order.

Different assumption are made by each system about how "equal" applicants are. The Wyoming lottery system assumes that applicants and preferences are weighted equally for every preference ranking. The ZHA system assumes that applicants are weighted equally, but that preferences are weighted unequally (irrespective of their rank order). In the ZHA lottery system, preferences of applicants who are drawn early on in the procedure are weighted more heavily than those of undrawn applicants.

Figure 4.6 compares the outcomes of the ZHA and Wyoming hunt preference allocation procedures. The example uses actual application data gathered for the ZHA lottery systems, applied to a fictive draw outcome. The applicant order in the hunt preference lists was used as the random draw order for both lottery systems based on data collected for the ZHA lottery system. Application data for Tuli, Doma and Rifa hunting areas for 1991 are in Appendix 6.1 (page A39), Appendix 6.2 (page A43), and Appendix 6.3 (page A45), respectively.

Comparison of Preference Allocation Procedure
TULI SAFARI AREA
YEAR: 1991

Hunt No.	ZHA rules Applicant No.	ZHA rules Preference No.	WYOMING rules Applicant No.	WYOMING rules Preference No.
1	2	1	2	1
2	8	3	16	1
3	4	1	4	1
4	7	1	7	1
5	15	11	26	1
6	3	1	3	1
7	5	7	27	1
8	9	5	61	1
9	1	1	1	1
10	12	1	12	1
11	17	8	46	1
12	6	1	6	1
13	11	2	122	1
14	18	12	15	1
15	14	7	30	1
16	19	16	31	2
17	10	1	10	1
18	16	3	112	1
19	13	4	29	1
20	21	4	73	1
21	22	15	71	1
22	27	16	60	1
23	26	22	72	1
24	28	21	153	1
25	29	25	157	1
26	30	25	44	1
Total Preference 1		31%		96%

Comparison of Preference Allocation Procedures
DOMA SAFARI AREA
YEAR: 1991

Hunt No.	ZHA Rules Applicant No.	ZHA Rules Preference No.	WYOMING Rules Applicant No.	WYOMING Rules Preference No.
1	4	1	4	1
2	1	1	1	1
3	7	1	7	1
4	8	1	8	1
5	6	1	6	1
6	2	1	2	1
7	9	2	10	1
8	3	1	3	1
9	5	2	13	1
10	10	4	17	1
Total Preference 1		70%		100%

Comparison of Preference Allocation Procedures
RIFA SAFARI AREA
YEAR: 1991

Hunt No.	ZHA rules Applicant No.	ZHA rules Preference No.	WYOMING rules Applicant No.	WYOMING rules Preference No.
1	22	1	22	1
2	29	7	77	1
3	30	8	141	1
4	39	33	106	1
5	36	29	47	1
6	8	6	166	1
7	10	6	17	1
8	7	5	19	1
9	17	2	160	2
10	19	6	10	1
11	1	1	1	1
12	23	11	136	1
13	16	7	41	1
14	6	1	6	1
15	25	9	161	2
16	21	7	52	1
17	5	2	11	1
18	14	1	14	1
19	15	2	104	1
20	4	1	4	1
21	11	6	18	1
22	12	7	44	1
23	9	5	32	1
24	2	1	58	1
25	18	4	135	1
26	13	8	27	1
27	26	14	40	1
28	27	4	285	2
29	28	22	50	1
30	31	24	51	2
31	20	1	20	1
32	32	14	112	4
33	3	1	3	1
34	33	25	113	1
35	38	8	232	1
36	40	15	148	3
37	44	17	56	6
38	45	37	105	1
39	24	6	146	1
Total Preferences 1		20%		82%

Figure 4.6 Comparison of fictive hunt allocation results for ZHA lottery system and Wyoming lottery system hunt preference allocation procedures

Source: Data based on applicant's hunt preferences for hunts available in ZHA hunting areas in 1991. Preferences for Tuli, Doma, and Rifa are in Appendix 6.1 (page A39), Appendix 6.2 (page A43), and Appendix 6.3 (page A45), respectively.

The results in Figure 4.6 show that the Wyoming lottery system consistently allots each hunt amongst those applicants who prefer this particular one the most (as their *First Hunt Preference*). Such hunters will be most committed to undertake the hunting trip. The ZHA lottery system, by contrast, consistently allots hunts to applicants **who do not prefer this particular hunt most**, and who prefer it much less than other applicants (*Next Hunt Preference*). Such applicants are less committed to this hunt than other applicants would be. If hunters could swop or trade hunts, they could benefit mutually and improve the hunt allocation achieved by the ZHA lottery system. Trading hunting licences in Zimbabwe is not legal, however, so this system is not as efficient as the hunt allocation procedure used by the Wyoming lottery system.

Based on the *First Hunt Preference* totals in Figure 4.6, the author considers the Wyoming hunt preference allocation procedure to be superior to that used by the ZHA lottery system at promoting commitment because it assigns hunts to applicants who place the highest value (according to their personal preference ranking of hunts) on the specific hunts they are allocated.

4.3.9. Principle limitations of lotteries to allocate hunts equitably

Equality is a distributive concept, not a productive concept. The more people that demand hunting, the smaller the probability **of each person who applies** actually going hunting. The value of the hunt they can expect to win is thus decreased. Lotteries, therefore, do not increase the supply for more persons demanding hunts, they merely distribute the available supply equally according to some definition of equality ("fairness"). (With market-priced allocation systems such as auctions additional revenue could be used to increase the supply of hunting opportunities.) Decision-makers choosing a lottery system and applicants thus face the following choice: To apply for a popular valuable hunt, but expect not to win or hunt it because of the low probability of winning **for all applicants**, or to apply for an unpopular and less valuable hunt and expect to have a higher probability of winning it and actually going hunting that year. The choice is difficult, because the exact probabilities are unknown for Zimbabwe's lottery systems. Even if this data were known to decision-makers and applicants in advance, the basic trade-off question still remains unanswered: What is each percentage point loss in probability worth to each individual hunter? For example, what would each applicant be prepared to pay in order to win a particular hunt and be able to go hunting with certainty, rather than have a 30% or 50% chance of winning that particular hunt and a 70% or 50% chance of not going hunting? Being fix-priced licensing systems, lotteries do not give applicants such a choice to answer this question for themselves; lottery systems are, after all, designed to be impersonal.

4.4. Summary: Hunt allocation by DNPWLM lottery system for the study area in 1991

The design of the DNPWLM lottery system caused hunts to be wasted, and allocated to hunters who did not value them or want to hunt them. By allowing applicants to purchase multiple tickets the probability of winning a hunt in Charara/Makuti, and the access to hunts, varied according to the hunter's willingness to pay. This phenomenon gave wealthy Zimbabwean citizen hunters an advantage to win hunts in the lottery. Applicants had very unequal probabilities of winning a hunt in 1991, and were not random, as indicated by the name "lottery" in the licensing system's name. The allocation of specific hunts to individual draw winners was likewise determined by the number of tickets purchased and the draw order.

The probability of winning an option to hunt was not independent of the applicant himself. Yet the specific hunt and hunt characteristics (including the hunt price) a winner of the DNPWLM lottery system was allocated was not determined personally by applicants based on their personal hunting preferences; specific hunts were allotted using an arbitrary rule decided by the DNPWLM.

4.5. Conclusions: Allocating hunts efficiently and equitably by lottery for the study area

The conclusions to the case study assessment in Chapter 4, and the recommendations that follow, are based on the following premises:

1. Principally, a fix-priced lottery system is to be used to allocate scarce big game hunting resources in Charara/Makuti study area to Zimbabwe citizen hunters. The fixed prices value the total species quota (the consumptive hunting resource); maximum hunting revenue is determined by the quota's species composition and the price per species set by government.
2. Efficiency of hunt allocation aims to minimize administrative costs.
3. Maximum benefits from hunting and a maximum variety of hunts should be supplied to hunters with resources available to the DNPWLM. The resources budgeted by the DNPWLM are not known.
4. Applicants should choose their own hunts rationally based on detailed information.
5. A lottery system's purpose is to allocate hunts to applicants independent of their maximum willingness to pay (ie. not based on a price mechanism) - the exact opposite of the DNPWLM lottery system's outcome for Charara/Makuti in 1991.
6. Equality of hunt allocation aims to give all citizen hunters who apply an equal probability, not only of winning, but also of accessing, a hunt in the Charara/Makuti study area.

The case study assessment showed that hunts in Charara/Makuti study area were not allocated efficiently or equitably to Zimbabwe citizen hunters by the DNPWLM lottery system in 1991. If decision-makers were to decide principally to continue using a lottery system, and agreed to adopt the objectives of efficient and equitable hunt allocation as defined in the present chapter for lottery systems, then major conclusions from the case study assessment may be drawn as follows.

4.5.1. Conclusions for efficient hunt allocation

Efficiency of hunt allocation, defined as the number of available hunts that benefitted hunters after being allocated by the lottery system, was 55% of that expected in 1991. Conclusions relating to this finding are:

4.5.1.1. **Findings:** Applicants lacked information and a choice of hunts. **Conclusion:** Applicants need to make rational, informed, and personal choices of the hunts they prefer in Charara/Makuti. To do this, applicants need to know:

- All hunts supplied by the licensing system and their hunt characteristics. The essential characteristics are: hunting bag (species, sex and number of animals), hunt price, hunt duration, hunting dates, number of hunters per party and hunt;
- Probabilities of winning a hunt;
- Rules and procedures used to allocate hunts;
- Timing of the hunt allocation process;
- Payment procedures;
- Conditions and consequences (eg. penalties) of hunt forfeit;
- Infrastructure and facilities offered in hunting areas and at hunting camps.

4.5.1.2. **Findings:** Quotas are packaged into uniform hunts in the Charara/Makuti study area; Hunts lacked variety of characteristics. **Conclusion:** The packaging of the total species' quotas must cater for variety to increase choice of hunts for applicants, because applicants cannot package their own hunts in a lottery system - as they can do in an auction system (see section 3.2.4, page 90). This is particularly important since hunt prices are fixed, and determined by administrators when they allocate the quotas to hunts. Variety for hunts includes the aspects: trophy quality versus non-trophy quality, expensive versus cheap hunt prices; long versus short hunt durations; big game hunting bags versus plains game hunting bags.

4.5.1.3. **Finding:** Lotteries cannot allocate valuable resources personally and efficiently; they can only allocate resources and value impersonally and randomly. **Conclusion:** All lottery systems - even if their allocation procedures take account of applicant's personal hunt preferences - have a fundamental limitation of ensuring hunts are allocated efficiently. Lottery systems aggravate the problem of allocating hunts efficiently and equitably (ie. personally) if citizen hunter's personal valuations of the hunting opportunities vary widely - as they do in Zimbabwean

society - due to personal and income differences, amongst others (for income distribution, see Figure 2.4, page 55).

4.5.1.4. **Findings:** The present licensing system for Charara/Makuti has a serious problem of lack of commitment by many applicants who were allocated a hunt by the DNPWLM lottery system. **Conclusion:** Major causes are: Applicants could not choose hunts personally, but were allocated hunts arbitrarily; applicants did not value[1] the arbitrarily allocated hunts very much; hunting bags were valued far less than the costs of the hunting trip; applicants could not trade their hunts once they were assigned; by not going hunting, applicant's behaviour was economically rational because they minimized their financial losses; applicant's financial commitment to go and hunt was not high, because no advance or down-payment on the hunt was requested by the DNPWLM during application, and the cost of tickets purchased comprised a mere 2% to 15%[2] of an average hunting trip's total cost in Charara/Makuti.

4.5.1.5. **Finding:** Any lottery's fundamental limitation to allocate hunts to applicants who are committed to go and hunt was exacerbated by the arbitrary hunt allocation procedure used by the DNPWLM lottery system in 1991 for the Charara/Makuti study area. The procedure caused a mismatch between the price of allotted hunts and the price applicants were willing to spend for a hunt. **Conclusion:** The commitment of hunters allocated a hunt by the lottery was even more problematic than it could have been, had the lottery hunt allocation procedure accommodated applicant's hunt preferences.

4.5.1.6. **Finding:** Hunting big game in Charara/Makuti and other protected areas in Zimbabwe is a very expensive sport and recreation, of which the costs of the actual hunting bag - priced at government controlled fixed prices per species - were only about 11% on average in Charara/Makuti study area (Table 4.1, page 131). Costs to access the hunt (transport, food, camping equipment, weapons and ammunition) comprise at least 74% of the total hunting trip costs to the area. **Conclusion:** To increase the net-value of a hunt for hunters living far from the hunting areas, the value of the hunting bag or the value of other hunt characteristics for participants (real benefits) must be increased; in this way, the difference between the benefit-value of the hunting trip and the costs of access (eg. transport) will increase. Hunts and hunting bags need to be made more valuable to make it worth the expense of undertaking the hunting trip for Zimbabwe citizens living far away from the hunting areas. Otherwise those living far from the hunting areas will be disadvantaged by the allocation system.

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[1] The valuation process is complex and poorly understood (see models in Sinden and Worrell, 1979); however it is an individual, and personal, process.

[2] Z$200 for a minimum of 10 tickets and a hunting trip costing in total Z$11'700, equals 2%; Z$1'980 for the maximum of 99 tickets and a hunting trip costing in total Z$13'390, equals 15%. See Table 4.1, page 131.

4.5.1.7. **Finding:** In general, citizen hunters valued hunts offered in Charara/Makuti study area less in 1991 (compared to 1990/89), because that year the quota was packaged into 100 hunts (twice the 50 hunts in 1990/89) but based on the same species' quotas. **Conclusion:** With more, less valuable, hunts in 1991, Charara/Makuti hunts were made less accessible rather than more accessible for all hunters - particularly for those citizen hunters in Zimbabwe living furthest from these hunting areas (eg. in urban centres of Mutare and Bulawayo). Citizen hunting cannot be made accessible or affordable to Zimbabweans by reducing the size, price and value of the hunting bag allocated to hunts, due to the influence of geographical location and high access and transport costs associated with a hunting trip. To make hunting more accessible, the supply can either be geographically distributed in Zimbabwe[1], or the hunting trip must be made more valuable for hunters, eg. by increasing the size, price and value of the hunting bag.

4.5.1.8. **Findings**: Applicants, hunters and the DNPWLM incurred significant costs due to the design of the lottery hunt allocation procedure for Charara/Makuti, none of which are easily quantified. They include: the cost of lottery tickets for applicants who did not benefit from hunting; the cost of hunts for lottery winners who did not benefit from hunting; the administrative cost to the DNPWLM of the additional re-allocation using the first-come-first-served system (preparation, advertisement, and administration); unpriced costs of hunter's frustration, inconvenience, and time wasted by both applicant's and the DNPWLM. **Conclusion:** At the microeconomic level, lottery systems are costly to administer, and especially so if lotteries are to achieve equality of hunt allocation as defined in premise 6, page 154 (eg. using the Wyoming hunt allocation procedure).

4.5.1.9. **Finding:** The second stage allocation of hunts by the DNPWLM first-come-first-served system to applicants in Harare was 85% efficient (compared to 55% for the first stage DNPWLM lottery system). **Conclusion:** The inequality of the queuing system (applicants travelled different distances to reach the central Harare licensing office) did indeed ensure that only hunters who were committed and valued the opportunity to hunt were selected, and prevented defaulting. The system was efficient for the DNPWLM, but costly for applicants. (The DNPWLM first-come-first-served system does not fit the definition of an equitable hunt allocation system used for lotteries. See conclusion 4.5.2.11.)

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[1] Zimbabwe citizens who are members of the ZHA can benefit by having three big game hunting areas in Zimbabwe to choose from (see Map 2.1, page 47). Unless an economic incentive is offered to landowners outside protected areas (eg. high hunt prices), no additional big game will be supplied to Zimbabwe citizens in a free market economy. Unless opportunity costs are incurred by the DNPWLM and Zimbabwe Government (eg. less revenue), no additional big game can be supplied to Zimbabwe citizens inside protected areas presently used for other purposes, such as safari hunting.

4.5.2. Conclusions for equitable hunt allocation

From the assessment of the equality of hunt allocation for the DNPWLM lottery system in Charara/Makuti study area, the following conclusions can be drawn:

4.5.2.1. **Findings:** The DNPWLM lottery system for Charara/Makuti did not give all applicants an equal probability to win any hunting opportunity (*Any Hunt*). Probability of winning a hunt ranged from very low ($p > 9\%$) for applicants with one ticket, to almost certainty ($p < 99\%$) for the applicant with 99 tickets. Citizen hunters had to purchase **more than 5 tickets** to have any reasonable probability of winning an option to hunt, based on 1991 data. **Conclusion:** Contrary to the purpose associated with lottery systems of equalizing probabilities of winning for all participants, the **DNPWLM lottery system was designed as an unequal lottery system**: Applicants with the greatest willingness to pay had the highest probability of winning a hunt in the Charara/Makuti study area. Due to lack of documentation and policy on the DNPWLM lottery system, the author assumed that a lottery system should be designed as an equal lottery system. (On conclusions how to achieve this, see conclusion 4.5.2.7.)

4.5.2.2. **Finding**: Hunters and applicants did not necessarily face the same lottery rules to be able to hunt in Charara/Makuti, because co-hunters in a hunting party were not specified during application and were not considered by the draw procedure. **Conclusion**: Under present lottery qualification rules (unspecified hunting parties) applicants can adopt a cooperative strategy to increase their probability of actually going hunting in any area (see footnote 1, page 148, for details).

4.5.2.3. **Finding**: Applicants with identical numbers of tickets in the 1991 lottery draw did not have the same probability of winning a hunt (*Any Hunt*). **Conclusion**: Some winners of the unequal DNPWLM lottery system with 5 tickets each were worse off than they might have been had they entered an equal lottery system with only a single ticket per person.

4.5.2.4. Applicants had no personal choice about which hunt they were allocated; an arbitrary rule based on the draw order determined which hunt was allocated.

4.5.2.5. **Finding:** The licensing system offered 100 hunts for a maximum number of 200 hunters (one hunter, and one co-hunter per hunt). Of an estimated 196 Zimbabwe citizens who applied to hunt in Charara/Makuti in 1991 using the DNPWLM lottery system, an estimated 52% (or 133 applicants) were at the same time members of the Zimbabwe Hunters' Association (ZHA). **Conclusion:** In 1991, 133 applicants for Charara/Makuti had access to other, more expensive, big game hunts in other protected areas in Zimbabwe (Tuli/Doma/Rifa hunting areas) as voluntary members of the association. All Zimbabwe citizen hunters have the option of joining the association.

4.5.2.6. **Finding:** In 1991, the DNPWLM lottery system effectively catered for about 63 Zimbabwe citizen hunters who were not already members of the ZHA. **Conclusion:** By any standards, 63 persons out of Zimbabwe's total population of 10.4 million persons - or 0.0006% - represent a very small number of beneficiaries for whom an area covering 1'691km^2 of prime land in Zimbabwe's protected area system was exclusively reserved.

4.5.2.7. **Finding:** Two types of equality have been documented that are attainable with lottery systems and hunter's ranked preference lists to allocate hunts "fairly". Objectively, neither form of equality can be classified as "more" or "less" equitable: This classification is a value judgement to be made by decision-makers who choose the licensing system. The author has decided that for the allocation of different hunts to different people, equality of hunt allocation should be the same probability of winning the same thing (a specific hunt and preference rank) for all persons who personally choose to apply for this hunt. **Conclusion:** If personal preferences of specific hunts are to be respected for all applicants, equality of hunt allocation can be achieved by lottery as:

- Either, an equal probability of winning (*Any Hunt*) and an **unequal** probability of winning a specific hunt (*First Hunt Preference*) by all applicants who apply for a specific hunting area. This definition is realized at present by the ZHA lottery system in Tuli/Doma/Rifa hunting areas in Zimbabwe.
- Or, an equal probability of winning (*Any Hunt*) and an **equal** probability of winning a specific hunt (*First Hunt Preference*) by all applicants who apply for a specific hunting area. This definition is realized by the Wyoming lottery system in America.

The factors affecting the choice of procedure include administrative, technical and financial costs. This choice is not clear-cut (see conclusion 4.5.2.14).

4.5.2.8. **Finding:** To enforce equality of hunt allocation for hunts in Charara/Makuti hunting area does not give all citizen hunters who want to hunt big game in the whole of Zimbabwe an equal probability of winning a hunt. **Conclusion:** Only by using one, centralized, lottery system to administer all protected areas where citizen hunting in Zimbabwe is supplied[1] using the Wyoming lottery system's equal hunt preference allocation procedure can equality of hunt allocation be guaranteed. Then **all citizen hunters in the country** applying for similar types of hunts can assured of equal chances of winning; no person can then adopt a strategy to maximize his personal probability of winning, either by applying in several lottery systems (as is presently the case for members of the ZHA), or by collaborating with other applicants to form a hunting party.

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[1] Big game and plains game hunting for citizens is supplied using 3 different licensing systems in 6 different hunting areas of Zimbabwe's protected area system, see Table 2.7, page 50.

4.5.2.9. **Finding:** Instituting equality of hunt allocation using a centralized lottery system for all citizen hunters in Zimbabwe (see conclusion 4.5.2.8) would not prevent persons who are willing (and could afford) to pay for big game hunts in the DNPWLM auction system from entering the cheaper, fix-priced lottery system.[1] **Conclusion:** The objective of using fix-priced lottery systems (rather than market-priced auction systems) to allocate valuable big game hunts and protected area and other human and financial resources to Zimbabwe citizens is unclear, and in the author's opinion questionable, **unless it is to be applied to the same type of hunting throughout Zimbabwe.**[2]

4.5.2.10. The geographical location of the application office and the Charara/Makuti hunting areas relative to the hunter's home significantly affects his costs of applying and accessing the hunts supplied; transport costs are a major portion of the total costs of any hunting trip for citizen hunters (Appendix 18, page A110). **Conclusion:** If application offices and hunting areas were decentralized, citizen hunting would become more efficient (by reducing transport costs) and more equitable (by making additional hunts accessible to additional hunters by reducing total costs of the hunting trip). To coordinate a decentralized supply of hunting in Zimbabwe is costly to administer using the Wyoming lottery system that depends on being centralized to achieve equality of hunt allocation (see conclusions 4.4.2.9 and 4.4.2.10 above). Such attempts to centrally plan and coordinate economic activities are diametrically opposed to price-coordinated market economies.

4.5.2.11. **Finding**: The hunts that were re-allocated by the DNPWLM from their Harare licensing office using a first-come-first-served system benefitted hunters living in, or close to, Harare, and disadvantaged those who were not delivered the Zimbabwe Herald (which advertised the re-allocation) on the same day it was issued. **Conclusion:** The first-come-first-served allocation system did not treat citizen hunters equally. The queuing system allocated hunts efficiently and inequitably for applicants, but efficiently for the DNPWLM because it ensured that hunter's were committed and did not default (see conclusion 4.5.1.9).

4.5.2.12. **Finding:** Equality is a complex theoretical concept that requires clear definition, and is difficult and costly to implement in practice. **Conclusion:** The benefit or net-worth of adopting equality and a lottery system to allocate resources is unpriced and extremely difficult to quantify to allow an objective and rational decision to be taken. The direct costs of administering a lottery system can be quantified, not so the benefits. Only by comparing the allocation results of lottery

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[1] Hunters who can afford to pay market prices for hunting in the DNPWLM auction system will always have more options open to hunt, if in addition they are willing to be members of the ZHA. Such hunters cannot easily be excluded from entering fix-priced lottery systems.

[2] To achieve this objective in practice, a centralized, coordinated licensing system is used in Wyoming. The Wyoming lottery system allocates all hunts offered at one point in time to licence all types of hunters on state and private land throughout the state of Wyoming.

systems with other allocation systems can the relative costs be established as opportunity costs. Resource managers, policy-makers and resource users are challenged to consider the real costs and benefits of this subjective concept and whether, and how, it is to be put into practice.

4.5.2.13. **Finding:** If applicants are to be given a choice of a specific hunt they are to be allocated by a lottery, and equality of hunt allocation is to be the objective of this lottery system in Charara/Makuti, then equality of hunt allocation cannot be achieved amongst all applicants applying for different hunts (equal probability of winning *Any Hunt*). **Conclusion:** Equality of hunt allocation can only be achieved amongst those applicants applying for the same hunt in those hunting areas (equal probability of winning a *First Hunt Preference* for a specific hunt). For example, all applicants preferring hunt number C1 in Charara can be assured of an equal draw probability; applicants preferring hunt number C20 can likewise be assured of an equal draw probability; however different applicants will have unequal probabilities of winning hunt number C1 and hunt number C20 in Charara.

4.5.2.14. **Finding:** Using applicant's ranked hunt preferences, two procedures can be used to accommodate choice and achieve different equalities of hunt allocation: the ZHA lottery system's unequal hunt preference allocation procedure, or alternatively the Wyoming lottery system's equal hunt preference allocation procedure. The choice between the procedures involves a difficult (subjective) trade-off for decision-makers[1]. **Conclusion:** On the one hand the unequal ZHA procedure does not promote commitment by winners as much as the equal Wyoming procedure; on the other hand, the unequal ZHA procedure can be administered manually and is less costly, whereas the equal Wyoming procedure requires a sophisticated computerized licensing system and is costly (in terms of human, technical and financial resources). To achieve equality of hunt allocation and accommodate choice with a lottery system requires a difficult trade-off to be made: High explicit financial costs are incurred to achieve greater equality and promote hunter commitment and efficiency with the Wyoming procedure; low explicit financial costs are incurred to achieve less equality and not achieve hunter commitment and efficiency with the ZHA procedure. For decision-makers in Zimbabwe's DNPWLM a rational choice at this microeconomic level is difficult, because many costs are not quantified and remain unpriced.

4.5.2.15. **Finding:** Applicants in the DNPWLM lottery system for hunts in Charara/Makuti did not all face the same rules as those citizens who hunted in the study area, because hunting members in the party were not specified. **Conclusion:** If all persons are to have an equal probability to apply for and benefit from actually hunting a specific hunt (eg. *First Preference Hunt*) in Charara/Makuti, then lottery

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[1] The book "Unpriced values: Decisions without market prices" by Sinden and Worrell (1979) deals with unpriced, largely unquantified, and therefore subjective choices which are nevertheless economic.

systems must adopt the Wyoming hunt preference allocation procedure and meet four conditions:

- All hunters who want to hunt a specific hunt must be uniquely identified on the application form (eg. using the Zimbabwe national identification number);
- Applicants must not be allowed to enter for the same hunt twice, by applying as an individual and as a member of an official or inofficial group application;
- Applicants must not be allowed to enter for two hunts using the same preference priority, either as an individual or as a group member;
- Strict control procedures must be set up and enforced during processing of applications for the lottery to exclude duplicate applications from the draw before assigning hunts.

4.6. Limitations of lotteries for allocating hunts efficiently and equitably

All lottery systems that attempt to achieve equality of resource and benefit distribution inherently limit revenue. The design adopted for the DNPWLM lottery system was an anomaly, because it maximized ticket revenue from applicants (and their chances of winning a hunt) within the limits of a lottery system. The DNPWLM lottery system, however, still limits revenue earned from Charara/Makuti hunting areas by the DNPWLM outright by pricing hunting resources at fixed prices. The concept of equality relates to the distribution of scarce resources and their benefits amongst different people; the equality concept has nothing to do with producing these resource and benefits.

If decision-makers want to distribute the benefits of citizen hunting in Charara/Makuti in a particular way - by giving hunters an equal probability to benefit from a hunt - then the quality and quantity of the hunts still has to be produced to be available for distribution. The production of wildlife for sport hunting involves economic costs for the DNPWLM. The question answered by concepts of equality - being distribution patterns - is: **How is the resource- and benefit-cake to be sliced?** Equality concepts are not concerned with the manner in which resources and benefits are produced (efficiently or wastefully), or with the quality and quantity in which benefits and resources are to be produced in the first place, before they are available for distribution. Instead, equality concepts are concerned with establishing distribution patterns for resources and benefits based on non-economic criteria, such as need, luck, administrative rules, etc. The questions concerned with production are answered by concepts of efficiency, being oriented around material production of goods and services, consumer choice, and costs: **What size of resource- and benefit-cake is to be produced?**

By using government controlled fixed prices to value the hunting resources allocated exclusively to Zimbabwe citizens, the DNPWLM is limiting the conservation benefits that can be derived from the Charara/Makuti study area and its hunting resources. Foregone revenue

and forgone benefits that - in addition to those derived by citizen hunters - this revenue could have financed (eg. education, research of protected areas, visitor facilities, DNPWLM staff salaries and training programmes) are called opportunity costs in economic terms (Samuelson, 1973: 472-473; 562). **Opportunity costs are the costs associated with not doing something.** By adopting a lottery system to allocated hunts in Charara/Makuti the DNPWLM is opting outright to limit the size of the conservation benefit-cake and the agency's (and the Zimbabwe Government's) potential to achieve equality: Additional benefits for citizen hunters and other beneficiaries of Zimbabwe's protected areas cannot be funded - conservation benefits are wasted.

How significant are the opportunity costs of the DNPWLM lottery system for Charara/Makuti hunting areas in Zimbabwe? This important question is the subject of the next chapter.

4.7. Recommendations: Efficient and equitable hunt allocation by lottery for the study area

At the outset of this dissertation, the lack of and often conflicting policy priorities for resource allocation of wildlife and land in protected areas for citizen hunting was documented. The conflict is between using non-market principles and unqualified notions of equality, equal access and subsidization at any economic cost to allocate resources in protected areas, and using market principles to promote conservation of the same resources throughout Zimbabwe on all other land categories.

The policy vacuum and conflicts precluded definitive recommendations being made for the study area. The following recommendations are preliminary, based on reasonable objectives specified by the author for hunt allocation at the microeconomic level (see premises 1 to 6, page 154). The recommendations assume that lotteries are - in principle - to be used to allocate citizen hunting in Charara/Makuti. This principle assumption is challenged in Chapter 5.

4.7.1. Recommendations for efficient hunt allocation by lottery

To successfully allocate every hunt planned for a lottery system to citizen hunters who will benefit (achieving efficient hunt allocation), resource managers should:

4.7.1.1. Consider the macroeconomic opportunity costs of the DNPWLM lottery system before any of the recommendations that follow are adopted. Chapter 5 considers some of these opportunity costs.

4.7.1.2. Document and inform applicants of the entire lottery licensing system before they apply. At minimum, applicants should know:

- All hunts and hunt characteristics allocated by the lottery system for a specific hunting area, eg. Charara/Makuti study area (see recommendation 4.7.1.4);
- Application procedures (where, deadlines, formalities);

- Payment details (how, where, deadlines);
- Hunt allocation procedure;
- Licence issuance formalities;
- Hunt forfeit rules (deadlines, penalties);
- Marksmanship test requirements (see recommendation 4.7.2.9);
- Hunting regulations for conduct and ethics expected of sport hunters;
- Regulations, procedures and penalties regarding wounded animals should be emphasized.

4.7.1.3. Define all hunts and hunt characteristics for a lottery system;

4.7.1.4. Define the minimum hunt characteristics as:

- Hunt number (identifying each hunt uniquely);
- Hunting bag (species, sex, number of animals);
- Hunting dates (to coincide with holidays and weekends);
- Hunt duration (in days);
- Hunt price (total fixed trophy prices, price per hunter per day);
- Number of hunters permitted per hunt (size of hunting party);
- Hunting camp assigned to the hunt;
- Hunting camp's location and facilities available (or lack thereof) in the hunting area (eg. water, slaughtering facilities);
- Number of DNPWLM staff (trackers) to accompany each hunting party;

4.7.1.5. Document and inform applicants explicitly, clearly, and comprehensively on each hunt's specific characteristics well in advance of the application deadline for the lottery draw;

4.7.1.6. Allow applicants to choose their preferred pre-defined hunts, and respect these ranked hunt preferences in the lottery hunt allocation procedure;

4.7.1.7. Realize the importance of the quota allocation to hunts (packaging) as being the single most critical function for planning a lottery licensing system for achieving efficiency and equality (see framework in Figure 2.3, page 23).

4.7.1.8. Package the species' quotas into hunts during the planning stage of the licensing system to maximize the variety of hunting experiences supplied (within ecological resource and budget limitations of the DNPWLM). Zimbabwe citizen hunters should have a wide variety of hunt qualities, hunt prices, and hunt durations to choose from.

Suggestions include:

- Allocate species' quotas to hunting bags to offer a few, quality, hunts with a variety of hunt prices rather than many, low to average quality, hunts with low hunt prices.

- Whilst packaging the species' quotas into hunts, differentiate strictly between trophy hunts (male trophy animals of all species) and non-trophy hunts (female and non-trophy bearing male animals) to increase variety and choice.
- Whilst packaging the species' quotas into hunts, differentiate strictly between big game hunts and plains game hunts. Shorten hunt durations for plains game hunts, to again increase variety and choice.
- Take account of sport hunter's hunting requirements (consumer orientation) and experience. Allocate necessary species as bait animals for cat hunts. Liaise with professional and amateur hunter associations.

4.7.1.9. Calculate the cost of administering a lottery system to achieve equality of hunt allocation, and estimate the number of applicants. Set a nominal fee for each application to cover administrative and postage costs. The purpose of the application fee should be to cover costs, not to maximize revenue and earn a profit from the lottery system. (Market-priced auction systems maximize revenue more efficiently. See Chapter 5.)

4.7.1.10. Address defaulting and lack of commitment by hunting applicants as a priority, because it is costly for all parties concerned. Ideally defaulting could be prevented by somehow allocating hunts only to those hunters who are serious about hunting and who will go and hunt. Thus ways to discriminate (differentiate) between individual applicants must be found that are acceptable. Criteria include: price (willingness to pay), time and effort (willingness to queue), financial commitment (application and upfront payment). For fix-priced lottery systems, suggestions to increase the hunt's value for hunters include:

- First, allow applicants to personally choose and rank their most preferred hunts (eg. using a preference list). Preferences should then be considered using one of two available hunt preference allocation procedures (see conclusion 4.5.2.14);
- Second, require applicants to advance payment for the price of their first hunt preference when they apply, in order to qualify for the draw;
- Third, the DNPWLM should, in turn, commit itself to refund all unsuccessful applicants in full within a short, specified time period, once the lottery draw results are made public. Undrawn applicants and the DNPWLM are then financially no worse off after, than they were before, the lottery.

4.7.1.11. Increase the value of hunts for hunters (the opportunity cost of not going hunting). Applicants who apply and are allocated a hunt by the lottery system should stand to loose more by defaulting, than by going hunting; citizen hunter's commitment to go hunting is increased. To increase hunt value and quality of hunting requires the hunt price to be increased and the quality of services to be improved:

4.7.1.12. Consider implementing a raise in total hunt price (recommendation 4.7.1.11) using the following measures:
- Charging higher trophy prices per species in the hunting bag (consumptive resource);
- Charging every hunter and visitor a price per person per day for entry and access to the protected area (non-consumptive resources);

4.7.1.13. Consider implementing a quality improvement of the hunting experience for some, or all hunts offered in Charara/Makuti (recommendation 4.7.1.11) using the following measures:
- Upgrading facilities and services for hunting camps;
- Instituting a marksmanship test for all citizen hunters (see recommendation 4.7.2.9);
- Providing maps of the hunting areas;
- Enforcing more walking and stalking by hunters to limit driving during hunting trips;
- Limiting the practice of baiting for lion hunts.
- Documenting and communicating these improvements to all potential applicants (marketing function).

4.7.1.14. Recognize that most recommendations to improve efficiency (and equality that follow) are designed to increase quality and price of the hunting trip: **Most measures require a larger DNPWLM budget and more human resources to be allocated to the management of Charara/Makuti study area.** A budget increase is considered by the author to be highly unlikely under current financial and institutional arrangements that apply to the DNPWLM, given Zimbabwe's current economic climate (see research assumptions in section 1.5, page 8).

4.7.2. Recommendations for equitable hunt allocation by lottery

As defined in this dissertation, the term equality includes all distributive notions of resource allocation amongst people, including: "equal opportunity", "equal access", "fair, or equitable lottery systems", or "a fair chance to win". For the DNPWLM to be "seen to be fair" during hunt allocation as a government agency serving the Zimbabwean public, licensing systems should be defined, allocation principles and rules operationalized and quantified, and documented. All this information on the licensing system should be made freely available to the public, especially the interested and affected citizen hunters. Administrators and decision-makers should be open and accountable - that is answerable - to the public.

Decision-makers may be guided by the objective criteria of probability and costs of administering the lottery system, but deciding on equality remains a subjective political choice taken by those with decision-making power in the DNPWLM and the Zimbabwe Government (the political rationality, as described by Hollick, 1981).

Recognizing that the concept and implementation of equality is subjective, the following recommendations are based on the author's value system. They are proposed for debate and consideration by decision-makers in the DNPWLM, the agency responsible for defining equality and turning this concept from theory into practice, a vexatious task as aptly noted by Rae, *et al.*, (1981): 1-7.

4.7.2.1. To apply notions of "fairness", "equity", "equality" or "equal opportunity and access" to resource distribution using lottery systems, and recognizing the subjective and multi-faceted nature of these distributive notions (see Rae, *et al.*, 1981), decision-makers in the DNPWLM should first clarify the following:

- State the purpose of using such a concept, rather than using the hunter's willingness to pay;
- Define the concept of equality clearly. **What** is to be equal? (eg. *Any Hunt*, *Next Hunt Preference*, or *First Hunt Preference*). **Which type of sport hunting** should it apply to? (eg. to big game, plains game, trophy or non-trophy (venison) hunts?); **For whom** is it to be made equal? (For all applicants, that is licence holders, or for all hunters entering a hunting area, that is hunters and co-hunters); **Where** in Zimbabwe is it to be made equal? (eg. confined to state land and protected areas only: in one single big game hunting area, in more than one big game hunting area, or in all Zimbabwe's big game hunting areas within the system of protected areas). Rae, *et al.*, (1981) show that many aspects, and consequently many definitions, of equalities are possible.
- Consider and specify why sport hunting for Zimbabwe citizens should necessarily take place on state land within Zimbabwe's protected area system, but not on other state land categories (eg. state land in communal areas not managed by appropriate authorities, state land in protected forest areas, and state-owned commercial farm land).
- Specify the rule(s) that are to be applied;
- Specify whom the rule(s) are to include and whom they are to exclude;
- Implement the concept so that all persons have the same rules;
- Ensure that the rule(s) cannot be avoided by some persons to achieve a different benefit distribution for themselves to that originally intended by the objective;
- Consider the opportunity costs of using lotteries based on a concept of equality as compared to prices and market incentives for resource allocation. (see comparative study in Chapter 5.)

4.7.2.2. Ranked lists of applicant's hunt preferences can be considered using one of two procedures documented in this dissertation:

- An unequal, manual, unsophisticated and financially and administratively cheap procedure used by the ZHA lottery system for Tuli/Doma/Rifa hunting areas (see review, section 3.2.1.3);

- An equal, fully computerized and centralized, sophisticated, and financially and administratively costly procedure used by the Wyoming lottery system (see review, section 3.3.1).

Both procedures have benefits and costs. Both distribute hunts differently amongst applicants; different distribution patterns are defined as different equalities in this dissertation.

4.7.2.3. Regarding the relative benefits of the hunt allocation equalities achieved by the procedures in recommendation 4.7.2.2: The Wyoming procedure allocates hunts amongst applicants who rank these hunts highest on their preference lists. The procedure increases these winner's commitment to go hunting. The ZHA procedure, by contrast, allocates hunts randomly amongst all applicants irrespective of their ranking of these hunts in the preference list. The procedure reduces these winner's commitment to go hunting.[1]

4.7.2.4. Regarding the administrative costs of implementing both procedures in recommendation 4.7.2.2: The Wyoming procedure is complex and costly to administer. For efficient administration, the procedure relies on computerization of the licensing system, which is hardly warranted for the approximately 200 Zimbabwe citizen hunters who applied to hunt in Charara/Makuti in 1991. This procedure must be centralized. It requires skilled staff, a computer programme and computer facilities. The Wyoming procedure is unsuited to being conducted in public for applicants, it is less open and its results are less accountable for administrators. The ZHA procedure is less complex and costly to administer. The procedure can be administered manually. It requires less skilled staff, but no computer. The ZHA procedure is suited for public entertainment, it is more open, and its results are more accountable for administrators.

4.7.2.5. The decision of which hunt preference allocation procedure (in recommendation 4.7.2.2) to choose depends on a number of issues:

- Clarifying, debating and defining the policy and principles to be adopted for resource allocation by the DNPWLM for wildlife and protected areas in Zimbabwe (see recommendation 4.7.2.1);
- Clarifying, debating and defining the policy on citizen hunting for Zimbabwe's protected areas as well as for other land categories;
- Adopting a precise definition for equality of hunt allocation by the DNPWLM for citizen hunting in Zimbabwe's protected areas (see recommendation 4.7.2.1). The allocation criterion for a licensing system may be the hunter's willingness to pay, or an equal probability of winning a specific hunt, but not a mixture of both (as exhibited by the DNPWLM lottery system for Charara/Makuti in 1991);

[1] See the comparison of hunt allocation outcomes for the ZHA and Wyoming procedures, Figure 4.6, page 152.

- Defining the DNPWLM financial and human resources (budget) available to implement a policy citizen hunting in the Charara/Makuti (and Zimbabwe's protected area system);
- Clarifying the macroeconomic opportunity costs of principally using a lottery system, rather than alternative systems, to allocate scarce resources for hunting in Charara/Makuti study area (eg. the forgone revenue). (These macroeconomic opportunity costs are the topic of Chapter 5 following.)

4.7.2.6. If decision-makers decide that equality of hunt allocation should be applied to Charara/Makuti, and that a lottery system with one application (ticket) per applicant should be used, under present rules some Zimbabwe citizens would still be able to hunt in Charara/Makuti who had not entered the lottery. The author recommends that in principle all hunters, rather than all applicants, should have equal probabilities of winning and accessing hunts in the Charara/Makuti study area.

4.7.2.7. To implement recommendation 4.7.2.6, the following measures are suggested:

- Applications for each hunt preference must identify all members of the hunting party;
- Each applicant in the party should be identified uniquely using the Zimbabwe national identification number. (Name, initials, and address alone are not unique, as this research using the DNPWLM ticket register has shown.)
- Rigorous control procedures must ensure: first, that no applicant can apply twice for the same hunt and preference[1]; second, that no applicant can apply twice for different hunts using the same hunt preference.
- Applicants should be informed of this rule, should it be implemented.

The author, however, considers that the administrative, technical, personnel, and financial costs of achieving this type of equality would be very high (see recommendation 4.7.2.4).

4.7.2.8. Lottery results should be communicated to applicants as in the Wyoming lottery system (see Chapter 3) to make lotteries more transparent for the public and all applicants. This information is vital for applicants and resource managers to make rational informed choices. The author recommends that all applicants - both winners and losers - of any lottery be documented with application data, and with statistics of the lottery draw results of the previous year. Such information could be included in the refund of the hunt price to unsuccessful applicants (see recommendation 4.7.1.10).

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[1] By applying once as an individual, and once as a group member.

4.7.2.9. In not one of Zimbabwe's big game hunting areas are, at present, sport hunters (citizen hunters or safari hunters) tested for marksmanship. The author recommends that all sport hunters should undertake a marksmanship test every time they hunt immediately prior to entering the hunting area in order to qualify for their hunt. Hunters who fail the test, in the author's opinion, should forfeit their hunt and the full hunt price and not be allowed to hunt in protected areas. Applicants should be informed of this rule, and test qualifications should be drawn up and made public, should the recommendation be implemented. A marksmanship test in Zimbabwe would serve a number of purposes, that combined, promote efficient and equitable hunt allocation and use of the nation's arguably scarcest and most valuable wildlife resources in public areas:

- Enforce and maintain high standards for sport hunting as a recreation of repute;
- Improve shooting quality according to specified standards of marksmanship for all hunters;
- Minimize traumatizing and wounding of wild animals that may endanger human life (eg. park visitors, neighbouring communities, park employees, hunters);
- Minimize costs for DNPWLM staff and hunters who must track, follow-up and report wounded animals to DNPWLM control offices;
- Prevent waste of valuable wildlife resources from the resource manager's point of view, and animal suffering from the species' point of view.

4.7.2.10. To implement recommendation 4.7.2.9, the DNPWLM should design a marksmanship test that complies with accepted international standards and is locally applicable (see standards set for NPB lottery system in Chapter 3, footnote 1, page 106). The test should take place at the DNPWLM Marongora control office (for Makuti hunting area), or at the existing rifle range near Kariba aerodrome (for Charara hunting area) (see map of study area, Appendix 20, page A113); alternatively, the DNPWLM could authorize accredited rifle ranges or rifle associations with the necessary facilities.

4.7.2.11. The macroeconomic opportunity costs of the DNPWLM lottery system should be considered by decision-makers before any of the above recommendations in Chapter 4 are adopted. Chapter 5 considers some of these opportunity costs.

4.8. Progression of the study

All recommendations to improve efficiency and equality of hunt allocation for a lottery system impose financial costs on the DNPWLM who administers the lottery system for Charara/Makuti hunting areas. Whether these costs are justified at this microeconomic level of assessment to allocate valuable resources in Charara/Makuti is a question of policy and the political decision-making process, since the benefits of lottery systems are not priced or known.

The more important question for policy and decision-makers in the DNPWLM, however, is how large, and how significant, the opportunity costs of forgoing revenue by pricing valuable resources at fixed, rather than at market, prices are at a macroeconomic level of assessment.

The choice for decision-makers is thus: What allocation system can supply the greatest real conservation benefits to present and future generations from protected areas such as Charara/Makuti? Are efficient and equitable lottery systems the answer? Chapter 5 following now considers some opportunity costs of the DNPWLM lottery system, by comparing it to other Zimbabwean licensing systems.

CHAPTER 5

COMPARATIVE STUDY OF ZIMBABWE'S LICENSING SYSTEMS: A MACROECONOMIC ASSESSMENT OF RESOURCE ALLOCATION

5.1. Introduction

The previous chapter established that at a microeconomic level, the DNPWLM lottery system allocated hunts inefficiently and inequitably. Causes were sought, and suggestions to improve the lottery allocation system were made. By limiting revenue, however, all lottery systems in addition incur other macroeconomic costs, especially if compared with revenue maximizing allocation systems based on market principles - such as the auction system. The purpose of this chapter is first, to see how well Zimbabwean licensing systems generate revenue and recreational opportunities and second, to establish the type and amounts of benefits foregone[1] by the DNPWLM lottery system in relation to other allocation systems.

In this chapter, the five Zimbabwean licensing systems (see Table 5.1), reviewed in detail in Chapter 3, are compared.

Table 5.1 Licensing system alternatives compared for Zimbabwe: 1991

Administrative Agency	Type of Allocation System	Hunting Areas	Abbreviation used
DNPWLM	lottery system	Charara hunting area	A
		Makuti hunting area	B
ZHA	lottery system	Tuli hunting area	C
		Doma hunting area	D
		Rifa hunting area	E
DNPWLM	tender system	Dandawa in Nyakasanga hunting area	F
DNPWLM	auction system	Nyakasanga hunting area	G
		Sapi hunting area	H
Safari Operator	marketing system	Charara/Makuti hunting area	I

The systems refer to hunting resources in seven hunting areas, are administered by the government Department of National Parks and Wild Life Management (DNPWLM), the

[1] Known as "opportunity costs" in economics, or benefits that could have been earned by allocating resources differently. Here, care must be taken to distinguish between benefits that are foregone, and the actual costs of producing and distributing these benefits, which taken together would result in net-benefits or net-costs. The actual costs of producing (protecting, managing and researching) wildlife for sport hunting in Zimbabwe's protected areas are not considered here. See section 5.1.2, page 178 on data limitations of this analysis.

private Zimbabwe Hunters' Association (ZHA) through its local branches, and by a commercial safari operator. The alternatives supply sport hunting to citizens and to foreigners, and cover the whole range of sport hunting types defined for Zimbabwe in Chapter 1 (see section 2.1.7, page 16), namely:

- Citizen hunting, offered by alternatives A to F;
- Citizen/safari hunting, offered by alternatives G and H;
- Safari hunting, offered by alternative I.

Two pricing methods are used by alternatives A to I to value and allocate hunting. Lottery systems on the one hand value each hunt's animal quota at **fixed prices** set by government (alternatives A and B), or at fixed prices set by the ZHA (alternatives C, D, and E). The price values each hunt's consumptive resources (whilst non-consumptive resources remain unpriced). Lottery systems are thus referred to as fix-priced systems. Tender, auction, and commercial marketing systems on the other value each hunt at market prices determined by the hunters themselves according to their willingness to pay. Accordingly, these systems are referred to as market-priced systems. The market prices value the total hunt experience expected by the hunter (eg. alternatives F, G). In Zimbabwe, only commercial marketing systems (alternative I) price access time to hunting areas explicitly as a non-consumptive resource. As expected, hunting revenues differ greatly between market- and fix-priced systems.

To allow revenues based on different resources (quantity and quality of species' quotas, access time) to be compared for different hunting areas and alternatives two economic indicators are used: A wildlife index measures wildlife quotas as the consumptive hunting resource, and hunter-days measures hunting time available to hunters as the non-consumptive hunting resource, for each alternative and hunting area respectively. Revenue measures the hunting benefits produced by alternative systems.

In addition to direct hunting benefits, two Zimbabwean licensing systems (alternatives C and E) provides significant numbers of people with important non-hunting benefits. Three distinct user-groups benefit indirectly from hunting and access to Zimbabwe's protected areas:

- Hunters: from hunting benefits and indirectly from the accompanying non-hunters;
- Non-hunting visitors who accompany a hunting party: indirectly from the hunting, and directly from non-hunting use of the area;
- School children and teachers: indirectly from the hunting revenue used to finance access and environmental education programmes.

The benefits of conservation education for school groups in two hunting areas are a direct result of the ZHA's ability and commitment to invest hunting revenue in these activities. In this way, the alternatives C and E administered by the ZHA are a good example illustrating how important the institutional arrangements are for enabling revenue from profitable activities (sport hunting) and one group of resource users (citizen hunters) to finance

conservation benefits (infrastructure and environmental education) for potentially unprofitable but socially beneficial activities (educational programmes) for other users (visitors, teachers, and school children).

The benefits these various user-groups gain from using the sport hunting areas are qualitatively (eg. conservation education and hunting) and quantitatively different. The benefits are also based on different resources: Revenues, quotas, and access times. A "social" indicator was developed to allow these benefits to be compared between the various alternatives for different resource bases: Recreation-days per dollar measures the "visitor intensity" of the hunting revenue. Recreation-days is the time spent in the hunting area by each user-category (hunters, visitors who accompany hunters, school children and teachers). Hunting areas are seen here as multi-purpose resource areas, in accordance with their definition as Safari Areas (see section 2.4.2, page 46).

Two objectives of resource allocation for each alternative and hunting area are proposed for the comparison:

- Maximize total revenue earned from the hunting resources;
- Maximize conservation benefits (hunting and non-hunting) for people from direct, personal, access to protected areas (hunting areas).

Two preliminary remarks on the objectives are necessary. To maximize the total (gross) revenue from selling the hunting resources to hunters, the question of **whom this hunting revenue accrues to** is important for the analysis. There are additional direct benefits from hunting than those measured by revenue indicators due to foreign exchange earned from foreign safari hunters but not from Zimbabwe citizen hunters. There are also indirect benefits that are not measured by revenue indicators due to economic multiplier effects of foreign exchange revenue. The conservation and development implications of earning revenue under different institutional arrangements are the topic of the second objective, assessed in section 5.3 and interpreted in section 5.4 as the institutional dimensions of resource allocation.

The indirect social benefits from hunting measured by the social indicator differ both in the type of benefit, and the persons that benefit. The indicator assesses (quantifies) people's benefits, but does not attempt to evaluate (price) the enjoyment experienced by different user groups (ie. foreign hunters, citizen hunters, visitors, school classes) for different activities (ie. hunting, recreation, educational value). The two associated problems of placing a monetary value on different individuals and different benefits, and then aggregating these individual values into a social value are avoided here (see Arrow, 1983; Rae, *et al.*, 1981; Sinden and Worrell, 1979). Benefits are deemed to be valued personally by users who are willing to pay for them. Users thus benefit if they have access (priced access for hunters, and unpriced access for visitors and school groups). Recreational benefits thus depend on how hunting revenue is spent or distributed by institutional arrangements to benefit people directly. If, for example, hunting revenue from 100 hunters is not spent to increase non-hunting benefits in

the form of employment, non-hunting visitors or educational benefits, **no additional persons have access or benefits from this hunting revenue**. The economic indicators of hunting revenue earned may be better for this example than for other systems, but the social indicator of recreation-days (the number of people who spend time in the hunting area) may well be lower for this example than for systems where hunting revenue can be invested to develop further access to conservation benefits, thereby giving more people than just hunters access to protected areas (eg. through educational programmes).

Both economic indicators assessing the first resource allocation objective of licensing systems are concerned with efficiency, that is with producing benefits from limited resources by allocating sport hunting.

The social indicator assessing the second objective is concerned with equality, that is with **investing and distributing revenue** (from the first objective) **to achieve visitor access and educational benefits**. This objective is emphasized for Zimbabweans by the DNPWLM in wildlife, tourism and sport hunting policy guidelines[1]. Equality in this sense indicates how "user intensive" the hunting revenue was, and shows how many persons benefitted directly from every Zimbabwe dollar of hunting revenue earned by each alternative and hunting area.

The comparative assessment in this chapter takes a macroeconomic viewpoint of resource allocation. It looks at benefits and benefit differences from the perspective of Zimbabwe's economy. (Chapter 4 took a microeconomic viewpoint.) The comparative assessment shows that there are significant differences between market-priced and fix-priced systems of allocating sport hunting resources.

The chapter is structured as follows: Section 5.2 applies the two efficiency criteria, with revenue per wildlife index in section 5.2.1, and revenue per hunter-day in section 5.2.2. In these sections, revenue from foreign hunters in foreign currencies is valued in Zimbabwe dollars at official (fixed) exchange rates, but it noted that in so doing the Z$-value of hunting revenue is undervalued. In section 5.3 the equality criterion is applied to data to assess the institutional and social dimensions of resource allocation. The results are then interpreted graphically to highlight the trade-offs that exist (section 5.4) and to reveal the issues that decision-makers need to consider and address when choosing a particular allocation system.

In section 5.5, an estimation of the market value of foreign currency to the Zimbabwe economy is made using information available since the recent liberalization of the foreign exchange system in Zimbabwe. The nature and extent of the value of foreign exchange is examined in the light of Zimbabwe's economic development priorities. In the final section

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[1] For example, see: Zimbabwe Government (1992) [Policy for Wildlife 1.1.1992], sections 2.1.6; 2.3; 4.3; 4.4.1; 4.4.4; 4.4.8. Zimbabwe Government (1990b) [draft Policy for Wild Life 22.9.1989], sections 8 vi); 11. Parks and Wild Life Act (1975) [Act 14 of 1975], section 26 (1) and (2) on the purpose of Safari Areas. Child and Heath (1990): especially 217-218.

to this chapter, a summary of initial conclusions and recommendations based on insights from this chapter's comparative assessment alone is given. Key policy areas that require attention by decision-makers in the DNPWLM and government are highlighted.

Each section is structured with:

- Introduction to the analysis;
- Data and methods;
- Results;
- Discussion of results;
- Initial conclusions.

Throughout this chapter, extensive reference is made to data included in appendices for readers to corroborate data and calculations, whilst minimizing detail in the text.

5.1.1. Assumptions of the analysis

The comparison of alternatives is based on certain assumptions that are built into the tables used to present the results in this chapter (Table 5.3, Table 5.4 and Table 5.6). The assumptions made are:

5.1.1.1. That hunters (foreign and local), visitors, and school children all benefit equally as persons, because physical access quantifies benefits. Each day spent by one person from any user-group is not worth more, or less, than the same day spent by a different type of user. In particular, foreign hunters and Zimbabwe citizen hunters have equal weighting.[1]

5.1.1.2. That revenue earned in foreign exchange currencies, when valued using the current controlled exchange rates valid at the time of research, grossly under-valued the importance of foreign exchange to Zimbabwe's economy. The distortion is quantified for the DNPWLM lottery system in section 5.5, page 213, with a market-valued foreign exchange rate.

5.1.1.3. Every hunt had the full number of hunters possible in the hunting party. For example, it was assumed that all hunts offered by the ZHA had the maximum of four hunters (1 hunter and 3 co-hunters). Further research is needed to establish the actual numbers of hunters in each hunting party.

5.1.1.4. Any visitor accompanying a hunting party spends on average only half the hunting period in each hunting area. Available data (Zimbabwe Government, 1988a; Zimbabwe Government, 1989a; Zimbabwe Government, 1990a) do not distinguish the average period spent per visitor; this figure was assumed by the author based on personal observation during a field trip, where visitors arrived and left during the course of the hunting period. Further research and validation of this assumption is needed.

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[1] This assumption matches the idea of one person one vote.

5.1.2. Limitations of the analysis

The analysis and results are limited, because the assessment does not attempt to place values on all the benefits from resource allocation, nor to determine the relative importance of benefits to different resource users (eg. hunting, visitor, and educational benefits). The total value of benefits is largely unknown for all systems where users (hunters, visitors, pupils) are charged non-market prices (eg. citizen hunters) or no price at all (eg. co-hunters, visitors, or pupils).[1] Benefits to citizen hunters are assumed by the author to be greater than the fixed prices paid at present, in other words, it is assumed that Zimbabwe citizen hunters would be prepared to pay more than the present fixed price to go hunting. Just as fixed prices cannot reflect the value of benefits to consumers accurately, fixed prices do not reflect the actual costs of producing these benefits either. The benefit-cost equation at present does not have to be balanced for each activity (hunting, visitor access, education), for each hunting area, or for the conservation agency over the entire protected area system. The DNPWLM budget is a subsidy for all these activities. The subsidy is the extra cost of producing sustainable quotas and protected areas to enable sport hunting in the first place, but which the hunt price charged to sport hunters at present excludes.

The assessment also does not consider the costs of supplying benefits in the comparative assessment. These costs would have to include not only the administrative costs of supplying citizen hunting, citizen/safari hunting or safari hunting, but should also include the full current costs of protecting, researching, administering, managing and developing the hunting areas as their rightful proportion of the DNPWLM budget for each protected area. Such a view is based on economic theory and current conservation practice in southern Africa (see McNeely, 1988; Leibold, 1991; Magome, 1993). At the outset of this dissertation the author assumed that for conservation to be sustainable activity for present and future generations, protected areas must be managed according to ecological principles of sustainability and according to financial principles of sustainability (see study assumptions, section 1.5, page 8). This assumption means that an unbalanced budget effectively constitutes a subsidy to the DNPWLM for maintaining protected areas. The subsidy is an economic cost that Zimbabwe's population at large pays for those who use the resource. The assumption is justified by current moves in Africa and other parts of the world that where possible, conservation should pay its way. Government resources are limited particularly in the context of developing countries in Africa where demands made on them are already high and will increase in the foreseeable

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[1] Environmental Impact Assessment procedures use a wide variety of methods in an attempt to assess (measure and quantify) costs and benefits of actions or policies. Decision-makers use this information to evaluate the significance of costs and benefits, that is they place values on them and attempt to determine a net value. The net value may be positive, in which case the action of policy is beneficial, or negative, in which case it is harmful if executed. This approach is based on expert decision-makers deciding with best-known methods and information on behalf of other persons. Economic theory is based on an opposing world-view, namely that which accords individual persons sovereignty in making economic decisions for themselves. Economic theory does not assume that all information is available, nor that this information is free - as the world-view of informed decision-making underlying the impact assessment procedures do. Until the full price based on full costs of maintaining protected areas and supplying their benefits is charged to those that use them, a socially representative value of the benefits and costs, and the assessment of their net positive of negative value, is not possible. The comparative method should be treated with caution, because it may be based on a flawed method and world-view of how, and by whom, choices are to be made.

future due to the sustained, exponential, population growth rates. (Over half Zimbabwe's population of 10.4 million persons in 1992 was under the age of 20. The annual population growth rate is 3.1 percent.)

Thus, the main limitation is that this chapter assesses **partially quantified benefits**, and does not subtract any costs of providing benefits. **Gross benefits**, rather than net benefits, are quantified.

The costs of providing all benefits are largely unquantified to date, and are borne by various people and organisations in different ways. At present, costs (mostly) accrue to the DNPWLM, but some are also borne by safari operators as lessees of hunting areas, by the ZHA and members of this association who provide educational and other services in their own time free of charge. Due to severe under-funding of the DNPWLM and increasing demands made on the existing budget to protect endangered species (eg. black rhinoceros and elephant) in the Zambezi valley hunting areas (including the Charara/Makuti study area) from poaching activity at the present time, society is arguably also bearing the unknown cost of insufficient management and control. Under-funding has also caused other unquantified costs for the agency: the loss of qualified staff, the lack of quality personalized tourist services, insufficient maintenance and development of infrastructure.

5.2. Economic costs of resource allocation

This section compares how efficiently licensing systems can generate hunting revenue, taking two hunting resources as the basis for efficiency calculation. It demonstrates the dichotomy between market-priced systems based on economic incentives and market principles (eg. auctions) and fix-priced systems based on political/administrative principles and probability (eg. lotteries) for resource allocation.

Revenue efficiency is first defined as the gross hunting revenue each system generates based on the quota of wildlife species (section 5.2.1). The wildlife index was used to overcome the problem of invalidly comparing hunting revenues obtained from different sport hunting quotas (due to different numbers and species of wildlife) in the various hunting areas amongst each other.

Revenue efficiency is secondly defined as the gross hunting revenue each system generates based on the total number of hunter-days supplied during the entire hunting season in each hunting area (section 5.2.2). The criterion represents the gross revenue earned for each day a hunter is allocated in the hunting resource area. The measure may be compared to the daily rate a tour operator charges clients (eg. for a canoeing trip), or to the fee the DNPWLM charges visitors for a service activity (eg. for hiking and horse riding trails).

5.2.1. Efficiency criterion: Gross revenue earned per wildlife index

The concept of measuring the efficiency of hunting revenue using a wildlife index is taken from Child, B., (1988). Its purpose is to standardize mixed hunting bags of trophy and non-trophy species. Berry (1986) used an ecologically adjusted index to equate different types of wildlife production systems to compare the efficiency of trophy hunting, non-trophy (venison) hunting and meat production.

5.2.1.1. Definition

Revenue efficiency is defined as the total gross hunting revenue (in 1991 Z$) earned per hunting area and licensing system, divided by the index value of the available wildlife quota.

5.2.1.2. Understanding the wildlife index

For rational decisions to be made by resource managers and hunters on wildlife for hunting, resource managers need a basis on which to assess efficiency, whilst hunters need detailed information on each hunt's characteristics to evaluate which combination is more valuable to them based on their personal preferences.

African wildlife in Zimbabwe has traditionally been hunted as a *hunting bag* of mixed species for a set number of hunting days. Species of wildlife include big game trophy animals that act as draw cards for hunters, as well as other species of plains game to complement the hunting bag. If efficiency of earning revenue is to be measured in terms of the total number of animals on quota as a factor limiting revenue in each hunting area, then total revenue per animal is neither comparable for hunting bags with different species, numbers, and sexes of animals, between different hunting areas, nor is it consequently comparable between different licensing systems.

Resource managers using the Wyoming single licence draw system in America do not encounter this problem of comparison, because this system allocates hunts using one licence for each animal and species.[1] Consequently, the total deer hunting revenue, for example, can be divided meaningfully by the total number of deer hunter-days, to obtain the average revenue per deer hunter per hunter-day (Crowe, 1987: 37-44).

The practical problem of comparison for resource managers of African wildlife can be illustrated using an analogy of two vendors selling fruit at a market. The first vendor elects to sell each species of fruit separately (Wyoming system) and sets a price per kilogramme for her apples, pears and oranges, for example. The second vendor decides to sell only baskets of mixed species of fruit (African system), and sets a price for her mixed fruit baskets which all contain different numbers of apples, pears, and oranges. The first vendor has no problem setting her prices for each species of fruit efficiently. She can compare her fruit

[1] See review of Wyoming lottery system, section 3.3.1, page 98.

prices per kilogramme directly with those of other vendors selling the same type of fruit. By buying each fruit separately, this vendor's customers can likewise compare her prices per kilogramme with those of other vendors. The second vendor who sells fruit baskets, however, does have a problem setting her prices efficiently for the fruit baskets if she does not know the price per kilogramme for each type of fruit in her baskets (or the cost of each per kilogramme), or what each individual fruit basket is worth to her customers. Without this information, the second vendor and her discerning customers have no comparable basis with which to assess the prices of the mixed fruit baskets.

The difficulty the second vendor has in the above analogy applies to resource managers (the vendors) analyzing sport hunting in the context of African wildlife resources. Data and the index method that are used to resolve the problem, and equate different quotas for each licensing system, are now described.

5.2.1.3. Data and methods

All citizen hunters require a hunting licence to hunt in Zimbabwe's protected areas.[1] The licence records the hunting bag (number, species and sex of the animals) and the price paid by the hunter in Zimbabwe dollars. The licences were obtained from the licensing offices of the DNPWLM in Harare, Marongora and Kariba, and from ZHA branches in Harare and Mhangura. The data for 1991 was entered and analyzed using a spreadsheet programme, with different systems being differentiated.

Hunting revenue was calculated as the quota for each hunting area valued at fixed or market prices, depending on the allocation system. Revenue from foreign hunters in foreign exchange currencies (alternatives G, H and I) is valued at official fixed exchange rates valid at the time of research (31.5.1991). These are taken from data published by the Reserve Bank of Zimbabwe (1991). Hunting revenues for each licensing system and hunting area are in Appendices 7.1, page A49 to Appendix 7.7.4, page A75. The revenue for the DNPWLM lottery system (alternatives A and B) includes ticket revenue (all priced tickets purchased by applicants to participate in the lottery) and the value of the quota at fixed prices, detailed separately in Appendix 14, page A104. Total ticket revenue (Z$43'060) was apportioned according to the ratio of hunts in these hunting areas, that is 40:60, respectively.

An *index value of the wildlife on quota* was calculated to allow hunting bags of mixed trophy and non-trophy species to be compared. The 1991 trophy prices for **foreign hunters** set by the government schedule (see Appendix 8, page A77)[2] were used as an indicator of each animal's relative value in the quota. Each species in the quota was then valued, and the index totalled for wildlife species grouped in five trophy categories: Big game, big plains game,

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[1] Parks and Wild Life Act, section 29 (a) (ii), and section 30 (a) (i).

[2] The reader is alerted to the fact that the trophy fee schedule distinguishes between prices for sport hunts sold to Zimbabwe citizen hunters, and slightly higher fixed prices for sport hunts sold to safari operators for foreign hunters.

small plains game, big other game and other game. The index is from that described by Martin (Zimbabwe Government [1991]). Individual species included in each category accompany the government trophy price schedule (see Appendix 14, page A104).

Table 5.2 shows the total indices calculated for each hunting area, differentiated according to five animal categories to indicate how each hunting area's quota composition differs.

Table 5.2 Indices of wildlife for quotas for licensing system alternatives: 1991

	ALTERNATIVE								
	A	B	C	D	E	F	G	H	I
Type of hunting	Citizen		Citizen			Citizen	Citizen/Safari		Safari
Licensing system	DNPWLM Lottery		ZHA Lottery			DNPWLM Tender	DNPWLM Auction		Safari Operator Marketing
Hunting area	CHARARA	MAKUTI	TULI	DOMA	NEFA	DANDAWA	NYAKASANGA	SAPI	CHARARA/ MAKUTI
Total index of wildlife quota:	72'657	100'560	145'225	82'800	228'046	12'000	230'153	150'470	118'525
Separate indices of wildlife quota:									
• Big Game	78%	74%	18%	68%	65%	0%	72%	59%	80%
• Big Plains Game	1%	13%	30%	23%	6%	0%	5%	10%	8%
• Small Plains Game	18%	1%	50%	8%	24%	100%	17%	26%	7%
• Big Other	1%	8%	1%	1%	0%	0%	3%	3%	5%
• Other	2%	3%	1%	1%	1%	0%	3%	2%	0%

Source: Index values for each licensing system according to hunting area in Appendix 9.1 (page A79) to Appendix 9.7.2 (page A101). For species included for each index category, see Appendix 14, page A104.

With this method, the index value of a trophy bull elephant is 7'500, a trophy buffalo 1'000, and that of a guinea fowl 5, for example. Thus a fictive hunting bag containing a trophy elephant (7'500), a trophy buffalo (1'000) and ten guinea fowl (50) has a total wildlife index value of 8'550.

To obtain the *ratio of revenue efficiency per wildlife index*, total gross hunting revenue was divided by the total wildlife index value on quota, for each hunting area and allocation system. For example, assuming that our fictive hunt sold for Z$17'100, then the gross revenue per wildlife index calculated according to the criterion is: Z$17'100 divided by 8'550, or 2.0. If this hunt were sold for less, say Z$12'000, the index of revenue efficiency would be 1.4, implying that less revenue was earned from the same animals in the standardized bag.

5.2.1.4. Results

A comparison of the revenue efficiency of alternative licensing systems, derived by using the above method, is given in Table 5.3, page 184. Pertinent results are highlighted in bold in the last line of the table. Gross revenue per wildlife index differs between lottery systems, auction systems, and safari operator marketing systems, by several orders of magnitude.

The comparison in Table 5.3 shows that:

5.2.1.4.1. All lottery systems (alternatives A, B, C, D, and E) that allocate big game to Zimbabwe citizen hunters have a revenue efficiency of about 1.0 per wildlife index, which is far lower than the corresponding revenue efficiency of auction and commercial marketing systems.

5.2.1.4.2. The efficiency of auction systems (alternatives G and H) that allocate big game to citizen and safari hunters is about five times, and that of the commercial marketing system (alternative I) is about seven times, that of lottery systems. (This result is based on fixed exchange rate values for foreign exchange currencies, not their market exchange rate values.)

5.2.1.4.3. The DNPWLM lottery system (alternatives A and B) allocates hunting resources in the Charara/Makuti study area to citizen hunters less efficiently than does the ZHA lottery systems (alternatives C and E). It is important to note, however, that a total of Z$43'060, or almost one fifth of all hunting revenue earned by the DNPWLM lottery system, stems from ticket revenue and is due to the system's **inequitable** hunt allocation procedure (see section 4.3, page 141). The procedure allowed applicants to maximize their probability of winning an option to hunt by purchasing unlimited numbers of priced tickets, and thereby maximized ticket revenue[1] for the DNPWLM.

5.2.1.4.4. The auction system (alternatives G and H) appears to be more efficient than the tender system (alternative F). However care must be taken with this interpretation. As the wildlife indices in Table 5.2 indicate, the tender system only sold bags of plains game consisting solely of impala which are less valued by sport hunters, whilst the remaining systems sold mixed bags with large proportions (60% or greater) of big game species (ie. hunts with trophy elephant, buffalo, lion and leopard) and other rarer antelope species (ie. sable, waterbuck, nyala). These are the species most valued by sport hunters.

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[1] Readers should note that although total ticket revenue may be maximized, the DNPWLM lottery system does not maximize total revenue because fixed prices were paid for all animals. An auction system would maximize total revenue, whilst at the same time making the allocation process more transparent for participants.

Table 5.3 Comparative efficiency of Zimbabwe's licensing system alternatives, in (gross) hunting revenue per wildlife index value on quota: 1991

$$\text{Efficiency of hunting revenue} = \frac{\text{Hunting revenue Z\$}}{\text{Index value of wildlife quota}}$$

	ALTERNATIVE								
	A	B	C	D	E	F	G	H	I
Type of hunting	Citizen		Citizen			Citizen	Citizen/Safari		Safari
Licensing system	DNPWLM Lottery		ZHA Lottery			DNPWLM Tender	DNPWLM Auction		Safari Operator Marketing
Hunting area	CHARARA	MAKUTI	TULI	DOMA	RIFA	DANDAWA	NYAKASANGA	SAPI	CHARARA/ MAKUTI
Hunting revenue									
Hunt value	56'482	72'085	180'857	68'800	285'976	35'560	1'027'490[a]	737'700[a]	865'550[b]
Ticket value	17'224	25'836	0	0	0	0	0	0	0
Total hunting revenue (Z$)	73'706	97'921	180'857	68'800	285'976	35'560	1'027'490	737'700	865'550
Indices of wildlife quota	72'657	100'560	145'225	82'800	228'046	12'000	230'153	150'470	118'525
Efficiency of revenue (Z$) in hunting revenue per wildlife index	**1.01**	**0.97**	**1.25**	**0.83**	**1.25**	**2.96**	**4.46**	**4.90**	**7.30**

a) Foreign hunters bid in Zimbabwe dollars, and paid in foreign exchange using the official fixed exchange rate of the day.
b) Foreign hunters pay in foreign exchange (eg. US$), which was converted using the fixed exchange rate of Z$3.07 per unit US$ (per 31.5.91).

Source: DNPWLM licensing data, 1991.

5.2.1.4.5. The DNPWLM tender system (alternative F) achieved a market price for impala that is about three times that set by the government foreign hunters for impala in the 1991 schedule (see Appendix 8, page A77).

5.2.1.4.6. The safari operator marketing system (alternative I), with a revenue efficiency of about 7.0 appears to be more efficient than the DNPWLM auction system (alternatives G and H) at allocating big game hunts of a similar quota composition (see Table 5.2) with revenue efficiencies of about 5.0. Care should be taken with this result because it refers to gross revenue, not net revenue (gross revenue minus costs of supplying the hunting services) for the DNPWLM and the safari operator, due to this chapter's macroeconomic perspective. Secondly, gross revenue for the auction system is based on what the DNPWLM as the landholding agency earned from selling the resources, but excludes gross revenue earned by Zimbabwe safari operators and agents who bought auction hunts for resale to foreign hunters. Thirdly, the results are based on fixed exchange rate values for foreign currencies, not on their market exchange rate values. (A market value for foreign exchange is estimated later in this chapter, see section 5.5, page 213.)

5.2.1.4.7. The safari operator marketing system appears to earn more for Zimbabwe by commercially marketing the Charara/Makuti sport hunting quota than any other allocation system. Reasons for this result (eg. the safari operator adds value to the quota with personal services), as well as implications of foreign exchange earnings and their economic multiplier effects for Zimbabwe are discussed in section 5.5, page 213.

5.2.1.5. Discussion of results

■ **Competition, valuation and pricing of hunt characteristics**

Market-priced allocation systems based on competition and willingness to pay maximum prices for hunting undoubtedly achieve the highest revenue efficiency per wildlife index over fix-priced lottery allocation systems which currently allocate citizen hunting in Zimbabwe.

The results presented in Table 5.3 are in no way unexpected, however, since high returns from safari hunting as a land-use are well known and documented (Child, B., 1988; Bigalke, 1986; Cumming, 1988; Anderson, n.d.). Safari operators not only attempt to achieve the highest selling price for a hunt. Being commercially oriented, they also minimize and cover their costs to maximize the net-value of their safari hunting business. Also, the purpose of auctions is to achieve the highest prices possible for the seller. Conversely, the purpose of lottery systems is to give persons equal access **based on their unwillingness to pay market prices**. By so-doing, lottery systems limit gross revenue earned from hunting outright.

Fix-priced lottery systems and market-priced tender, auction and safari marketing systems also value different hunting resources. Zimbabwe's lottery systems value only the consumptive hunting resource. Fixed trophy prices value each species in the hunting bag (the consumptive resource). Access time (the non-consumptive resource) and other characteristics associated with individual hunts remain unpriced by Zimbabwe's lottery allocation systems (alternatives A, B, C, D, and E). Tender and auction systems allow hunters to value and determine the market price of all resources associated with the hunt. In competition with other hunters, the hunt price and value is the maximum that the last hunter is willing to pay. Hunts are priced at their margin. Safari operators value the hunt differently to auctions. Although a safari operator's hunt prices are also competitive market prices, they are not the highest possible from all international clients. A safari operator's hunt price is lower than the marginal hunt price, being limited by his reputation, the cost structure of his commercial safari hunting business, any local and international competition from safari hunters, and by the services he offers the foreign hunter in addition to the actual hunting bag (eg. professional hunting or taxidermy and shipment services).

- **Influence of quota composition on results**

Does quota composition (type of species and their relative proportions in the hunting area) affect the prices achieved and the results? From Table 5.2, the quota compositions for all licensing systems (except for the DNPWLM tender system in alternative F) appear to be similar. Nevertheless, although the safari operator marketing system (alternative I) has a smaller total wildlife index than those calculated for the DNPWLM auction systems, the DNPWLM lottery system, and the ZHA lottery system (alternatives C and E), the safari operator still achieves the highest gross revenue.

The following factors can increase a safari operator's revenue:

- The way he packages the different species into hunts and sells them;
- The additional services offered to foreign hunters which "add value" to the wildlife quota, such a professional hunting services, transport;
- Charging foreign hunters for each day's hunting sold as part of the package - and not just for the trophy species the hunter shoots (kills or wounds).
- The slightly higher proportion of big game to plains game species for the safari operator marketing system (80%) compared to other alternatives (60-80%) suggest that the quota composition, that is the relationship between numbers and types of big game and plains game species, is decisive for the value achieved.

- **Influence of market participants on competition and results**

Foreign hunters and Zimbabwe safari operators acting as agents for foreign hunters who pay for hunting at the DNPWLM auction in foreign currency, but bid in Zimbabwe dollars, have greater purchasing power than Zimbabwe citizen hunters. Their participation at the auction helps to drive up prices at the auction. The DNPWLM auction is not competitive, however, because Zimbabwe safari operators and agents are each limited to purchasing a maximum of

two hunts for foreign hunters; bureaucratic regulations for auction participants to register with the DNPWLM as bidders are considerable, and costly to administer (ABC Auctions, 1991). Such regulations limit competition and prevent safari operators and the auction system from earning maximum gross revenue per index unit of wildlife they could sell, if they could sell more than two hunts to foreign hunters.

With the participation of foreign hunters (or their Zimbabwean agents) at the DNPWLM auction, this system generated between 70 and 80% of total revenue in foreign exchange currencies (see Appendix 7.7.2, page A69), whereas the allocation of similar quotas exclusively to Zimbabwe citizen hunters earns no foreign exchange currency for the Zimbabwe economy. The safari operator marketing system earns all revenue in foreign exchange, but the hunting area is only leased to a single operator which limits competition and the number of operators who have access to big game in the safari hunting industry. Big game is a limiting resource for safari operators to earn maximum revenue and to become commercially viable.

Foreign exchange revenue is of vital importance to the Zimbabwean economy for two reasons: Due to its **scarcity value** for productive sectors of the economy; and due to its **multiplier effects** for economic activity, job creation, and its consequent stimulus to earn more foreign exchange by increasing exported goods and services. Foreign exchange earnings are a national development priority of the Zimbabwe Government (Zimbabwe Government, 1991b; Zimbabwe Government, 1990c) in terms restructuring the economy, reducing the country's foreign debt, and promoting financially sustainable development (without aid grants). (The scarcity value and multiplier effects of foreign exchange compared to Zimbabwe dollar revenue are quantified in section 5.5, page 213; at this point, their importance is merely noted.)

- **Relevance of financial institutional arrangements on results**

From a macroeconomic perspective, the question of which system is most beneficial for the DNPWLM as the landholder, or for the state as the (present) receiver of revenue, is considered to be a question of second order, which cannot be discussed with data presented in Table 5.3, page 184 alone. The costs of protecting and managing the wildlife in protected areas would have to be known, and management services rendered by the ZHA, the safari operators and the DNPWLM would have to be priced. These tasks were beyond scope of this report. The institutional effects on resource allocation and secondary conservation and development benefits are discussed in section 5.4, page 208.

- **Effect on results of an equal hunt probability for the DNPWLM lottery system**

If the recommendations to equalize the probability of winning a hunt by all applicants for the DNPWLM lottery system (section 4.7.1, page 163) were adopted, what would be the effect on hunting revenue results in Table 5.3 for alternatives A and B?

By limiting each applicant and hunting party to one ticket, the DNPWLM lottery system would earn a ticket revenue of Z$4'000[1] instead of Z$43'060. Total gross revenue from hunting in the Charara/Makuti study area would be reduced by about Z$40'000. Less gross hunting revenue means that the revenue efficiency calculated for this system would be reduced from about 1.0 to 0.70 per wildlife index. **Therefore, with an equalized hunt allocation, the DNPWLM lottery system would be the least efficient of all alternatives shown in Table 5.3, page 184.** An equal DNPWLM lottery allocation system's revenue efficiency per wildlife index for the equal DNPWLM lottery system (about 0.7) would be ten times lower than that (about 7.0) for a safari operator marketing system. The difference represents a significant and relevant economic opportunity cost for decision-makers in the DNPWLM to consider, before a new lottery system aiming to be "fair", or give citizen hunters "equal access to hunting", is adopted for the Charara/Makuti study area.

- **Flexibility of auction system for market participants and the DNPWLM**

For safari operators in Zimbabwe big game trophy quotas are the scarcest resource that limit revenue (Child, B., 1988). This scarcity increases competition amongst safari operators for access to hunting areas with big game quotas. Such areas are allocated by the DNPWLM as exclusive hunting concession to single operators. This allocation method reduces the number of market participants and therefore market forces in the safari hunting industry. This fact was not pointed out by a major consultancy report[2] submitted to the DNPWLM, but it is critical to achieve a market-orientated resource allocation, because it relates to market structure, flexibility and competitiveness. Safari operators through the association representing the industry has indicated that more big game resources are required, and the DNPWLM is under pressure to renew lease agreements more often and to allocate hunting concession areas using criteria other than the highest price in order to allow new participants to enter the market (see Price Waterhouse, 1992b: Volume 4: 52-57). Such pressure is understandable, but counter to market principles and earning maximum benefits from scarce resources based on price and competition. By applying the DNPWLM auction system to the Nyakasanga and Sapi hunting areas, more participants are able to access big game resources under market conditions than would occur if the same areas were allocated as exclusive hunting concessions to a single (or a number of) safari operators. The above mentioned report, does not recognize this essential difference in market structure and the advantage of the auction system *per se* over allocating hunting areas and big game resources as single concession areas.

Contrary to this author's view, the Price Waterhouse report suggests that the DNPWLM auction system should be discontinued for Nyakasanga and Sapi hunting areas, and one hunting area should be allocated as an exclusive hunting concession area, and the other to Zimbabwe citizen hunters. How the resource allocation should be achieved is not stated.

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[1] With approximately 200 applicants in 1991, at Z$20 per ticket.

[2] See Price Waterhouse, 1992b: Volume 2: 17-27; Price Waterhouse, 1992b: Volume 4: 35-60; Appendix I.

It should also be noted that the DNPWLM does not, at present, allocate all the hunting resources associated with exclusive safari hunting concession areas in accordance with competitive market principles. Although participants tender competitively for concession areas with known hunting quotas for lease periods of up to five years (the non-consumptive hunting resource), the consumptive big game hunting quota is sold at government controlled fixed trophy prices per species to safari operators. Safari operators only pay the trophy price for the shot quota (animals killed or wounded); unshot animals on quota are not paid for, and represent an economic opportunity cost, providing the quota could have been marketed at all. Unshot quotas also represent an ecological opportunity cost if these numbers are allowed to increase, since with time such populations will have to be reduced by culling or live capture or by natural causes.

Zimbabwe citizen hunters have also indicated that big game hunts are extremely limited, as reported by Price Waterhouse: Volume 4 (1992b): 49-50 and Grobbelaar (personal communication). The ZHA would be interested in additional state land reserved exclusively for allocation to citizens. At present, such a choice appears to be an either-or-decision, and at present is taken administratively at a policy-level by the DNPWLM: An entire hunting area is allocated either to a safari operator as an exclusive hunting concession for foreign clients, or as an exclusive hunting area to Zimbabwe citizen hunters.

The DNPWLM auction system is the only alternative that allows the market forces and market prices to determine what proportion of hunting resources are "allocated" to foreign hunters and citizen hunters respectively. In 1991, 70-80% of total hunting revenue earned by the DNPWLM auction systems from Nyakasanga/Sapi hunting resources was earned from foreign hunters in foreign exchange, while the remaining 20-30% was earned from Zimbabwe citizen hunters in Zimbabwe dollars. If Zimbabwe citizen hunters do not purchase a hunt "because the foreigner outbid me", then in economic terms, there is an opportunity cost associated with enforcing an allocation other than the one the auction produces by market forces. These opportunity costs consist of forgone foreign exchange revenue and economic multiplier effects (see the results of the market-valued foreign exchange rate in section 5.5, page 213).

An advantage of the auction system over the exclusive lease option, is that if one safari operator is given an exclusive hunting and access rights to a particular area, there are fewer market participants and competition is not enhanced.

- **Influence of fixed exchange rates on value of hunting revenue**

As pointed out in this chapter's assumptions, the exchange rates used in Table 5.3 are controlled, not market prices (see section 5.5, page 213 for the market-valued exchange rate).

■ **Safari operator revenue is not a maximum**

The estimated amount of Z$865'000 as gross safari operator revenue does not include additional revenue that could achieve by the safari operator, if he sold the remaining animals on quota for the Charara/Makuti hunting areas, nor does it include additional revenue obtainable from combining the predominantly big game buffalo quota in Charara/Makuti with additional plains game on private or other land in Zimbabwe which increases the quota's market value. Such opportunities do exist for increasing the safari operator revenue which is based on a packaging only the Charara/Makuti quota into a number quality big game trophy hunts (see Appendix 16, page A109).

5.2.1.6. Initial conclusions

The following conclusions may be drawn from findings in Table 5.2:

5.2.1.6.1. In terms of gross revenue relative to an index value of the wildlife quota, the efficiency of lotteries, auctions and commercial marketing allocation systems can be summarized as follows:

Licensing System	Relative
Lotteries	~ 1.0
Auctions	~ 5.0
Commercial Marketing	~ 7.0

5.2.1.6.2. Zimbabwe citizen hunters are heavily subsidized in relation to market prices, by a factor of between 5 and 7, with foreign exchange revenue valued at fixed exchange rates.

5.2.1.6.3. Zimbabwe citizen hunters are probably subsidized by a factor of greater than 7 if foreign currency revenue is valued at market exchange rates. (Foreign exchange is valued at market rates in section 5.5, page 213.)

5.2.1.6.4. In relation to the present allocation system, the subsidy of citizen hunters in Charara/Makuti would be exacerbated if the DNPWLM adopted a lottery system aimed at equalizing hunt allocation in accordance with the recommendations made in Chapter 4 (1 ticket per person). Revenue would decrease by at about Z$40'000, per year. Zimbabwe citizen hunters would then be subsidized by a factor of 10, in relation to market prices, with foreign exchange valued at fixed exchange rates.

5.2.1.6.5. The present policy of allocating Charara/Makuti's sport hunting resources to citizen hunters represents an initial amount of about Z$865'000 in foreign exchange (valued at fixed exchange rates) that is lost. Additional losses include unquantified foreign exchange revenue to other sectors of Zimbabwe for

services such as air fares, hotels, taxidermy and shipping services, and unquantified losses of economic activity from multiplier effects for Zimbabwe, such as jobs, income and sales tax revenue to the Zimbabwe Government.

5.2.1.6.6. The DNPWLM tender system supplies citizen hunters with plains game hunting that is three times ($175) the government controlled price set for impala (Z$50-75) for foreign hunters.

Based on these conclusions alone, the policy question to be addressed by decision-makers in the DNPWLM and Zimbabwe Government can be formulated economically: Are the benefits of allocating big game hunting in Charara/Makuti exclusively to citizen hunters worth, at the very minimum, Z$865'000 in foregone foreign exchange revenue?

5.2.2. Efficiency criterion: Gross revenue earned per hunter-day

The purpose of this section is to assess the revenue efficiency of each alternative in terms of the resource of the time available to hunters in the hunting area. Sport hunting is seen as only one of many ways of using the wilderness qualities of Zimbabwe's protected areas during any year. If access time (standardized using hunter-days) rather than the trophy quota (standardized using the wildlife index in the previous section) is used as a basis for comparison, how efficient are the alternative systems at allocating hunting? Does the gross revenue earned from every hunter for every day he has access **and** hunting rights to the hunting area match the gross revenue that a safari operator could earn per person per day (the daily rate charged per tourist) for non-hunting tourist activities in otherwise similar natural resource areas?

5.2.2.1. Definition

Efficiency per hunter-day is defined as the total gross hunting revenue (in 1991 Z$) earned per hunting area and licensing system, divided by the number of hunter-days available to hunters.

Hunter-days standardize different numbers of hunts per hunting area and wildlife quota, each with varying numbers of hunters per hunt (2 or 4 hunters), varying hunt durations (ranging from 6-12 days for citizen hunting, and 10-14 days for citizen/safari hunting, and extending to 21 days for safari hunting). Child, B., (1988) uses the concept of efficiency per hunter-day in his analysis of Zimbabwe's safari hunting industry. A similar concept is used by resource managers to plan the Wyoming lottery system (Crowe, 1987).

If, for example, the gross revenue efficiency of an allocation system should be calculated as Z$100 per hunter-day, what does this figure mean? This figure would be the daily rate paid by the hunter for the privileges of accessing and hunting - the total value charged by resource managers for the wildlife experience. It includes the trophy benefits, venison benefits (the

consumptive value of the hunt) and the recreational benefits (the non-consumptive value of the hunt).

5.2.2.2. Understanding the criterion

Hunting revenue is related to access time as the second important scarce resource that is part of every hunt, although the resource has not been treated by decision-makers as an economic (ie. scarce) on for Zimbabwe's licensing systems to date. Access time is not explicitly priced for sport hunting in Zimbabwe (except by safari operators), so that access to protected areas has tended to be under-valued, and thus under-priced. This situation has been known for some time, and is documented for the aspect of tourism by Child and Heath (1990) in their article "Underselling National Parks in Zimbabwe". Price Waterhouse, (1992b): Volume 2: 5, cite a cost comparison of entry fees to Zimbabwe's protected areas with those of other African countries, confirming that in Zimbabwe access is the cheapest.[1] Why is access time in protected areas a scarce resource, and why should access time be priced explicitly for sport hunting?

"A hunt" thus gives hunters the right to actually use two resources at once:

- First, the right to access the hunting area for a specific period of time (the non-consumptive resource);
- Second, the right to hunt a defined hunting bag of animals (the consumptive resource).

The hunter's right to use both these resources also benefits the members of his hunting party. With the DNPWLM allowing up to thirty persons in the hunting camp at any point in time (Zvinongoza, personal communication), significant numbers of non-hunters do actually accompany hunters on their hunting trip for a holiday (see non-hunting members of the ZHA, Table 3.7, page 80). Part of the recreational value (for the hunter) of a hunting trip is due to the fact that family and friends can share in, and benefit from, the access time a hunter purchases as part of his hunt.

Readers should note, that the issue is not whether hunters actually pay a price for access time, or whether hunters personally explicitly value the time period they purchase as part of their hunt, or indeed whether hunters perceive the hunt price to be for the time period, the trophy, or the venison. **Revenue per hunter per day concerns the opportunity cost of using the hunting season and the hunting area for sport hunting, rather than for any other activity.**

The scarcity and economic value of total access time spent hunters on hunting trips can be understood in a number of ways. With the hunting season divided into a number of hunts with fixed hunting periods, the DNPWLM allocates 2 days between each hunt, termed *slack*

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[1] In Z$ for four adults per car, entry costs are: Botswana 104; Tanzania 90; Kenya 34; South Africa 24; Malawi 7; and Zimbabwe 5.

time. For any given hunting season and given species' quotas, this allotment of the hunting season means that:

- With longer hunt durations per hunt, fewer hunts and consequently fewer hunters can access the hunting area per season;
- With shorter hunt durations per hunt, more hunts can be supplied to more hunters per season, but proportionately more time is spent unproductively between the hunts (total slack time);
- With shorter hunt durations per hunt, more hunting parties and more hunters will enter the hunting area at any one time, increasing hunting pressure and the possibility of shooting accidents; the maximal hunter density (eg. hunters per km^2), and consequently maximal number of hunter-days per hunting area and hunting season, are limited (No research is available on this point for African environments.);
- With more, shorter, hunts in any hunting area and season, the turn-around rate (number of hunting parties per hunting camp during the season) is higher, which increases the DNPWLM personnel required to accompany each hunting party in the hunting area. Due to severe DNPWLM budget constraints, available personnel on the ground in hunting areas (trackers or game scouts) are a **key limitation** for providing hunting opportunities in a hunting area.
- During the time DNPWLM personnel accompany and control sport hunters, **these trackers and game scouts are not available for other duties during the hunting period, particularly for anti-poaching patrols to protect endangered species (eg. black rhinoceros and elephant) in protected areas.** Financial and human resources for protection are stretched to the limit, and thus compete directly with DNPWLM personnel made available to accompany hunting parties for citizen or safari hunting.[1]
- The alternative to using a hunting area for sport hunting activities during the hunting season (climatically, the most attractive time to visit the Zambezi valley), is to use it for recreational activities. In this case a safari operator and the DNPWLM would limit the use to a carrying capacity of X persons per day in any area. The opportunity cost of using the hunting season then the difference in economic value between revenue from non-hunting and hunting options in that area.
- Finally, gross revenue per hunter-day can also be seen from the hunter's perspective as his cost of purchasing the hunt for the hunting benefit, per day. This cost represents each hunter's daily budget for the hunt (excluding the cost of transport, food, and ammunition).

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[1] During the field trip to the Charara/Makuti study area in August 1991, DNPWLM Wardens (park managers) for these areas at Kariba and Marongora emphasized that at that time, they could not offer additional hunts or guided hiking trails in these areas because protection of endangered species had priority (Gapara and Zvinongoza, personal communications). The threat to endangered species in the entire Zambezi Valley protected areas has increased, reducing the population of black rhinoceroses to critically low levels in Zimbabwe, down from 2'000 previously estimated animals to 400 known animals (Figures given by M. Kock at a conference attended by the author (Kock, 1993). Budget constraints of the DNPWLM do not allow personnel for protection to be increased.

5.2.2.3. Data and methods

Data and methods used to calculate the *total hunting revenue* for each Zimbabwe licensing system alternative are identical to those used for the revenue efficiency per wildlife index (see 5.2.1.3, page 181).

This analysis assumes that the full complement of hunters and co-hunters allowed per hunting party actually went hunting for each licensing system.

The number of *hunter-days* for each alternative is calculated according to the formula:

Hunter-days	=	No. Hunts per hunting area	x	No. Hunters per hunt	x	No. Hunting days permitted per hunt

Applying the formula to calculate the hunter-days in the ZHA lottery system for Tuli hunting area (alternative C), for example, the formula produces:

1'144 Hunter-days	=	26	x	4	x	11

For alternatives with more than one hunt duration, (eg. alternatives G and H had 10-day and 14-day hunts), hunter-days were calculated separately for each period, and then totalled. Details of hunter-days calculated for each licensing system alternative are included in Appendix 10, page A103.

5.2.2.4. Results

A comparison of the revenue efficiency of alternative licensing systems, derived by using the above method, are in Table 5.4, page 196. Pertinent results are highlighted in bold in the last line of the table. Gross revenue per hunter-day differs by several orders of magnitude between lottery systems, auction systems, and safari operator marketing systems. The comparison in Table 5.4 shows that:

5.2.2.4.1. All lottery systems (alternatives A, B, C, D, and E) have a revenue efficiency of about Z$150 per hunter-day, which is far lower than the corresponding revenue efficiency of the auction and marketing systems.

5.2.2.4.2. Of the systems allocating citizen hunting, the ZHA lottery systems for Tuli and Rifa hunting areas (alternatives C and E) are the most efficient, due to the extra levy members are charged per trophy species (20-70% in 1991) on top of the government controlled price per species for local hunters. No levy was charged for trophy elephant in 1991 by the ZHA lottery system for Doma (alternative D), due to poor trophy quality, which explains why the result is lower in alternative D than for alternatives C and E (on levy, see review of ZHA lottery system, section 3.2.2, page 71).

5.2.2.4.3. The DNPWLM tender system for Dandawa impala hunts appears to be the least efficient system at allocating the resource of access time. Citizen hunters who purchased a DNPWLM Dandawa impala hunt had the cheapest access to a protected area and to a prime campsite located on the Zambezi river, paying an average value of Z$74 per person per day. As mentioned previously (conclusion 5.2.1.4.4), care must be taken with this result because all other licensing systems allocated at least 70% big game, whereas the DNPWLM tender system for Dandawa impala hunts comprised only plains game, a species less valued by trophy hunters.

5.2.2.4.4. The efficiency of auction systems (alternatives G and H) is about Z$1'000 per hunter-day, or more than six times that of other systems. That of commercial marketing systems (alternative I) is about Z$1'900 per hunter-day, or more than 12 times that of lottery systems. The result is based on fixed exchange rates for foreign exchange currencies, not their higher market exchange rates.

5.2.2.4.5. The safari operator marketing system (Alternative I) earned almost twice as much revenue per hunter-day as the auction system (alternatives G and H). It allocates access time and space twice as efficiently as auction systems.

5.2.2.4.6. The safari operator marketing system appears to earn more for Zimbabwe in gross revenue and foreign exchange by marketing the sport hunting quota in Charara/Makuti commercially than any other allocation system. Reasons for this result (eg. the safari operator adds value to the quota with personal services), as well as further foreign exchange and economic multiplier effects of this system are discussed later in the chapter in section 5.5, page 213.

5.2.2.4.7. The DNPWLM lottery system (alternatives A and B) allocates hunting resources in the Charara/Makuti study area less efficiently than the ZHA lottery system (alternatives C and E). It is important to note, however, that a total of Z$43'060, or almost one fifth of all hunting revenue earned by the DNPWLM lottery system, stems from ticket revenue and is a due to the system's **inequitable** hunt allocation procedure (see section 4.3, page 141). The unequal DNPWLM lottery hunt allocation procedure allows applicants to maximize their probability of winning an option to hunt by purchasing unlimited numbers of priced tickets, and thereby to maximize ticket revenue collected by the DNPWLM.

Table 5.4 Comparative efficiency to Zimbabwe's economy of licensing system alternatives, in (gross) hunting revenue per hunter-day: 1991

$$\text{Efficiency of hunting revenue} = \frac{\text{Hunting revenue Z\$}}{\text{Hunter-days}}$$

	ALTERNATIVE								
	A	B	C	D	E	F	G	H	I
Type of hunting	Citizen		Citizen			Citizen	Citizen/Safari		Safari
Licensing system	DNPWLM Lottery		ZHA Lottery			DNPWLM Tender	DNPWLM Auction		Safari Operator Marketing
Hunting area	CHARARA	MAKUTI	TULI	DOMA	RIFA	DANDAWA	NYAKASANGA	SAPI	CHARARA/ MAKUTI
Hunting revenue									
Hunt value	56'482	72'085	180'857	68'800	285'976	35'560	1'027'490	737'700	865'550
Ticket value	17'224	25'836							
Total hunting revenue (Z$)	73'706	97'921	180'857	68'800	285'976	35'560	1'027'490[a]	737'700[a]	865'550[b]
Hunter-days	480	720	1'144	480	1'716	480	984	744	460
Efficiency of revenue (Z$) in hunting revenue per hunter-day	**154**	**135**	**158**	**143**	**167**	**74**	**1'044**	**992**	**1'882**

a) Foreign hunters bid in Zimbabwe dollars, and paid in foreign exchange using the official fixed exchange rate of the day.
b) Foreign hunters pay in foreign exchange (eg. US$), which was converted using the fixed exchange rate of Z$3.07 per unit US$ (per 31.5.91).

Source: DNPWLM licensing data, 1991.

5.2.2.5. Discussion of results[1]

Results show that market-priced allocation systems achieve revenue efficiencies per hunter-day that are several orders of magnitude larger than those achieved by fix-priced lottery allocation systems with which the DNPWLM and the ZHA allocate big game citizen hunting in Zimbabwe. A number of questions will be discussed that influence these results.

- **Influence of quota composition and quota packaging into hunts**

In using the criterion of revenue per hunter-day, the analysis assumes that there is a direct relationship between the price hunter's are prepared to pay and the length of the hunt, ie. between hunting revenue and the total number of hunter-days offered by a certain quota.

It may be argued, that sport hunting revenue is not limited by the number of hunter-days supplied by any licensing system, but rather by the wildlife species' quota available in any hunting area. The question arises, whether hunting revenue could increased by offering more hunter-days? To offer more hunter-days, given species' quotas and hunting season in a particular hunting area would have to be allocated to hunts in the following ways:

a) By lengthening the hunt duration per hunt, but keeping hunts and hunters per hunt constant;
b) By packaging the species' quotas into more hunts, but keeping the hunt duration and hunters per hunt constant;
c) By increasing the number of hunters per hunt (hunting party), keeping hunts and hunt durations per hunt constant.

Safari operators package and price their hunts by starting with the longest hunt durations, and charging hunters the highest daily rate for this type of hunts. An example serves to illustrate that with different packaging of the same species quota, retaining the same number of hunter-days, revenue can be increased using the safari operator method: Assume a quota of 10 buffalo is packaged first to offer long hunts (say ten 10-day single buffalo hunts) to a number of hunters (say X hunters). Then package the same buffalo, but offering short hunts (say ten 5-day single buffalo hunts) to more hunters (say 2x hunters). It follows, that 200 hunter-days are generated by the first packaging method (10 x 10 x 2 = 200 hunter-days), and the second packaging method generates the same number (10 x 5 x 4 = 200 hunter-days). However, long hunts each fetch higher prices per hunter-day. Therefore, with longer hunts the safari operator earns more revenue selling longer hunts than by selling shorter hunts, for the same number of hunter-days; this increases his revenue efficiency per hunter-day.

- **Does access time influence hunter's trophy quality and hunting revenue?**

Applied to a foreign safari hunting client of a commercial safari operator, it may be argued that the foreign hunter's aim is not to have a longer hunt, but to have enough time to secure a quality trophy. A relevant question that cannot be answered in this dissertation concerns

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[1] The critical review and comments made by B. Child on this section are gratefully acknowledged.

the definition of "trophy quality": Is the trophy quality that safari hunting clients pursue defined as the species of animal secured (eg. buffalo rather than kudu species), or as the quality of the actual trophy (eg. an outstanding set of 24-inch rather than an average set of 16-inch buffalo horns)?

If hunt durations were increased, would hunters pay more for a hunt? Conversely, if hunt durations were decreased, would hunters necessarily pay less for a hunt if they still obtained a quality trophy? In other words, what is the optimal time that should be allocated to each hunt? This question is answered next.

- **Do hunters value time?**

Do hunters actually want longer hunt durations to hunt? This question can be answered in the affirmative, for several reasons: The longer the hunting period, the more time hunters have to stalk and search for a quality trophy animal, rather than shooting the first low or average quality trophy animal they encounter. With more time, hunters can afford to be more selective in their hunting behaviour. This result has ecological implications for resource managers who plan trophy quotas. Obviously, a positive correlation of greater search time and trophy quality depends on the type of hunter, his personal motives, preferences and hunting ethics.

Secondly, time spent stalking is also a valuable hunting experience for the hunter, since a hunt's value to the hunter should be viewed holistically, and not based solely on the motive to kill an animal. Loomis (1992) presents empirical data showing that sport hunters do value time, and value it in addition to the actual hunting bag. He reports that few authors have taken this fact into account when attempting to model and quantify demand for hunting.

Thirdly, time spent by hunters in the hunting area is valuable purely for the access and opportunity to enjoy the hunting area in the company of other members in the hunting party.

Therefore, one can reasonably expect a hunter to value the amount of time each hunter can spend in the hunting area. Similarly, resource managers should price access time (the hunting season) as a scarce resource.

- **How would an equal DNPWLM lottery system affect the results?**

By limiting total gross revenue earned from the species quota using an equal hunt allocation by lottery, Z$40'000 would be foregone in ticket revenue for the Charara/Makuti study area. Less hunting revenue means that the revenue efficiency of this system would be reduced from about Z$140 to Z$100 per hunter-day for the study area.[1] **Therefore, if hunt allocation was equalized, the DNPWLM lottery system would be the least efficient at earning revenue per unit access time of all licensing system alternatives in Table 5.4, page 196.** Revenue

[1] Calculated for alternatives A and B in Table 5.4, page 196, as follows: Total hunt values (56'482 + 72'085), divided by total hunter-days (480 + 720), equalling an average of Z$107 per hunter-day.

efficiency per hunter-day for the DNPWLM lottery system (Z$100) would then be 19 times lower than that for a safari operator marketing system (Z$1'900). (The same tendency was noted for the previous efficiency measure.)

- **Can fewer hunter-days generate more hunting revenue?**

Compare the safari operator system of packaging hunts and pricing hunting resources with the DNPWLM lottery system for the quota in Charara/Makuti. The safari operator marketing system generates more hunting revenue from fewer hunter-days in total, compared to the DNPWLM lottery system. This conclusion suggests that hunts could be packaged differently, using less of the hunting season, yet making more revenue. How is this possible?

The following example illustrates how adding time to a hunt would raise gross revenue earned by the safari operator. If a trophy buffalo could be sold either as part of a 15-day hunting package at US$800 per day or as part of a shorter 5-day or 10-day hunting package at US$500 per day, the safari operator can earn more revenue using the first option; The importance of packaging an area's species quotas to make the most of the wildlife resource (efficiency) is evident.

- **What if the foreign hunter doesn't use all of the hunter-days?**

Hunting revenue for the safari operator is not reduced if safari hunting clients secure their trophies in less than the full hunt duration of, say, 21-hunting days, because the safari hunter still pays the daily rate for the full 21-days.

For Zimbabwe, even though foreign hunting clients do not always make full use of the hunting period (eg. 21-days for an African big game safari hunt), and often secure their trophies within a shorter time period (Child, B., personal communication), foreign hunters still pay the safari operator the agreed daily rate for the full time period. Thus, time is priced and valuable.

If safari operators and foreign hunters do not make use of the full 21-days actual access time because they frequently secure prime trophy species in a shorter time period (Child, B., personal communication), and this implies that shorter 10-day or 14-day hunts may be perfectly adequate for safari operators to market a full 21-day big game hunt. The fact that safari operators and agents for foreign hunters have participated successfully in the DNPWLM auctions of Nyakasanga and Sapi hunting areas since 1986 tends to support this conclusion. It is credible, because the onus is on the safari operator to ensure that his foreign hunting client secures a quality trophy.

The auction system thus makes it possible for many safari operators to secure prime big game trophy hunting and access time and increase the value of the hunting package when it is sold to a foreign client. By auctioning hunts in a hunting area to many safari operators, the auction system has the added advantage of increasing the number of participants in the safari hunting

industry and being market conform, over leasing the area on an exclusive basis to only one safari operator. Competition in the safari hunting industry and efficiency is thus promoted.

- **How does revenue per hunter-day compare with daily-rates from recreational land-use?**

If land-use in Zimbabwe's protected areas was determined rationally according to economic criteria (as it is on all other land categories in Zimbabwe), then based on the concept of opportunity cost, the gross revenue amount earned per hunter-day from sport hunting should exceed the amount that could be earned from non-consumptive uses such as tourism per visitor-day. If not, then the absolute difference in revenue from citizen hunting and recreational activities represents an economic opportunity cost to Zimbabwe of using the hunting season and hunting area for sport hunting.

Gross revenue per hunter-day from citizen hunting in Charara/Makuti may be compared with the following figures quoted by other authors for recreational revenue per visitor per day. (The data is indicative, and not comprehensive.)

The following figures are based on information supplied by a long-standing Zimbabwe safari operator (Thompson, personal communication). Average market prices for wilderness trails charged by Zimbabwe safari operators in 1992 were:

Table 5.5 Comparative values for recreational access

Value of possible recreational activities by a Safari operator	Z$ per person-day
Z$300 per person per day for Zimbabwe citizens	Z$300
Rand200-250 per person per day for South African visitors	about Z$400-500
US$200 - 300 per person per day for other (non-South African) visitors	about Z$600-900
Value of present Citizen Hunting activities by DNPWLM	
Citizen hunting allocated by DNPWLM lottery system	Z$140

Source: Thompson, personal communications, 11.11.1991.

As mentioned above, several authors confirm that the rates charged by the DNPWLM for tourist entry to protected areas are the lowest in southern Africa (Child and Heath, 1990). Price Waterhouse, 1992b: Volume 2: 5 quote comparative data supporting this fact. In conclusion for Charara/Makuti hunting areas, the economic opportunity cost appears to be large, amounting to at least twice the revenue that could be earned per person if 100 non-consumptive hiking trails were organised at 2 persons per hiking party in the same period.

The revenue efficiency per hunter-day for a hunting area could also be increased by reducing physical area available for hunting by zoning certain areas for non-hunting activities. Total revenue from multiple land-use activities would then be correspondingly higher.

- **Auction prices allow hunters to value and price qualitative differences**

The difference in revenue per hunter-day between alternatives could also be attributed to qualitative differences between hunts offered in different hunting areas. Qualitative differences in hunts due to the varying species quota compositions do not account for revenue efficiency differences, as previously shown for efficiency with the wildlife index (see section 5.2.1).

Therefore, qualitative differences may well stem from another source, namely the additional services offered to hunters with the hunt under various allocation systems. The safari operator marketing system (alternative I), in particular, offers foreign hunters personalized services that add value to the hunt and wildlife resource. These services include professional hunting services, luxury accommodation and transport for foreign hunting clients.

Only competitive market-priced allocation systems (alternatives G, H, and I) allow qualitative differences between hunts to be explicitly, and personally, valued and priced by hunters. Each hunter's willingness to pay defines the hunt value. Fix-priced allocation systems cannot value or price qualitative differences. Indeed fix-priced lottery systems in Zimbabwe (alternatives A, B, C, D, E) only price the consumptive resource, that is the animals in the hunting bag, using the government controlled trophy fee per species. As a result, access time and other hunt characteristics (eg. location) remain unpriced, and the hunt and hunting resources are thus under-valued. Fixed prices are set by administrators, not by hunters. Hunters could personally determine the value of the hunting resources and benefits they enjoy more accurately. In addition, fix-priced lottery systems themselves reduces the value of a hunt **by reducing the certainty with which each applicant can obtain the hunting benefits** (probability of being drawn in the lottery). Those lucky winners drawn in a lottery benefit, because they pay much less in the end for the hunt than they would pay, if the price was kept flexible.[1]

[1] In economic theory, the difference between the actual price someone pays for something and a higher price they would be prepared to pay is called the "consumer surplus" (Samuelson, 1973).

5.2.2.6. Initial conclusions

5.2.2.6.1. The present DNPWLM lottery system in the Charara/Makuti allocates the hunting resource of access time for hunters in the least efficient manner of all the available alternatives. Revenue efficiency per hunter-day for the alternatives can be summarized as follows:

Licensing System	Absolute	Relative
DNPWLM Lottery	≈ Z$140	1.0
ZHA Lottery	≈ Z$160	1.1
Auctions	≈ Z$1'000	7.1
Commercial Marketing	≈ Z$1'900	13.5

5.2.2.6.2. Daily rates that safari operators could earn from recreational uses of Charara/Makuti exceed the present revenue earned from citizen hunting of Z$140 per hunter-day between 2 and 4 times (US$200 = Z$600 per person per day).

5.2.2.6.3. Zimbabwe citizen hunters are heavily subsidized in terms of gross revenue earned for every hunter and day supplied by the DNPWLM in Charara/Makuti study area.

5.2.2.6.4. Access time to hunting areas (hunter-days) is explicitly priced only by the safari operator marketing system (alternative I). It is priced as part of the entire hunt when allocated by the tender (alternative F) and auction systems (alternatives G and H). All lottery systems allocating citizen hunting in Zimbabwe price only the consumptive hunting resource (hunting bag); **the non-consumptive hunting resource (access time in hunter-days) is thus not explicitly valued, and the hunt is under-valued and under-priced by fix-priced lottery systems, although time is an important and valuable part of the hunt for all hunters.** (Compare the Ciskei first-come-first-served system, section 3.3.3, page 107, where hunters pay separately for a hunt's species quota and access time.)

5.2.2.6.5. The DNPWLM tender system provides citizen hunters with the cheapest access to protected areas, of all hunt allocation systems. In one instance, citizen hunters were paid an average of Z$74 per person per day for non-hunting access and a campsite with Zambezi river frontage in a protected area (Nyakasanga section).

5.2.2.6.6. Safari operators who purchase a big game hunt at the auction can successfully use shorter hunting periods to improve revenue efficiency by selling a full 21-day big game hunt to foreign hunters.

5.2.2.6.7. Zoning the Charara/Makuti area for multiple land-use could increase the revenue efficiency of the allocation system for sport hunting and allow non-consumptive tourist activities to take place concurrently with sport hunting activities. Such integrated land-use management can be found in the Pilanesberg National Park, Boputhatswana (see Brett, 1989; Boonzaaier, *et al.*, (1983); Pilanesberg National Park (n.d.)). The Mkuzi Game Reserve, South Africa also closely integrates hunting and non-hunting uses of the parks resources (see review, Chapter 3, section 3.3.2, page 104).

5.2.2.6.8. A competitive auction system: allows more safari operators to have access to big game hunting resources; enables more sport hunters to personally participate in correctly valuing the available hunting resources; achieves maximum revenue for the DNPWLM as the resource management agency.

5.2.2.6.9. Auctions are more efficient than lotteries at resource allocation; they conform to market principles.

5.3. Social costs of resource allocation

The criterion of equality in this chapter is defined in terms of the number of people that benefit from access to the wildlife resource area due to the hunting activities. People benefit from hunting, non-hunting, and educational activities.

5.3.1. Equality criterion: Recreation-days accessed per gross revenue-$

The equality indicator is measured as recreation-days divided by the gross hunting revenue in Z$.

5.3.2. Understanding the criterion

The three significant groups of people that benefit from the hunting activities in Zimbabwe's protected areas are:

- **Hunters** (hunters and co-hunters in the hunting party), included as hunter-days;
- Non-hunting **visitors** who accompany hunters in the hunting party (family and friends), included as visitor-days;
- **School children and teachers** who take part in environmental education programmes in two areas, included as pupil-days.

The sum of hunter-days, visitor-days and pupil-days is termed *recreation-days*, and measures the benefits people have who use any protected area during a year. Access for non-consumptive purposes (at the moment) relies on the revenue generated from the consumptive sport hunting activities in the wildlife resource area being invested in real, tangible conservation benefits for additional park visitors.

For example, how would the equality measure be affected if gross hunting revenue increased (eg. by replacing the lottery for an auction system), but the hunter recreation-days remained the same for that hunting area? By increasing revenue in the criterion's denominator, the equality ratio would be decreased, unless some of the hunting revenue was invested to enable a greater number of people (non-hunters) to access the hunting area. The criterion is limited in its interpretation, because the costs of producing the additional benefits are not taken into account. Ideally, the ratio of recreation-days per gross revenue dollar earned in a hunting area should rather be the ratio of recreation-days per unit profit (net-benefit). The criterion is also limited because it does not measure indirect benefits of such multiplier effects as indirect spending, job creation, tax income for government, for people who do not enjoy the protected area benefits directly through personal access.

5.3.3. Data and methods

For data and methods on *hunter-days*, see section 5.2.2, page 191, on the efficiency of revenue per hunter-day. For details on the calculation of hunter-days, see Appendix 10, page A103.

The total number of *visitor-days* is similarly calculated according to the formula:

Visitor-days	=	No. Hunters per hunting season	x	No. Visitors per hunter	x	No. Hunting days permitted per hunt	x	50%

Visitor-days are calculated assuming that on average, visitors stayed only half as long as hunters in the hunting area (see assumption 5.1.1.4, page 177). Applying the formula to calculate hunter-days in the ZHA lottery system for Tuli hunting area (alternative C), for example, produces:

1'716 Visitor-days	=	104	x	3.0	x	11	x	50%

Details on the calculation of visitor-days and visitor/hunter ratios for each licensing system alternative are included in Appendices 11 and 12, on pages A103 and A104, respectively.

The total number of *pupil-days* for Doma and Rifa hunting areas (alternatives D and E) was calculated according to the formula:

Pupil-days	=	No. Educational Camps per year	x	No. pupils per camp	x	No. educational days per pupil

and substituting values for Rifa education camp, the formula produces:

1'620 Pupil-days	=	9	x	30	x	6

The first education facility is located in Rifa hunting area and financed by revenue from hunting in that area. The second facility is located in a non-hunting section of Charara Safari

Area, but is financed by revenue from hunting in the Doma hunting area. These pupil-days are thus attributed to the Doma hunting area, and not to the Charara hunting area. Details of pupil-days calculated for Doma and Rifa education facilities are included in Appendix 13, page A104.

Data and methods of calculating *hunting revenue* for all alternatives are identical to those used for revenue efficiency (see section 5.2.1.3, page 181).

5.3.4. Results

The visitor-intensity of hunting revenue for each alternative, calculated with this method, is summarized in Table 5.6, page 206. The ratio of recreation-days per Z$ revenue was multiplied by a factor of 1'000 for all alternatives, and rounded to the nearest whole number.[1]

The comparison in Table 5.6 shows that:

5.3.4.1. Of the **citizen hunting** licensing systems, the ZHA lottery systems in Doma and Rifa (alternatives C and E) benefit the most people directly as a result of educational programmes for school pupils and teachers funded by hunting revenue.

5.3.4.2. Most people benefitted from the ZHA lottery system for Doma and Rifa hunting areas where revenue was limited by fixed prices, not from the auction systems (alternatives G and H) or marketing systems (alternative I) where revenue was far greater due to market prices. This surprising result is due to the revenue invested by the ZHA in educational programmes.

5.3.4.3. The ZHA lottery system for Doma and Rifa (alternatives C and E) is about 4 times more equitable than the DNPWLM lottery system (alternatives A and B), about 20 times more equitable than the DNPWLM auction system (alternatives G and H), and about 40 times more equitable than the safari operator marketing system (alternative I).

5.3.4.4. The equality of the DNPWLM tender system in Dandawa (alternative F) is comparable to the ZHA lottery system in Rifa, ie. a large number of people benefit relative to the revenue earned.

5.3.4.5. The DNPWLM lottery system for Charara/Makuti (alternatives A and B) is the least equitable of all citizen hunting allocation systems. On average, Charara/Makuti supplies only half as many recreation-days for every dollar revenue earned from citizen hunters; no additional persons benefit directly from the hunting revenue.

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[1] This does not alter the comparative use of the measurement, when alternatives are compared. The multiplication with 1'000 allows visual comparisons of whole numbers, rather than decimal numbers, to be made more easily.

Table 5.6 Comparative equality of Zimbabwe's licensing system alternatives, in 1'000 recreation-days accessed per Z$ hunting revenue: 1991

$$\text{Equality of revenue} = \frac{\text{Recreation-days}}{\text{Hunting revenue Z\$}}$$

	ALTERNATIVE								
	A	B	C	D	E	F	G	H	I
Type of hunting	Citizen		Citizen			Citizen	Citizen/Safari		Safari
Licensing system	DNPWLM Lottery		ZHA Lottery			DNPWLM Tender	DNPWLM Auction		Safari Operator Marketing
Hunting area	CHARARA	MAKUTI	TULI	DOMA	RIFA	DANDAWA	NYAKASANGA	SAPI	CHARARA/ MAKUTI
Recreation-days									
Hunter-days	480	720	1'144	480	1'716	480	984	744	460
Visitor-days	240	360	1'716	720	3'089	240	1'372	1'116	230
Pupil-days	0	0	0	1'500	1'620	0	0	0	0
Total recreation-days	720	1'080	2'860	2'700	6'425	720	2'356	1'860	690
Hunting revenue (Z$)									
Hunting revenue from Zimbabweans	56'482	72'085	180'857	68'800	285'976	35'560	199'435	224'300	0
Ticket revenue from Zimbabweans	17'224	25'836	0	0	0	0	0	0	0
Hunting revenue from foreigners	0	0	0	0	0	0	828'055	513'400	865'550
Total hunting revenue (Z$)	73'706	97'921	180'857	68'800	285'976	35'560	1'027'490[a]	737'700[a]	865'550[b]
Equality of revenue (Z$) in 1000 recreation-days per hunting revenue[c]	10	11	16	39	22	20	2	3	1

a) Foreign hunters bid in Zimbabwe dollars, and paid in foreign exchange using the official fixed exchange rate of the day.
b) Foreign hunters pay in foreign exchange (eg. US$), which was converted using the fixed exchange rate of Z$3.07 per unit US$ (per 31.5.91).
c) Equality of hunting revenue was multiplied by a factor of 1000 to obtain whole numbers, rather than decimals, for comparative purposes. The result was rounded to the nearest whole number.

Source: DNPWLM licensing data, 1991.

5.3.5. Discussion of results

Equality of recreation-days was the indicator used here to compare licensing systems with different types of benefits (hunting, recreational and educational) and pricing systems (fix-priced and market-priced) for hunting resources. Despite hunters paying higher prices for hunts in Tuli/Doma/Rifa hunting areas (alternatives C, D and E) than for hunts in the Charara/Makuti hunting areas (alternatives A and B), the ZHA lottery system does benefit more people directly than the DNPWLM lottery system in the study area.

Although the DNPWLM auction system (alternatives G and H) earns ten times the revenue in absolute terms, and more revenue in relative terms (per wildlife index and per hunter-day) than the ZHA lottery system, **none of the revenue benefits conservation.** Similarly, the safari operator marketing system for the Charara/Makuti hunting area (alterative I) earns most revenue, but is the least equitable of all licensing system alternatives. How is this possible?

Clearly, revenue efficiency does not necessarily mean that direct benefits for people from protected areas are being maximized or indeed promoted. The number of hunts, hunters per hunt, and the hunt duration per hunt that together determine the total number of hunter-days supplied in each hunting area **are all limited primarily by the consumptive wildlife quota (hunting bag).**

Yet the number of non-consumptive visitor- or pupil-days which can be supplied in a wildlife resource area is not limited by the sport hunting quota or by the natural resource base, but primarily by financial, technical, and human resource constraints that are required to develop facilities, services and opportunities for visitors. These inputs add economic tiers of value to natural resources, whose consumption is otherwise limited by natural limits of sustainable use (see Child, B., 1988 on the concept of economic tiers of value for wildlife). The non-consumptive visitor use of protected areas is ecologically sustainable, but requires financial sustainability for it to be supplied at all, and for its continued management, research, and protection.

5.3.6. Initial conclusions

Care needs to be taken in drawing conclusions based on this indicator, as it refers only to the **direct benefits** a visitor gains from entering the hunting area and the hunting revenue, and ignores indirect economic benefits from this revenue. In the comparison of the auction/safari operator systems versus the lottery systems this means that the economic multiplier effects and balance of payments impact of foreign exchange are disregarded. The indicator also gives the impression that the unpriced educational benefits (which are measured in physical access days by persons) are more valuable than foreign exchange and indirect economic benefits, which also remained unpriced in the indicator, although this is not intended.

5.4. Economic and social costs interpreted: Revealing the institutional dimension of resource allocation

5.4.1. Introducing the idea of a trade-off

Economic benefits from the allocation hunting resources were quantified in this chapter as gross revenue earned from hunters. Social benefits were quantified as the number of people that had direct access to the protected areas due to the revenue earned by the hunting allocation systems. Because sport hunting's social benefits remain largely unpriced by allocation systems, the indicators represent the author's interpretation of efficiency and equality concepts from a macroeconomic perspective.

The trade-off between efficiency and equality as theoretical concepts is often referred to as the efficiency-equality trade-off in the literature (see "The Big Trade-Off", Okun, 1975). Usually, it is implied that greater economic efficiency (getting more benefits out of scarce resources) can only be achieved at the expense of a more inequitable distribution of benefits (fewer people benefit from the same resources).

Based on data presented for sport hunting, is this trade-off necessarily a win-lose situation for conservation and protected areas in Zimbabwe? And why do the fix-priced lottery systems administered by the ZHA benefit more people for every Z$ of hunting revenue than the market-priced systems administered by the DNPWLM? These questions are addressed in the following sections.

5.4.2. Interpreting revenue efficiency and benefit equality as a trade-off

The efficiency and equality measures calculated in this chapter are depicted in Figure 5.1 and Figure 5.2, on page 209. The measures are interpreted as a trade-off, based on economic theory of choice (see Lindsay, 1984: Chapters 3, 4 and 18). the choice is between two objectives of resource allocation:

- Maximizing revenue from sport hunting resources in protected areas;
- Maximizing direct access for people to protected areas.

In Figure 5.1 and Figure 5.2 it is interesting to note that for both measures of efficiency, those alternatives whose revenue earning capacity is limited because they rely on fix-priced lottery systems for hunting revenue (alternatives C, D and E and alternative F) in fact produce conservation benefits for more people who directly enter these hunting areas. As indicated in the previous section and detailed in the review of licensing systems (Chapter 3), this is due to development of educational facilities undertaken by the ZHA, and to the promotion of hunting camps amongst ZHA membership. Hunting revenue is invested back into infrastructure, the maintenance of certain roads and facilities in the hunting area on behalf of the DNPWLM, and into environmental education for school children.

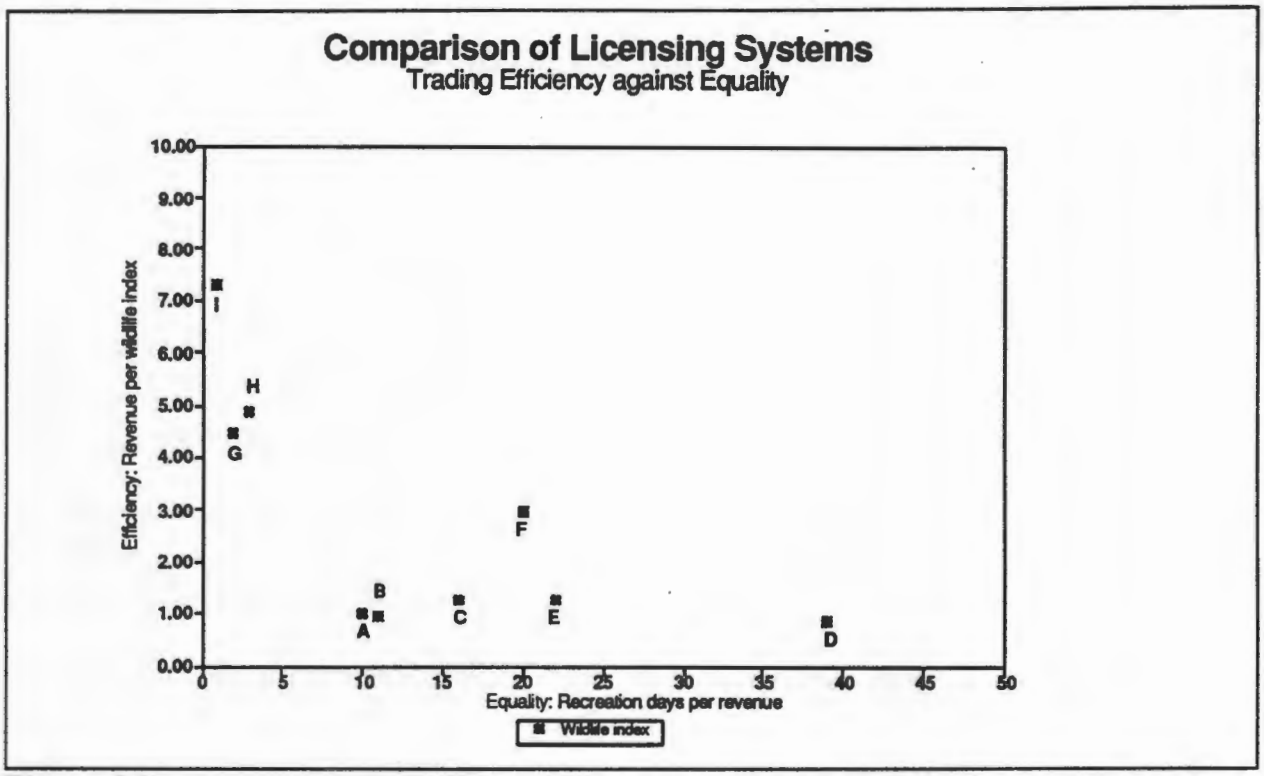

Figure 5.1 Comparing alternatives: Trading efficiency (wildlife) against recreational opportunities: 1991

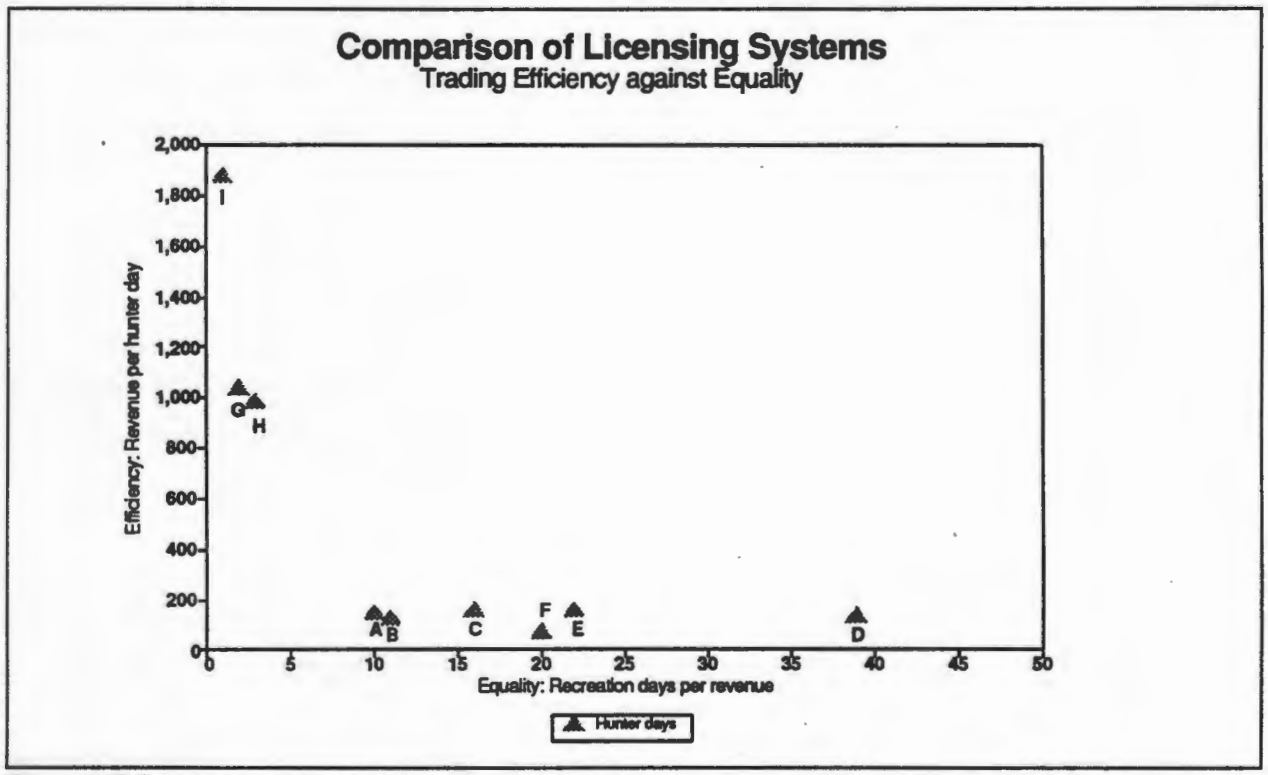

Figure 5.2 Comparing alternatives: Trading efficiency (hunter-days) against recreational opportunities: 1991

Key to the alternative allocation systems:

- **A** = DNPWLM lottery system for Charara
- **B** = DNPWLM lottery system for Makuti
- **C** = ZHA lottery system for Tuli
- **D** = ZHA lottery system for Doma
- **E** = ZHA lottery system for Rifa
- **F** = DNPWLM tender system for Dandawa
- **G** = DNPWLM auction system for Nyakasanga
- **H** = DNPWLM auction system for Sapi
- **I** = Safari operator marketing for Charara/Makuti

(Of the total revenue calculated for each ZHA lottery system, the ZHA only receives part of this revenue (approximately half), since it pays the DNPWLM for the quota. The ZHA also invests additional revenue that is not accounted for in the analysis from membership fees and fund-raising programmes back into these hunting areas in the form of facilities and environmental education programmes.)

The results of the trade-off are as follows:

5.4.2.1. The DNPWLM lottery system for Charara/Makuti earns the least revenue from hunting resources and benefits the least numbers of people. By contrast, the safari operator marketing system for Charara/Makuti could earn the most revenue.

5.4.2.2. Because present institutional arrangements limit the DNPWLM in its capacity to invest and develop hunting and recreational access, benefits from all DNPWLM administered allocations systems are lower than those administered by the ZHA.

5.4.2.3. There is scope to significantly increase conservation and development benefits from revenue-efficient licensing systems (alternatives G, H, and I) by developing more recreational opportunities. (In Figure 5.1 and Figure 5.2 indicated by a move to the right of the alternative's present position.)

5.4.2.4. Significantly increased revenue-efficiency of non-market licensing systems (alternatives A to E), and their conservation and development benefits can be achieved, by adopting a market-based auction system to sell hunting resources. (Indicated by a move upwards from their present positions in Figure 5.1 and Figure 5.2.)

5.4.3. Discussion: Trade-offs for resource allocation?

The obvious question is, why the market-priced allocation systems (Alternatives G, H and I) which generate the largest amounts of revenue are do not seem to promote non-consumptive resource use to a far greater degree than the Zimbabwe Hunters' Association is able to from a more limited hunting revenue? Two explanations are suggested.

In the case of Charara/Makuti - and for Zimbabwe's entire protected area system - the significant factor causing lack of conservation benefits is the government institutional arrangements that inhibit the DNPWLM from being responsible for the agency budget.

As a government agency, the Department of National Parks and Wild Life Management presently lacks institutional and financial autonomy and authority for retaining any revenue earned within protected areas. As an historically established principle of government, all revenue generated by any government department has to be returned to central treasury in the Zimbabwe Government. This principle has meant that there is no link between the budget allocations to the DNPWLM and the revenue earned by the agency from the protected areas (and the sport hunting areas). The DNPWLM is thus unable to link

revenue and expenditure, or to invest hunting revenue in the resource base and develop conservation benefits, due to the institutional restrictions.

Because the ZHA is a financially independent, non-government organisation, and is thus able to make decisions based on revenue from the association's membership and citizen hunting activities in Tuli, Doma and Rifa hunting areas. The ZHA invested a proportion of hunting revenue back into the development of conservation benefits in these protected areas. Hunting campsites were maintained and improved to make them more attractive for members, facilities and programmes were developed to conduct environmental education for school children and class teachers, transport was provided for schools to access and benefit from these facilities situated in remote areas.

The number of persons who benefit from consumptive hunting activities are limited by the wildlife resource, and development of facilities to a lesser degree. The number of persons who can potentially benefit from non-hunting activities are limited by financial, human, and technical resources rather than by natural resource limits (Child, B., 1988).

Thus, **although in terms of general economic theory greater revenue to the state benefits "everybody" in Zimbabwe, no direct conservation benefits can be accounted for this considerable revenue. The lack of direct accountability for revenue is an institutional limitation of present governmental policy that reduces the benefits produced by conservation and development in Zimbabwe's protected areas. Efficiency is reduced, as is equality, in the sense that the number of people who benefit directly (and indirectly) from conservation and protected areas is severely restricted.**

This factor is probably the single most important limitation for the DNPWLM and conclusion of this dissertation. The agency cannot link revenue and expenditures from its own efforts to the protected areas (the natural resource base). The DNPWLM, despite being the agency responsible for the conservation, management, administration, research and development of Zimbabwe's protected areas (Parks and Wild Life Estate), is severely restricted in its capacity to achieve these responsibilities for the extensive land area's under the agency's custodianship, due to lack of financial resources.

In summary therefore, there does not appear to be an inherent practical trade-off between the efficient production and distributing hunting resources and their equitable distribution as benefits based on Zimbabwe's wildlife and protected areas. Instead, it is the financial institutional arrangements between central government and the DNPWLM that make it impossible for the DNPWLM to realize the revenue, to develop the benefits from protected area resources in general, and to generate benefits from valuable sport hunting resources in particular.

By siphoning-off all revenue from protected areas to central treasury in government, the DNPWLM, Zimbabwe citizen hunters and non-hunters, the Zimbabwe economy and the Zimbabwe Government itself are forgoing benefits. Citizen hunting by present generations is thus an activity which is highly subsidized by government budget allocations to the DNPWLM for the Charara/Makuti study area. Such activities do not appear to be financially or ecologically sustainable for future generations, unless the natural resource base in hunting areas can be protected, researched, managed, used, and developed without adding to the nation's long-term external debt, to the Zimbabwe Government's internal budget deficit, or to the long-term internal debt.[1]

Non-consumptive activities could be developed to substantially increase access, quality and quantity of conservation benefits from protected areas, but only if revenue is returned to the DNPWLM and protected areas from which they were earned in the first place. Then revenue can be directed towards the protection, research, management and development of conservation benefits in protected areas by the DNPWLM, the agency entrusted with the custodianship of Zimbabwe's bio-diversity and protected area system. Wise use of resources - natural, human and financial - requires not only legal responsibility, but the financial means and institutional authority to realize this custodianship.

For the DNPWLM to efficiently protect, research, manage and develop protected areas and their associated benefits for present generations, and for the agency to secure these very benefits for future generations in Zimbabwe, it must apply to the principles of ecological, and financial, sustainability to its management of conservation and development in protected areas.

5.4.4. Initial conclusions from interpretation

5.4.4.1. There is no inherent conflict between increasing revenue, and increasing conservation benefits from hunting resources and protected areas for Zimbabweans, in particular within the Charara/Makuti study area.

5.4.4.2. By using market-priced systems to allocate hunting, the DNPWLM could generate more revenue for Charara/Makuti than at present, and thereby increase access opportunities, the quality of visitor services, and could undertake ecological management and research, thereby ensuring that the Charara/Makuti study area is used sustainably by present generations, and managed responsibly for future generations.

5.4.4.3. At present, institutional arrangements are the major factor severely limiting the conservation benefits whose development the DNPWLM can facilitate or itself provide for the public in the Charara/Makuti study area. Irrespective of which

[1] Deficits are annual shortfalls between actual revenue and expenditure. Debts are the cumulative result of such annual deficits having to be financed over a period of time.

allocation system is chosen by the DNPWLM to allocate hunting in the Charara/Makuti study area, under current financial arrangements the revenue does not accrue to the DNPWLM as the landholder for protected areas for conservation purposes, but subsidizes general government activities. This conclusion can be generalized to apply to Zimbabwe's entire protected area system.

5.4.4.4. In the short-term, the ZHA and safari operator allocation systems present a mechanism that would allow these financially independent organisations to invest and return some revenue to protected areas - inspite of the limitation cited in point 5.4.4.2. Contractual obligations could increase these benefits for conservation and development of protected areas.

5.4.4.5. Zoning the Charara/Makuti study area, and making use of hills and other natural features, would allow the area's inherent wilderness qualities to be used simultaneously for both sport hunting and for non-hunting activities. Multiple-use would increasing benefits from revenue, conservation, and economic development of the region. The recreational opportunities for people would be increased beyond the present minimal benefit level.

5.5. Foreign exchange costs: A market value for Zimbabwe

5.5.1. Introduction

The purpose of this section is to put an economic market value on foreign exchange that is forgone to Zimbabwe. By selling hunting resources hunting areas exclusive to Zimbabwe citizen hunters - rather than to foreign safari hunters or on the open market - foreign exchange revenue is foregone entirely. Recent developments brought about by the liberalization of the foreign exchange market in Zimbabwe allow the market value of foreign currency to be calculated more easily than has previously been possible. The significance of foreign exchange to Zimbabwe's economy, and the contribution of sport hunting, is now briefly discussed.

If the DNPWLM allocates hunting resources exclusively to Zimbabwe citizen hunters, revenue earned is in the Zimbabwe dollar currency. If these same resources could instead be sold to foreign hunters (either directly at an auction, or indirectly through a safari operator), revenue earned is in foreign exchange currencies, which are then converted to Zimbabwe dollars by the banking system at the Reserve Bank of Zimbabwe. Until 1991, foreign exchange was managed by the Reserve Bank in a tightly controlled system, and although it was acknowledged that the exchange rates set by the Reserve Bank did not reflect the true value of the foreign currencies to Zimbabwe, there was no easy method of judging their market exchange rates compared to the Zimbabwe dollar. This has now changed with the Economic Structural Adjustment Programme (ESAP) that is being instituted by the Government of Zimbabwe under the auspices of the World Bank.

Up to this point in Chapter 5, all foreign currency revenue has been calculated at official fixed exchange rates, which undervalued any revenue earned from foreign hunters. Consequently, the absolute and relative revenue efficiencies for the auction system (alternatives G and H) and the safari operator marketing allocation system (alternative I) have been understated. This section attempts to place a correct market value on foreign exchange in Zimbabwe for the 1991 research period.

5.5.2. A scenario: Marketing hunting by competitive auction[1]

As a point of departure, a scenario is assumed where packaged hunting resources are allocated at an auction **at which any person can bid, and where trading of hunts (and the rights to hunt) bought by participants is legal**. Thus Zimbabwean safari operators, Zimbabwean agents acting on behalf foreign hunters, foreign safari operators, foreign hunters, plains game farmers, Zimbabwean "dealers" and Zimbabwean citizen hunters all compete in this hunting market. Prices achieved at this fictive competitive auction would be genuine market prices, with the auctioneer selected by the DNPWLM according to the lowest commission requested by him on final auction prices. For simplicity, assume also that the DNPWLM sells a hunt to three different participants in this competitive hunting market at exactly the same price, say Z$100.

The participants in this auction market are:

Scenario A) A Zimbabwe citizen hunter;

Scenario B) A Zimbabwe agent, who purchases the hunt for a foreign hunter;

Scenario C) A safari operator, who markets the hunt to a foreign client with professional hunting services.

The difference in value of these three scenarios in terms of foreign exchange revenue and other benefits are sketched below, after outlining how the foreign exchange market in Zimbabwe currently operates.

5.5.3. Zimbabwe's foreign exchange market

With the advent of the Economic Structural Adjustment Programme (ESAP) in Zimbabwe in 1991, three innovations have been introduced to successively liberalize the allocation of foreign exchange.

- **Export Retention Scheme:**

The Export Retention Scheme (ERS) was introduced in July 1991. It allows exporters to retain a percentage of their foreign currency revenue to import foreign goods directly (previously all foreign exchange was returned to the Reserve Bank of Zimbabwe). This percentage is known as the *export retention rate*. The rate has been gradually increased from 15% in June 1991, and currently stands at 35% (until December 1993) (see Reserve Bank of

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[1] The author is grateful to H. High and A.M. Hawkins for making valuable comments on this section.

Zimbabwe, 1992; Standard Chartered, 1993). Exports of tourist services and goods such as safari hunting qualify for this scheme, which means that safari operators (exporters) can retain the "market value" of their foreign exchange revenue up to the limit of the export retention rate on their gross export revenue. The export retention rate is to be increased still further and will in time allow exporters to retain 100% of their foreign currency revenue, should they choose to do so, once the market is completely liberalized; this is expected by 1995.

- **Export Revolving Fund:**

The Export Revolving Fund (ERF) developed out of the surplus foreign exchange revenue that some exporters had earned under the ERS, but wanted to sell for cash in Zimbabwe dollars, rather than importing goods. To allocate this surplus foreign exchange, banking institutions set up a market to match sellers and buyers of such funds according to the price each is willing to pay. Consequently a foreign exchange market has now been created that is accessible to any person in Zimbabwe, and the market price paid for foreign exchange - known as the *export retention premium* - reflects supply and demand for foreign exchange at any point in time. A Zimbabwean purchasing export retention funds to import goods will thus pay: The Zimbabwe dollar value of the import licence at the current fixed exchange rate **plus the export retention premium of the day.**

This premium, being market determined, has varied considerably since the scheme was introduced, decreasing from 65%-70% initially in June 1992, to 45% by October 1992, and further to 25% in December 1992. The export retention premium was about 24% in February 1993 (Mpofu, personal communication; Standard Chartered Bank, n.d.).

For a safari operator exporting goods and services such as safari hunting or tourism, this means that the exporter can now earn the full "market value" of the foreign exchange revenue in Zimbabwe dollars that qualifies for export retention (see above). The premium now measures the difference between the fixed foreign exchange rate and the market-valued exchange rate for foreign currencies, as judged by market participants at the time. Therefore Zimbabweans now do have access to foreign currency at a price that reflects its market exchange rate in Zimbabwe dollars.

For example: Assuming that the 1991 fixed exchange rates were distorted from the market exchange rates by the same amount as the export retention premium in June 1992 (when the ERS was first introduced), a gross revenue of one US$ earned by a safari operator by selling a hunt to a foreign client was worth the Zimbabwe dollar equivalent of:

1 US$	x	Fixed Exchange Rate	x	Export Retention Premium	=	Estimated Market Value of Foreign Exchange Revenue to Zimbabwe

and substituting values:

1 US$	x	3.07	x	1.65	=	Z$5.06

The market exchange rate of Z$5.06 per unit US$ is approximately equivalent to the 1992 fixed exchange rate of Z$5.07 per unit US$ (Financial Gazette (Zimbabwe), 18.2.1992), after the Zimbabwe dollar underwent a major devaluation in 1991 (Reserve Bank of Zimbabwe, 1991).

- **Export Incentive Scheme:**

The Export Incentive Scheme (EIS) was introduced by the Zimbabwe Government to increase exports by the Zimbabwe economy. Exporters are paid a 9% bonus in Zimbabwe dollars on the gross value of their exports. Safari operators who export animal products and tourist services qualify for this bonus.

Care must be taken in the interpretation of the bonus in macroeconomic terms. For exporters, the bonus represents a direct subsidy paid by the Zimbabwe Government as an incentive to increase exports and improve the long term balance of payments deficit. The export incentive bonus is to be phased out once exports have increased, then forcing exporters to become more cost effective and compete at international world market prices. The temporary subsidy thus has to be financed by the Zimbabwe Government with other revenues until such time as it is phased out.

Taking a macroeconomic and long-term view, the 9% export incentive bonus is a short term subsidy of exporters, and does not represent an opportunity cost to Zimbabwe's economy since it only temporarily increases an exporter's gross revenue.[1] For this reason, the export incentive bonus was not included in the estimate of opportunity costs for foregone foreign exchange revenue to Zimbabwe's economy, as calculated below.

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[1] For the period during which exporters are subsidized by 9%, a loss in economic activity (eg. Gross National Product) is valid, and this amount is an actual cost. For this point I am grateful to Hugh High (personal communication).

5.5.4. Estimating foreign exchange opportunity costs of citizen hunting

Using the method of opportunity costs, the foreign exchange costs of the three auction scenarios that allocate hunting resources to different participants are now sketched. Where possible, these costs are quantified. It is realistic to assume for each scenario that any big game in Zimbabwe could be sold to other participants at the auction price, ie. that a strong demand by foreign hunters and safari operators does exist (Child, B., 1988).

- **Scenario A: A Zimbabwe citizen buys a hunt auctioned for Z$100:**

No foreign exchange is earned since the hunt is not exported. The allocation to a Zimbabwe citizen hunter does not qualify under the export retention scheme, and no value is added to this hunt, so the value of this hunt is Z$100 to the macro-economy.

- **Scenario B: A Zimbabwe agent buys a foreign hunter a hunt auctioned for Z$100:**

The hunt is exported to a foreign safari hunter, and foreign exchange is earned. The Zimbabwean agent will include certain hunting services at cost, adding value to the hunt's auction cost-price, and will charge a commission for his professional services, all to be paid for by the foreign hunter in foreign exchange. The professional service and commission values are thus also exported in addition to the auction price of the trophy hunt. These exported values qualify under the export retention scheme. If the agent's cost and commission are assumed to be 20% of the auction price, then the gross export revenue of the hunt to the Zimbabwe economy is: Z$120 which is sold to the foreign hunter in foreign exchange (say for US$120)[1]. This hunt then earns U$120 times the fixed exchange rate of Z$3.07 plus the premium of the entire foreign exchange to the Zimbabwe economy of 1.65, in total about Z$600.

This value excludes economic multiplier effects[2], since the foreign hunter also pays for airfares, vehicle hire, hotel bills and taxidermy services, all in foreign exchange. These economic effects are a multiple of those spent by in scenario A) by a Zimbabwe citizen hunter.

- **Scenario C: A Safari Operator buys a hunt for a foreign client auctioned for Z$100:**

The hunt is then marketed by the safari operator to a foreign safari hunting client with additional professional hunting services as part of a larger hunting package (eg. with plains game on private land). The safari operator thus exports the full Zimbabwe dollar auction value including additional services at cost, plus a mark-up (profit margin) on all items. The

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[1] This mark-up represents current practice in Zimbabwe. Safari operators purchase big game species in Z$ from the DNPWLM and sell these for similar amounts in US$; the hotel industry has a similar two-tier pricing system (Financial Gazette (Zimbabwe), 3.9.1992).

[2] Economic multiplier effects are well explained in Samuelson (1973).

foreign hunter pays for the entire hunting package in foreign exchange. This revenue qualifies for the export retention scheme. If the value of the cost and mark-up by the safari operator on the auction price is assumed to be 100%,[1] then the gross export revenue of the hunt for the Zimbabwe economy is: Z$200 which is sold in foreign exchange (say for US$200)[2]. This hunt then earns US$200 times the fixed exchange rate of Z$3.07 per unit US$ plus the premium of the entire foreign exchange to the Zimbabwe economy of 1.65, in total about Z$1'000.

This value again excludes economic multiplier effects, since the foreign client also pays for airfares, hotel bills and taxidermy services, all in foreign exchange. These economic effects also include job-creation, wages and salaries spent, tax revenue to central Government from economic activity (sales tax) and profit (income tax). These effects are not quantified here, but are real and significant costs to the macro-economy and the Zimbabwe Government.

5.5.5. Conclusions of methodology

The 1991 opportunity cost of foreign exchange revenue to the Zimbabwe economy can be estimated using the June 1992 export retention premium of 65%. This premium approximates the difference between the fixed exchange rate and the market value of foreign exchange valid for 1991 during the research period.

If hunting resources were allocated to all interested participants using an auction and a liberalized market (allowing safari operators and foreign agents to bid, allowing trading or "dealing" by market participants), then:

5.5.5.1. Citizen hunters benefit the economy at least **ten times less than safari hunters.**

5.5.5.2. Citizen hunters benefit the economy at least **six times less than agents acting for safari hunters.**

5.5.5.3. Citizen hunting forgoes significant additional economic activity as direct spending in foreign currency (multiplier effects) that is not easily quantified, but estimated to be the greatest when compared with the option of a safari operator marketing an auction hunt as part of a larger packaged hunt.

5.5.5.4. The above opportunity costs of citizen hunting do not take account of other macroeconomic effects that are forgone, such as: job creation, wages and salaries, tax revenue to the Government from sales (sales tax) and profit (income tax).

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[1] It could be argued that the Zimbabwean agent might pay a higher price than the safari operator. The argument goes, that the agent has an assured client and does not purchase the hunt at his own risk on account, whereas the safari operator first has to purchase the hunt, then find and market it to a foreign client at his own risk and on his own account (High, personal communication). It is also true, that safari operators have foreign clients as regular customers who make their hunting requirements known some time in advance, negating a difference in risk, and price paid, between an agent and a safari operator.

[2] See footnote 1, page 217.

These effects have not been quantified here, but are real significant economic costs to the economy and the Zimbabwe Government.

5.5.5.5. To be objective, it must be acknowledged that the gross revenue earned by the DNPWLM from the auction system does not include additional value added by safari hunters and foreign hunters or their agents who bought these hunts. This revenue can be significant (assumed to be 20-100% of the auction price), and auction systems may well, therefore, be more efficient at maximizing total revenue from the hunting resource.

5.5.5.6. **The DNPWLM, as the landholder or wildlife resource authority for protected areas, earns the same maximal amount of Z$100 by auctioning the hunting resources from each scenario, irrespective of who buys the hunting resource.**

5.5.6. Zimbabwe's foreign exchange opportunity costs from citizen hunting in the Charara/Makuti study area

By applying the market determined premium on foreign exchange earnings to the gross revenue earned by the safari operator marketing system alternative for Charara/Makuti in Table 5.3, page 184, the opportunity costs of citizen hunting to Zimbabwe are calculated in Table 5.7.

Table 5.7 Direct economic costs of foreign exchange foregone for Zimbabwe's economy by the DNPWLM lottery system in Charara/Makuti: 1991

Safari Operator Marketing of Charara/Makuti for safari hunting	Z$865'550	x 1.65	Z$1'428'158
DNPWLM licensing system for citizen hunting			Z$171'627
Direct opportunity cost of allocating Charara/Makuti's Citizen Hunting			**Z$1'256'531**

Section 5.5.4 showed that the direct economic costs or offering citizen hunting using the DNPWLM lottery system in Charara/Makuti of about Z$1.3 million do not include the value of foregone multiplier effects to other sectors of the economy (such as jobs, air fares, hotel bills, income tax and sales tax revenues). These secondary economic effects are considered by the author to be significantly greater for the safari operator marketing option than for the citizen hunting option, because the former use hunting resources productively and add economic value to the hunt, whereas the latter use hunting resources for consumption and add little economic value to the resource itself.

If hunt allocation were equalized (with 1 ticket per applicant) for the present DNPWLM lottery system, Z$40'000 ticket revenue included in Table 5.7 would in addition be foregone, and direct opportunity costs would be close to Z$1.3 million in foregone revenue.

5.6. Conclusions: Opportunity costs of licensing systems

The chapter set out to clarify the nature and extent of opportunity costs (forgone benefits) of different licensing systems in Zimbabwe.

■ **Benefits from sport hunting resources and Zimbabwe's protected areas**

The investigations in this chapter showed that allocation systems for hunting can generate the following benefit categories:

- Hunting benefits for sport hunters. They include consumptive (hunting bag) and non-consumptive benefits (access to time and protected area space) (see sections 5.2.1 and 5.2.2.);
- Recreational (non-hunting) benefits for non-hunters in a variety of forms (see section 5.3) ;
- Revenue benefits in the Zimbabwe dollar currency;
- Revenue benefits in foreign exchange currencies (section 5.5);
- Other conservation benefits if revenue is invested back into protected areas to develop access, infrastructure, services and human resources that are linked to the resource base (section 5.4).

Table 5.8 shows a summary of the estimated relative opportunity costs of Zimbabwe's licensing systems:

Table 5.8 Summary of estimated relative opportunity costs of Zimbabwe's licensing systems

Relative Opportunity Cost	Revenue Benefits in Z$ (priced hunting benefits)		Direct Access Benefits (Unpriced hunting benefits)	Value of Foregone Revenue Benefits in Foreign Exchange	Direct Benefits of Revenue for Conservation
DNPWLM lottery system	1.0	1.0	10	High	None
ZHA lottery system	1.2	1.1	39-16	High	Low-Medium
DNPWLM tender system			20	None (no market?)	None
DNPWLM auction system	5.0	7.1	2-3	Low	None
Safari Operator marketing system	7.0	13.5	1	Low	Low-Medium

Conclusions from each section are:

- The Charara/Makuti study area incurs a high economic cost by foregoing direct revenue from sport hunting of its big game resources on quota (section 5.2.1);
- The Charara/Makuti hunting area incurs a high economic opportunity costs by forgoing revenue from the resource of hunter-days, that is time available to visitors in the protected area (section 5.2.2);

- Charara/Makuti has high social opportunity costs of direct access that are foregone for people (section 5.3);
- The DNPWLM lottery system in the Charara/Makuti study area and other DNPWLM-administered allocation systems have serious institutional limitations to achieving efficient and equitable resource allocation. Sustainable development and conservation in Zimbabwe is thereby inhibited, and even perverted[1], due to lack of economic incentives (section 5.4);
- Both the economic and the social opportunity costs for the Charara/Makuti are even greater than anticipated from loss of direct foreign exchange if foreign exchange is valued at market prices set by scarcity. If indirect losses from multiplier effects are considered, the opportunity costs of present resource allocations are greater still (section 5.5);

■ **Significant subsidization of Citizen hunters in Charara/Makuti by Zimbabwe Government**

Citizen hunting of big game in protected areas is a highly subsidized activity. Concentrating on the Charara/Makuti study area, and hunting resources allocated by the present DNPWLM lottery system, this allocation system causes Zimbabwe to forego the equivalent of Z$1.3 million in foreign exchange revenue, in absolute terms. In relative terms, it is the cheapest big game hunting available in Zimbabwe (in terms of the consumptive resource and hunting bag) and the cheapest access to big game hunting and protected areas in Zimbabwe (in terms of the non-consumptive resource of access time in hunter-days).

■ **Significant macroeconomic opportunity cost of institutional arrangements for the DNPWLM**

The economic and social opportunity costs of the present allocation system in Charara/Makuti (fix-priced lottery system) and present institutional arrangements (returning all revenue to central treasury in government) are excessive under the policy of using this area exclusively for citizen hunting. A mere 63 additional Zimbabwe citizens benefitted from the system who did not already have access to big game hunting in protected areas as members of the ZHA; a maximum of 200 Zimbabwe citizens could have benefitted from hunting, had the allocation been entirely successful; Zimbabweans who can afford to undertake a big game hunting trip have to be amongst the most wealthy of Zimbabwe's total population of 10.4 million citizens. The policy of citizen hunting incurs Z$1.3 million direct costs of foregone foreign exchange revenue. Additional indirect costs are incurred that remain unquantified, consisting of forgone economic activity from foreign exchange and its multiplier effects, loss of government revenue as sales tax and income tax, and foregone access and conservation benefits.

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[1] With no direct economic benefits from the Charara/Makuti study area flowing to local communities at a local or regional level in the form of wildlife products, jobs, economic activity, local support for bio-diversity and conservation objectives in protected areas can be expected to be low, and the urge to poach wildlife increased. The Pilanesberg National Park has put conservation benefits for people first and won-over the support of the communities (see Magome, 1993). McNeely (1988) provides an academic background to perverse economic incentives for conservation.

- **Opportunity costs of the DNPWLM lottery system for Charara/Makuti study area**

The macroeconomic opportunity costs of the 1991 lottery system used by the DNPWLM to allocate citizen hunting for Charara/Makuti are significant. Opportunity costs, measured as direct losses in revenue, amount to Z$1.3 million. This entire amount is foregone as foreign exchange - recognized as a priority resource for Zimbabwe's economy under the present socio-economic development programme by the Zimbabwe Government (ESAP) and the business community. Additional foreign exchange is directly foregone by other sectors in the economy for hotel expenses, airline tickets, taxidermy services. Due to the high value of foreign exchange, other indirect opportunity costs from forgoing foreign exchange are also significant, but could not be quantified. They include:

- economic activity as multiplier effects from safari operators earning foreign exchange;
- job creation;
- Government revenue from turnover (sales tax) and profit (income tax) as part of the value added by the safari operator to hunting resources.

- **Performance of allocation systems**

Altering the fix-priced DNPWLM lottery system to a market-priced system (an auction or safari operator marketing system) would not benefit the DNPWLM or conservation and development in Charara/Makuti. To achieve real benefits from revenue, the institutional arrangement that prevents the DNPWLM from earning revenue from activities must be altered.

Market-priced auction systems have the ability:

- to generate the greatest revenue for the DNPWLM, allowing the DNPWLM to potentially self-finance maximum conservation benefits;
- to promote competition and efficient resource allocation amongst all persons who want to access big game in protected areas;
- to stimulate the supply of and conservation of wildlife and land in other areas of Zimbabwe using market mechanisms and economic incentives.

- **Auction systems are a fair, competitive, and efficient method resource allocation for all sport hunters and participants in Zimbabwe's safari hunting industry**

Using an auction system, the market price of hunting would ensure that the proportion of sport hunting resources (hunting quotas and access to space in hunting areas) would be allocated flexibly, competitively, and conform with market valuations and principles. Auctions minimize opportunity costs. It was shown that even if hunting is allocated at the highest auction price to Zimbabwe citizen hunters in competition with other market participants, there are substantial opportunity costs to Zimbabwe's economy due to the foreign exchange revenue that is forgone from exclusive allocation to a single safari operator. By adopting an auction

system, rather than an exclusive lease of a hunting area to a safari operator, the number of participants in the safari hunting industry is increased, along with competition and efficiency.

- **Influence of equality recommendations for lottery systems made in Chapter 4**

By adopting recommendations made in Chapter 4 to equalize hunt allocation in the Charara/Makuti study area (eg. based on the Wyoming lottery system), not only would such a lottery system be costly to administer, but hunting revenue would be reduced by an additional Z$40'000 compared to the 1991 DNPWLM lottery allocation system. An equal lottery system would cause macroeconomic opportunity costs of resource allocation in Charara/Makuti to be even more significant than those calculated for 1991 in this chapter.

- **Policy conflicts between Government and DNPWLM**

The conflict between the objectives of maximizing foreign exchange revenue and providing Zimbabweans with preferential (exclusive) access in terms of current DNPWLM policy statements is due to the choice being formulated as a political goal disregarding economic costs, instead of being presented as an economic choice.

For the DNPWLM and policy-makers in the Zimbabwe Government, the pertinent question is not: Whether big game hunting resources in Zimbabwe's protected areas should be allocated to foreign hunters for foreign exchange revenue or to citizen hunters for Zimbabwe dollar revenue.

Rather, decision-makers should ask: **At what economic cost to the DNPWLM, to government, to taxpayers, to current users and to future generations big game hunting in Zimbabwe's protected areas should be supplied to Zimbabwe citizens?** Or, what price are Zimbabwe citizen hunters and society (all non-hunting Zimbabweans) prepared to pay to supply big game hunting as an economic luxury to a privileged few?

- **No inherent trade-off exists between promoting efficiency and equality for the Charara/Makuti study area**

There is not necessarily a trade-off between maximizing foreign exchange and providing Zimbabweans with quantitatively and qualitatively increased benefits and access to protected areas. If the economic cake is large, then benefits and access are greater and are shared by more people than just foreign and Zimbabwean big game sport hunters. By limiting revenue outright with fixed prices for species, and preventing conservation benefits in and access to protected areas from being developed, the slicing of a diminished economic cake becomes politically and economically more difficult, because demand by all people for resource benefits is high.

CHAPTER 6

INTEGRATED RESOURCE ALLOCATION FOR THE CHARARA/MAKUTI STUDY AREA

By comparing the existing DNPWLM lottery allocation in Charara/Makuti with alternative systems in the previous chapter, it quickly became apparent that this licensing system is inferior to all other alternatives. The present lottery system is inferior:

- in terms of generating revenue and recreational opportunities from the resources available in the study area;
- because the lottery system causes Zimbabwe to forego significant conservation and development benefits, mainly because economic incentives are not harnessed.

The purpose of Chapter 6 is to summarize and conclude the investigation for the case study area and the DNPWLM lottery system by integrating major findings from all previous chapters of this dissertation. Zimbabwe's development priorities (Chapter 2) are integrated with the microeconomic results of the lottery system assessment (Chapter 4) and the system's macroeconomic assessment in Chapter 5.

Drawing on data presented in all the preceding chapters, this chapter filters the major conclusions indicated by this investigation concerning the allocation of hunting resources in Charara/Makuti study area. Such a filtering process is essentially an attempt by the author to integrate and evaluate possible options for policy and practice in the study area. The process is subjective, based on the author's values and the data presented. A strategy with actions is recommended for decision-makers in the DNPWLM to take these conclusions forward. These recommendations necessarily affect policy issues and conservation practice in Zimbabwe's protected areas.

In its simplest form, the key question requiring a decision may be formulated as follows:

Are Zimbabwe citizens willing to pay in excess of Z$1.3 million per year in foregone direct benefits for less than 50 of Zimbabwe's wealthiest citizens to have exclusive access to big game sport hunting in the Charara/Makuti study area?

In Chapter 3 hunting resources and technical details of the DNPWLM lottery system for the Charara/Makuti study area were reviewed.

In Chapter 4 the microeconomic performance of this lottery system in 1991 regarding the efficient and equitable allocation of hunts amongst citizen hunters was critically assessed as a case study. At the microeconomic level, the assessment showed that the DNPWLM lottery system allocated hunts in the Charara/Makuti very inefficiently and very inequitably in terms of the specified criteria. Recommendations that were made to achieve a more efficient and equitable hunt allocating using lottery systems would be costly to implement and require

complex administrative and specialized technical and human resources. The costs for such resources to the DNPWLM are considered by the author to exceed the agency's capacity at present. The costs to supply citizen hunting would stand in no relation to the few Zimbabwe citizens that could, under the most favourable administrative circumstances, benefit from citizen hunting in Zimbabwe. It was also apparent that for a lottery system to be "fair" to all applicants, there should only be one lottery system allocating big game resources in the whole of Zimbabwe.

Chapter 5 assessed the macroeconomic opportunity costs of the lottery system with respect to foregone revenue, the value of foregone foreign exchange and foregone access and other foregone conservation and development benefits in a comparative study. At the macroeconomic level, the assessment 5 showed that opportunity costs of lottery systems are significant, and directly impact the size of conservation and development benefits supplied by hunting resources in Zimbabwe's protected areas.

6.1. Summary of hunting resources: Supply and demand in the study area

6.1.1. The Charara/Makuti study area is part of Zimbabwe's system of protected areas under the authority of the DNPWLM. The area is used as a sport hunting area exclusively for Zimbabwe citizens. The area supports a sport hunting quota with a high proportion of big game and plains game distributed over a large area (1'452km^2) at low densities in the mid-Zambezi valley. Trophy and non-trophy buffalo (big game species) form the major part of the quota;

6.1.2. The hunting season in Zimbabwe is between May and October annually, in the dry season, which is most agreeable to all visitors (hunters and non-hunters) of the Zambezi valley for climatic reasons.

6.1.3. The hunting resources (sport hunting quota and hunting season) were allocated to 100 hunts of fairly low hunt quality. Most hunts (but not all) had either a trophy or a non-trophy buffalo allocated to the hunting bag; all the hunts had a uniform 6-day hunt duration and took place between specified hunting dates between May and October;

6.1.4. Zimbabwe citizen hunters who demand these hunts are amongst the most wealthy persons in Zimbabwe. Of Zimbabwe's total population of 10.4 million people, between 1'000 and 10'000 people, that is between 100th and 1'000th of a percent of the population, potentially qualify for big game citizen hunting in protected areas according to gross income estimates.

6.1.5. In 1991, an estimated 196 Zimbabwe citizen hunters applied for an option to hunt in the DNPWLM lottery draw for the Charara/Makuti study area. Of these, an estimated 133 applicants (or 52%) were members of the Zimbabwe Hunters' Association (ZHA), and they therefore also had access to big game hunts in other protected areas

in Zimbabwe (the Tuli, Doma or Rifa hunting areas) as members of that association. In 1991, the DNPWLM lottery system effectively catered for a mere 63 Zimbabwe citizens who did not already have big game hunting opportunities elsewhere, and who voluntarily chose not to have access to these other opportunities by not becoming members of the ZHA.

6.2. Summary of case study: Allocating hunts in the study area

Major results of the case study assessment in Chapter 4 were:

6.2.1. Of all the 100 hunts planned for the Charara/Makuti study area in 1991, only 55 hunts were allocated successfully to Zimbabwe citizen hunters by the DNPWLM lottery system. A further 12 hunts were re-allocated by the DNPWLM using a first-come-first-served system.

6.2.2. The remaining 33 hunts and their potential benefits (revenue, hunting and recreational experiences) were wasted, and did not benefit additional Zimbabwe citizen hunters by the end of the 1991 hunting season.

6.2.3. The dual allocation of hunts in the Charara/Makuti using two different licensing systems (a lottery system and a first-come-first-served system) was administratively inefficient for the DNPWLM, and costly in terms of time, money and effort spent by applicants.

6.2.4. Contrary to the objective of using a lottery system (as interpreted by the author in the absence of DNPWLM policy and conflicting statements made by administrators and practices observed by the author and documented in this dissertation), the DNPWLM lottery system gave applicants very unequal probabilities of winning a hunt.

6.2.5. Applicants who bought over 23 tickets each, paying more than Z$460 for this option, had an overwhelming probability ($p > 90\%$) of winning a hunt, whereas applicants who bought only one ticket each, paying only Z$20 for this option, had a remote probability of winning a hunt ($p = 10\%$).

6.2.6. The probability of winning a hunt was thus determined by each applicant's willingness to pay for a maximum number of tickets. **The current DNPWLM lottery system for the Charara/Makuti favours wealthy Zimbabwe citizen hunters.**

6.2.7. The current lottery system for the Charara/Makuti study area also benefits the state (the central treasury of the Zimbabwe Government) by an additional Z$40'000 earned as ticket revenue from hunting applicants. This revenue was only possible because the DNPWLM lottery system was designed as an unequal, rather than an equal, lottery system.

6.2.8. It was concluded that the design, administration and allocation of hunts using an equal lottery system for the Charara/Makuti study area is possible (using the Wyoming lottery system), but very resource intensive. A truly equal chance for all

Zimbabweans to win a hunt of their preference is only possible if one central lottery system were to be adopted to allocate big game hunts in the whole of Zimbabwe (including those of the ZHA lottery systems in the Tuli/Doma/Rifa hunting areas), and if application rules required that all hunters in the hunting party were to be specified on application. A centralized lottery system with these rules and suitable control procedures would ensure firstly, that no applicant could apply twice and secondly, that no hunter could hunt without having applied and drawn a hunt, thus effectively equalizing draw success for all citizen hunters who apply. (Present lottery systems do not ensure either condition.)

6.2.9. None of the lottery systems used at present in Zimbabwe to allocate citizen hunting achieves the type of "fairness" (defined as equality in this dissertation) one could expect of a lottery system. Neither the DNPWLM lottery system or the individual ZHA lottery systems for the Tuli/Doma/Rifa hunting areas gives all hunters an equal probability of winning a hunt of their choice (eg. their *First Hunt Preference*).

6.2.10. Equality, defined as an equal probability for each hunter to win a hunt of his preference) is a complex and costly objective to achieve, whose opportunity costs can only be assessed in comparison with other non-lottery systems of resource allocation.

6.3. Summary of comparative study: Allocating hunting resources

The economic, social and foreign exchange opportunity costs of the present DNPWLM lottery system were assessed in Chapter 5 at the macroeconomic level for the study area. Main results were:

6.3.1. The DNPWLM lottery used the lowest fixed prices per species available in Zimbabwe to sell big game hunting resources in the Charara/Makuti study area to citizen hunters.

6.3.2. Due to the fix-priced lottery system and the low prices, the DNPWLM lottery system generated the least absolute revenue from hunting resources of all Zimbabwe licensing system alternatives for allocating resources, both in terms of the species' quota and in terms of the access time supplied to citizen hunters.

6.3.3. The efficiency of revenue earning for the DNPWLM lottery system for the Charara/Makuti study area would be even lower than at present if an equal lottery system (according to Chapter 4's recommendations) to enforce an equal probability of being allocated a hunt of one's choice (ie. with one ticket per person).

6.3.4. All hunting revenue earned by the DNPWLM lottery system from resource allocation in the Charara/Makuti study area - because it is a protected area managed by a government agency - is returned to the state (the central treasury of the Zimbabwe Government), not to the DNPWLM as the agency that incurs costs and is responsible for the resource area's management. The revenue from the Charara/Makuti study area is thus not returned to the resource area from where this revenue originated to cover costs of supplying citizen hunting.

6.3.5. The ability of the DNPWLM to invest revenue and develop access and conservation benefits in the Charara/Makuti area is severely curtailed by the conservation agency's lack of financial resources brought about by present institutional arrangements that prevent the agency from assuming full budgetary and financial responsibility.

6.3.6. Under present institutional arrangements, the DNPWLM has no incentive or ability to increase the quality, quantity, or variety of conservation benefits and services presently being offered in the Charara/Makuti study area. This conclusion applies to all protected areas within Zimbabwe's Parks and Wild Life Estate - the land category for which the DNPWLM is the nation's legal custodian. The custodianship includes responsibilities for wildlife, bio-diversity and protected areas in the whole of Zimbabwe.

6.4. Major conclusions for resource allocation in the study area

Taken over the entire investigation, conclusions were that:

6.4.1. Citizen hunting is an economic want, and therefore a luxury for Zimbabwe citizens since sport hunting as a recreation falls into the category of luxury goods, rather than that of basic human needs such as food, housing and education, for example. (Citizen hunting, being a type of sport hunting, was differentiated from subsistence hunting.)

6.4.2. Citizen hunting is an expensive sport, especially when the hunting bag involves big and dangerous game species, of which buffalo is the most numerous on quota in the Charara/Makuti study area. At present, to afford a hunting trip in Charara/Makuti, Zimbabwe citizens must be amongst the country's richest citizens, in terms of both income and wealth, in order to participate in hunting for sport. Active and potential citizen hunters are estimated not to exceed 1'500 persons in Zimbabwe's total population of over 10.4 million persons (1992 census).

6.4.3. Given this perspective above, there is no economic or social reason for the Zimbabwe Government or the DNPWLM to subsidize citizen hunts, and every reason for the state to treat it as a luxury for which the wealthy should pay market prices. Support comes from economic theory of public goods, Maslow's hierarchy of needs, environmental economics that prices natural resources at market prices or higher to include unpriced ecosystem services (known as social costs).

6.4.4. If the additional administrative costs to the DNPWLM (in terms of hours worked, money spent by the hunting administrators) due to the inefficient and inequitable hunt allocation using a lottery system are recognized, then the DNPWLM lottery system is judged by the author to be the most inefficient licensing system available. The lottery system does not maximize present benefits or enhance future benefits from the Charara/Makuti study area for all persons concerned. It is inefficient for Zimbabwe's social and economic development, for the DNPWLM as the administering agency, and for citizen hunters who are willing to pay for the right to hunt big game. State-

subsidized sport hunting for Zimbabwe citizens is judged by the author to be unjustified in the context of Zimbabwe's present development status.

6.4.5. The comparative analysis raises the question of priorities for allocating hunting resources in protected areas. It also documents the significant loss of revenue as Zimbabwe dollars and more particularly as foreign exchange due to the present policy and lottery system adopted by the DNPWLM. Foreign exchange is considered a national priority under the present economic structural adjustment programme (ESAP) instituted by the Zimbabwe Government and the World Bank.

6.4.6. The comparative analysis revealed that even if the DNPWLM were to adopt a market-priced auction system to allocate sport hunting in the Charara/Makuti study area as a non-exclusive hunting area for Zimbabwe and foreign hunters alike according to their willingness to pay market prices, the present institutional arrangements for the DNPWLM are inimical for that agency to promote sound conservation and wise resource utilization practices. This conclusion specifically for the study area can be generalized to apply to all protected areas in Zimbabwe that are the responsibility of the DNPWLM. Revenue from protected areas must be linked to costs, by returning hunting (and other) revenue earned from each protected area back that same area for the protection, management, research and development of its natural resource base (and human resource capacity). Such a change in the financial and budgetary responsibilities of the DNPWLM would enhance present efficiency, equality, and promote financial and ecological sustainability of conservation and development in protected areas into the future. Benefits for present generations of Zimbabweans could be increased, whilst at the same time making sure that these same benefits are available for generations into the future on the same, sustainable management basis. (At present, the management of Zimbabwe's protected areas is not sustainable with both an internal government debt and external foreign debt having accumulated, which future generations must pay for.)

6.4.7. The author argues here for a change in thinking amongst the DNPWLM and the Zimbabwe Government as the nation's designated resource custodians, and amongst Zimbabwe citizen hunters as resource users of the Charara/Makuti study area. Hitherto the DNPWLM have supplied park visitors with, and citizen hunters have been privileged to benefit from, exclusive access to Zimbabwe's protected areas at low prices. Citizen hunting of big game, it is concluded, is an activity that is highly subsidized by the Zimbabwe Government and is therefore not sustainable in the longer term in financial terms. Citizen hunting at present does not contribute towards maintaining goals such as bio-diversity and ecosystem integrity or the long-term sustainable utilization of natural resources in Zimbabwe's context of wildlife legislation.

6.4.8. **The question Zimbabwe's wildlife resource custodians and users must address is not whether to protect, manage, research and develop the Charara/Makuti as**

a protected area, but how these conservation and development benefits are to be achieved in a financially sustainable manner, within the ecological limits posed by nature. Land is increasingly becoming scarce in Zimbabwe and on the African continent as a whole, due to the burgeoning population pressures. Unless conservation can not only pay its way, but in addition give larger numbers of citizens actual tangible benefits to cater for their basic needs and future wants, Zimbabwe's protected areas, their diverse wildlife populations and the natural ecosystems on which they depend will not be recognized for what they are - very valuable and naturally renewable resources with many benefits for mankind.

6.4.9. Microeconomic efficiency: Should decision-makers decide that sport hunting for Zimbabwe citizens (citizen hunting) should be allocated using a lottery system and fixed prices, then care needs to be taken with the design of the lottery system, and with the preference allocation procedure using preference lists to achieve equality of hunt allocation with lottery systems. It must be emphasized, however, that such a policy is contrary to the recommendation made by the author of this dissertation. An equitable (or "fair") lottery system does not increase the net hunting benefits for citizen hunters, but decreases them overall, due to additional costs of administering the lottery; total benefits from the resource allocation by lottery for all Zimbabweans are not increased, but would remain untapped or wasted. **Lottery systems, in principle, can only distribute existing resources and their associated benefits somehow amongst people; lottery systems are unable to produce additional resources or benefits, nor can they enhance the quality of available benefits for people.**

6.4.10. Macroeconomic efficiency: When debating whether to adopt market prices determined by competition and economic incentives for conservation (eg. a competitive auction system for sport hunting) or fixed prices determined by resource administrators and perverse economic incentives for conservation, decision-makers in the DNPWLM and the Zimbabwe Government should consider the economic and social opportunity costs of their options. Resource allocation decisions using market forces and prices are definitely more efficient and flexible than bureaucratically determined allocations, especially if a long-term perspective for present and future generations is adopted.

6.4.11. An important point for policy and decision-makers to consider when deciding on the manner in which the DNPWLM is to be made more market-oriented by altering the agency's institutional limitations concerns whether the conservation agency should be a profit-making, or a non-profit-making organisation. An example of the latter is the NPB in South Africa which is partially independent and self-financing to some degree, receiving subsidies for the remainder of its budget. An essential difference between these two approaches in maximizing benefits should be noted.

6.4.12. A profit-making enterprise has nothing to do with being socially irresponsible towards conservation. Profit-making strives to maximize net values from resources, and to

ensure that benefits exceed the costs of supplying these benefits in the long term. A long-term perspective of running a park or a business by socially responsible directors can aim for survival and continuity of the park or the enterprise, respectively.

6.4.13. The difference comes in the ability of the profit-making enterprise to maximize benefits by generating a surplus value as profit (revenue over costs) that can be used for socially responsible programmes. The non-profit-making enterprise limits benefits, since no net-value as profit is produced and this surplus is thus foregone outright through the goal of being a non-profit organisation. Such organisations (eg. the Natal Parks Board (NPB) which manages conservation in the Natal province of South Africa) are unable to use a net-surplus (profits) to increase socially responsible programmes and benefits. The importance of this difference was clearly highlighted in a recent Environmental Impact Assessment report (CSIR Environmental Services, 1993) that compared mining and tourist development options by a profit-making and a non-profit-making enterprise, respectively.

- Mining development was to be managed by Richard's Bay Minerals as a private profit-making enterprise and profits were to cover rehabilitation costs and fund substantial commitments to social development programmes to benefit communities locally and regionally.
- Conservation development, on the other hand, was to be managed by the Natal Parks Board as a semi-independent government agency that is non-profit-making.

Due to this limitation, the environmental impact assessment identified the NPB as being unable to generate any surplus value (profit) from its eco-tourism proposals in order to re-invest this money back into social development programmes and benefits that would go beyond the conservation development proposals themselves (see CSIR Environmental Services, 1993: xx; 140-142; and 153-154).

6.5. Present constraints to maximize the study area's conservation benefits

6.5.1. Financial and institutional constraints

Most recommendations that call for the development of existing or new facilities, human resources or services by the DNPWLM in the Charara/Makuti study area require this agency to have additional financial resources to implement them. Clearly, in the present severely restricted annual budget allocated to the DNPWLM by central Government, whose real value is decreasing as inflation rises, and in the climate of reducing government costs, personnel, and deficits, added financial resources are not available and cannot be realistically expected as subsidies. The resources could become available to the DNPWLM through self-funding of the conservation activities, and re-investment of the surplus funds where possible.

By subsidizing activities based on some of Zimbabwe's economically most valuable hunting resources (wildlife and resource areas) the DNPWLM also creates perverse economic incentives for other wildlife based activities.

These perverse price incentives curtail supply-side responses that would increase the supply of other hunting and tourist opportunities on land outside the Parks and Wild Life Estate. One such market that would benefit is the supply of plains game trophy and non-trophy hunting on private land to Zimbabwe citizens. Another market that would benefit is the supply of quality big game trophy hunting on communal land to Zimbabwe citizens (eg. the CAMPFIRE programme in Zimbabwe).

6.5.2. Lack of a formal, integrated planning document for the Charara Safari Area and region

The current activity of Citizen Hunting (and possibly limited Safari Hunting) practised in part of Charara/Makuti study area does not appear to be the most rational land-use for this area that would maximize conservation and development benefits for the region.

Decision-makers must determine the priority of earning foreign exchange revenue versus Zimbabwe dollar revenue as a resource of crucial importance to Zimbabwe's economy. Establishing this policy priority is of critical importance to all further decision-making and evaluation of options.

6.5.3. Lack of baseline information for ecological monitoring and planning

The evaluation of land-use options for Charara/Makuti demands a detailed resource inventory to be undertaken, and was outside the scope of this study. The importance of undertaking such a study in terms of comprehensive planning for the land bounding the eastern section of Lake Kariba cannot be emphasized enough, and needs urgent consideration. Planning processes should consult widely with all parties on the ground, and incorporate existing planning documents for the region (eg. Hutton, 1991).

6.6. The policy options available to the DNPWLM for land-use in the study area

Option A: Continue present (1991) policy: Exclusive subsidized citizen hunting in the entire Charara/Makuti study area, allocated using an inefficient and inequitable lottery system.

The Charara/Makuti area is used as an exclusive hunting area for Zimbabwe citizens to hunt big game and limited plains game at subsidized prices. Trophy hunts, non-trophy venison hunts and mixed trophy and non-trophy hunts will continue to be allocated wastefully and inequitably to wealthy citizens. Conservation and development benefits will not be maximized from the resources in the area. Long term sustainability is questionable, for example maintenance of endangered black rhinoceros populations in this area that was previously renowned for the species.

Clarify specific citizen hunting objectives. If the criteria of efficiency and equality as defined in this report are appropriate, consider implementing the recommendations made in this report for improving the efficiency and equality of hunt allocation.

Option B: Discontinue present policy: Instead, introduce exclusive subsidized citizen hunting in the entire Charara/Makuti study area, allocated using a more efficient and equitable lottery system.

The Charara/Makuti area remains an exclusive hunting area for Zimbabwe citizens. Hunts are allocated using either the Wyoming or ZHA lottery system to achieve a greater or lesser degree of equality amongst all persons for winning a hunt in these areas. The costs of administering such a system are judged to be high, and greater than for the administration of the present lottery system. The value of foregone benefits (opportunity costs) to Zimbabwe's economy, the Zimbabwe Government, the DNPWLM, and non-hunting visitors remains high.

Option C: Discontinue present policy: Instead, introduce non-exclusive competitively allocated sport hunting resources in the entire Charara/Makuti study area, allocated using an efficient, competitive auction system. Retain present financial institutional arrangements between DNPWLM and government.

Auction the sport hunting quota as basic hunts and individual species to earn the maximum price of the day. The Charara/Makuti area would become a non-exclusive hunting area accessible to any person who can pay market prices. Market prices for hunting are decided by the individual bidders' willingness to pay, and the available supply of hunting opportunities. Market forces also determine the proportion of hunting resources that are finally allocated between various market participants (eg. citizen hunters versus foreign hunters), and thus the proportion of revenue earned as Zimbabwe dollars and as foreign exchange. The revenue and net value from the auctioned sport hunting resources (consumptive and non-consumptive) are maximized for the landowner, in this case the DNPWLM who is responsible for Zimbabwe's protected areas. The amount of foreign

exchange earned from the resources for the country is maximized, and subsidies of any type of sport hunting in the Charara/Makuti can be eliminated. All participants have the assurance that they can buy the available hunting resources at the lowest market price of the day.

Opportunities for safari operators to access to Zimbabwe's most valuable big game species for trophy hunting (especially of a prime species such as buffalo) are increased using a well known, efficient, and accountable auction procedure. With more participants in the safari hunting industry, competition is enhanced.[1] (Access to big game resources, particularly for emergent safari operators, is probably the single biggest limitation to growth in Zimbabwe's safari hunting industry at present. See Price Waterhouse, 1992b: Volume 4.)

Under option C, despite these innovations, all hunting revenue earned at the auction would continue to be returned to central treasury and not be available to the DNPWLM for conservation and development of the natural, human, or physical resource base.

Option D: Discontinue present policy: Introduce exclusive sport hunting in the Charara/Makuti study area, and allocate the entire area to one single safari operator using a competitive auction. Retain present financial institutional arrangements between DNPWLM and government.

The Charara/Makuti area would become an exclusive hunting area accessible only to foreign hunters who can pay market prices in foreign exchange. Zimbabwe citizen hunters are excluded. The revenue from the auctioned sport hunting resources (quota and access rights) is maximized for the Zimbabwe Government, but no revenue is returned to the conservation agency or the resource area for development.

In contrast to Option C (above) and Option E following, opportunities for other safari operators to have access to big game species for trophy hunting are reduced. There are fewer participants and less competition in the safari hunting industry. In general, the lease period of safari hunting concessions made available by the DNPWLM is for 5-years, so that this system is less flexible for the agency and cannot take account of differences in market valuation or inflation during that period - costs borne by the DNPWLM up till now as reduced nominal and real revenues, respectively. Opportunity costs for conservation remain high.

[1] Competition is recognized as a necessary and positive factor in any industry and economy. There are benefits for new participants, consumers, and producers in the longer term to have a mechanism that ensures the lowest prices possible and high quality service and product.

Option E: Discontinue present policy: Instead promote quality sport hunting and various non-hunting activities based on market prices and integrated land-use in the entire Charara/Makuti study area. Alter the present financial institutional arrangements between DNPWLM and government.

Auction all sport hunting using a competitive market to anyone willing to pay market prices. Participants should include citizen hunters, foreign safari hunters, safari operators and dealers. Hunting licences should be made legally transferable. It is anticipated that more Zimbabwe citizens will join the local Zimbabwe Hunter's Association (ZHA) as a result of citizen hunting being priced at market prices, resulting in lower probabilities of winning a hunt for all members of the association. To counter balance this effect, and to reduce the opportunity costs of the ZHA lottery system, the association should be allowed to sell hunting to earn foreign exchange. This revenue can either be used for conservation education, or to increase the hunting opportunities already offered by the association.

With this option the DNPWLM would have all the revenue from auctioning the sport hunting resources available for conservation and development of the Charara/Makuti study area. The Charara/Makuti study area should be developed within an holistic policy framework to integrate multiple land-uses in the area. Consumptive and non-consumptive land-uses should be combined for the greater Charara/Makuti region. The Kuburi Wilderness Area, the communal land areas currently developing community based wildlife programmes, the recreational park of Lake Kariba, and the nearby urbanized areas of Kariba, Makuti, Vuti towns should be included. Development in the region should be harmonized, using economic and market incentives to promote wildlife conservation and tourist-based development.

Development potential includes: increasing hunting opportunities for Zimbabweans in the Parks and Wild Life Estate; providing all hunters and accompanying non-hunters with quality serviced hunting campsites; promoting guided non-consumptive recreational activities such as hiking trails, horse trails, and others. Revenue from sport hunting needs to be returned to the resource area to be used productively for the development and distribution of benefits.

A mandatory shooting test should be instituted for all sport hunters (Zimbabwe citizen hunters and foreign safari hunters) to improve shooting quality, reduce wounding of animals, and reduce follow-ups that are costly in terms of time, money and effort for DNPWLM staff and hunters alike.

6.7. The case for auctioning the study area's sport hunting resources

Only if clear, quantifiable objectives are set by the DNPWLM policy, and detailed park plans are drawn up for each protected area, each form of land-use, and thus for the licensing system and hunt allocation in the Charara/Makuti study area, can economic principles of efficiency and political principles of equality be rationally applied to resource allocation. With neither a coherent policy, nor specific plans, definitive recommendations for any one lottery system cannot be made within the scope of this dissertation. In the comparison of lottery and auction

systems, however, the magnitude of the differences is so great that the author felt it would be irresponsible to omit the recommended obvious course of action.

A guiding tenet for decision-makers, however, should be that all resources involved in the production and distribution of hunting are scarce, and limited. Scarce resources for the DNPWLM include:

- the protected area's natural resource base of wildlife and associated eco-systems;
- human resources to accompany each hunting party (agency staff);
- human resource expertise for administration, research, and management of the resource base; and most important of all financial, resources.

It follows, therefore, that resources should be allocated so as to maximize present and future benefits for people, whilst minimizing present and future costs to society. In environmental terms, policies and actions should be efficient, equitable, and above all sustainable in ecological and financial terms (see Leibold, 1991).

Equality, however this goal is defined, has costs of some kind or other which are borne by various groups of people. In Chapter 4 the dissertation revealed and quantified some of the implicit microeconomic costs incurred by the DNPWLM and by Zimbabwe citizen hunters during the 1991 hunt allocation process. Chapter 5 considered and partially quantified other macroeconomic costs of using the fix-priced DNPWLM lottery system rather than market-priced systems to value and allocate hunting resources in the Charara/Makuti study area. It is recommended that **Option E** be considered by the DNPWLM as having the least direct and indirect costs overall for Zimbabwe, and the potential to achieve the greatest conservation and development benefits from the natural resource base.

In revealing these costs of lottery systems, a snapshot view of the data was taken as though there was a lottery with a specific number of applicants in any year. By taking a more realistic dynamic view, it can be seen that over time with rising incomes, a larger population, and changing recreational tastes, sport hunting could easily become more popular, with the consequence that the number of applicants in any lottery would increase from year to year. This trend has been noticeable with the hunting membership of the Zimbabwe Hunters' Association, for years where data is available (see Chapter 3, Table 3.7, page 80). With rising membership and applicants and an unchanged number of hunts to be allocated by a lottery system, **the hidden costs of lottery systems for all applicants are a lower probability for any citizen hunter to win any hunt at all.** In this situation, the costs of lottery systems are not obvious, but very real for all participants who want to go sport hunting.

The main advantages of using a competitive auction in **Option E** to allocate scarce resources for sport hunting are as follows:

- **With auctions, the processes of valuation, allocation, and distribution all adjust dynamically over time, whereas for lotteries they are static.**

For example, if the number of applicants for a particular hunt increases (the hunt becomes more popular, the species become less numerous, or hunter's incomes rise), then in a market-priced system higher hunt prices result and applicants who bid unsuccessfully at the auction would instead demand other hunts elsewhere in Zimbabwe (eg. on communal land and private land with wildlife enterprises). The price of these hunt alternatives would also rise and signal potential suppliers to increase the supply of these hunt alternatives. The net result of the market-priced system: More hunters can go to hunt, some at higher prices, and some at lower prices.

Contrary to this flexible interplay between price, demand and supply, an increase in demand for one type of hunt with a fix-priced lottery system would cause **all applicants, not only the final draw winner**, to collectively have a lower probability of winning this specific hunt. None of the remaining hunt's prices would rise in the lottery system due to the increased demand. The net result of the lottery system: The same number of persons go and hunt at fixed prices and everyone has less chance of winning a hunt at all. There is no economic incentive for suppliers of hunting alternatives in other areas of Zimbabwe (eg. on communal land and on private land) to increase the quantity of hunts supplied if a lottery system is used to allocate resources. Lottery systems are static, and merely distribute the available hunts according to some pre-defined pattern and definition of equality. Revenue earned from lottery systems is fixed. All participants (not just the winners of the lottery) incur an unpaid additional "price", or cost, from randomizing citizen hunting benefits of winning a valuable hunt at fixed prices for all applicants, namely a reduced chance of winning and actually going hunting for everyone.

- **Prices are incentives and information signals for people demanding and supplying a scarce resource; as such, prices are one of a competitive market's main properties and advantages[1].**

With monetary prices and valuations, costs and benefits of allocation decisions are at least made explicit for all persons concerned. Monetary units have the advantage of being comparable between persons as their willingness to pay for resources and benefits. Resource allocation decisions based on non-monetary allocation mechanisms, such as the draw probability in a lottery or the time wasted in a queue, are economic decisions. However, despite the disappointment of not winning a hunt or of not being allocated one's most preferred hunt being real costs for individual citizen hunters, these costs are not explicit, and are rarely quantified by those affected, because they remain unpriced.

Efficiency of hunt allocation as defined in Chapter 4 is not, therefore, based on the costs of producing these hunting benefits for all Zimbabwe citizens. One such implicit cost is that other Zimbabwean producers of wildlife and wildlife products (eg. sport hunting) are not given economic incentives to produce more hunts for Zimbabwe citizens even if a lottery system that uses subsidized prices for big game allocates all hunts efficiently to applications is used. Consequently, lottery systems that allocate citizen hunting affect the efforts of the CAMPFIRE programme, whose main rational is to place the highest economic value on natural resources that previously had low, or zero economic value for communities concerned.

Ideally, efficiency should consider the financial sustainability (profitability) of supplying and distributing resources, in addition to the well known criterion of ecological sustainability. Resource management of protected areas in Zimbabwe should **incorporate the goals of ecological and financial sustainability for present and future generations of Zimbabweans.**

[1] The Austrian School of economics emphasizes market mechanisms as incentives and as constant sources of information for resource allocation decisions by all participants. See O'Driscoll and Rizzo (1985): 105-106, and Shand (1990). Also Lancaster (1979) in the context of firms, and McNeely (1988) in the context of conserving bio-diversity.

6.8. Summary of actions for decision-makers in the study area

At a policy level:

- Alter institutional arrangements to make DNPWLM financially independent and responsible for all revenue and costs from the Charara/Makuti study area.
- Decide on resource allocation principles for wildlife conservation and resource allocation in protected areas versus similar activities on all other (non-protected) land areas in Zimbabwe.
- Determine the priority bio-diversity conservation goals and strategies to manage the Charara/Makuti study area as an integral part of the ecological processes (eg. elephant migration routes) within it, and those on all surrounding land categories. Plan in close consultation with all local communities.

At a practical level: By 1994

- Institute a competitive auction system to allocate sport hunting resources in the Charara/Makuti study area to all participants, on the basis that they are willing to pay market prices in Zimbabwe dollars (**Option E**). Market participants should include Zimbabwean and foreign safari operators, Zimbabwean agents for foreign hunters, foreign hunters in person, and Zimbabwe citizen hunters.
- The hunting licence, which incorporates the right to enter the hunting area, to hunt a specific quota within a specific time period between set calendar dates, and to camp at a demarcated site, should be made legally transferable.
- Consult with Tsetse Control in the Department of Veterinary Services, the Zimbabwe National Army, Campfire representatives and the Kariba town planning authorities to coordinate an integrated plan and approach to development for the region surrounding the eastern shoreline of Lake Kariba.

At a practical level: By 2000

- Draw up a resource inventory and zonation plan.
- Develop a park plan for the Charara/Makuti study area integrating it into neighbouring areas and land-use developments.
- Develop park plan in a consultative process. Institute a business plan, complete development and baseline documents.
- Finalize institutional decision-making for financial and budget independence of the DNPWLM from the Zimbabwe Government's central budget.

References

n.d. = no date of publication
n.p. = no place of publication, and = no publisher.
Italics = title of whole published work and title of periodical. Unpublished works are not italicized.
[ ] = inferred from other sources; either personal knowledge, or details otherwise in the published or unpublished material.

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Wotton, T., TWA Auctioneers, PO Box HG 622, Highlands, Harare, Zimbabwe.
Zvinongoza, S., Warden Marongora, Department of National Parks and Wild Life Management, Private Bag 2002, Karoi, Zimbabwe.

Appendices

Appendix 1 Common and scientific names of species

Common Name	Scientific Name
Baboon	*Papioursinus*
Bat-eared Fox	*Otocyon megalotis*
Blesbok	*Damaliscus dorcas phillipsi*
Buffalo	*Syncerus caffer*
Bushbuck	*Tragelaphus scriptus*
Bushpig	*Potamocheorus porcus*
Civet, african	*Civettictis civetta*
Crocodile	*Crocodylus niloticus*
Duiker, common	*Sylvicapra grimmia*
Eland	*Taurotragus oryx*
Elephant	*Loxodonta africana*
Fallow deer	*Dama dama*
Francolin	*Francolinus sp.*
Genet, small-spotted	*Genetta genetta*
Giraffe	*Giraffa camelopardalis*
Grysbok, Sharpe's	*raphicerus sharpei*
Guinea Fowl, crowned and crested	*Numida meleagris, and Guttera eduardi*
Hippopotamus	*Hippopotamus amphibius*
Hyaena, spotted	*Crocuta crocuta*
Impala	*Aepyceros melampus*
Jackal, side-striped and black-backed	*Canis adustus, and Canis meomelas*
Klipspringer	*Oreotragus oreotragus*
Kudu	*Tragelaphus strepisceros*
Leopard	*Panthera pardus*
Lion	*Panthera leo*
Nyala	*Tragelaphus angasii*
Pigeon/Dove	*Columba sp, Streptopelia sp., Turtur sp.*
Porcupine	*Hystrix africaeaustralis*
Red hartebeest	*Alcelaphus buselaphus*
Reedbuck	*Redunca arundinum*
Reedbuck, mountain	*Redunca fulvorufula*
Sable	*Hippotragus niger*
Serval	*Felis serval*
Springbok	*Antidorcas marsupialis*
Steenbok	*Raphicerus campestris*
Tsessebe	*Damaliscus lunatus*
Warthog	*Phacochoerus aethiopicus*
Waterbuck	*Kobus ellipsiprymnus*
Wild cat, african	*Felis lybica*
Wildebeest, black	*Connochaetes gnou*
Wildebeest, blue	*Connochaetes taurinus*
Zebra, Burchell's	*Equus burchelli*

Appendix 2 Quota allocation to hunts for Zimbabwe hunting areas: 1991

Appendix 2.1 Quota allocation: Charara Safari Area

CHARARA SAFARI AREA: ALLOCATION OF HUNTING QUOTAS 1991
Citizen Hunting Area (includes Makuti Totals)

YEAR: 1991

DATE from:	1.5	1.5	9.5	9.5	17.5	17.5	25.5	25.5	2.6	2.6	10.6	10.6	18.6	18.6	26.6	26.6
DATE to:	7.5	7.5	15.5	15.5	23.5	23.5	31.5	31.5	8.6	8.6	16.6	16.6	24.6	24.6	2.7	2.7
DRAW NO.	4	5	9	10	14	15	19	20	24	25	29	30	34	35	39	40
HUNT NO.	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
SPECIES																
Elephant (M)								1								
Elephant (F)																
Elephant (F tl)																
Zebra																
Hippopotamus																
Bushpig																
Warthog		1				1			1			1				1
Giraffe																
Buffalo (M)	1		1		1		1			1		1		1		1
Buffalo (F)		1		1		1			1		1		1		1	
Buffalo (NT)																
Nyala																
Bushbuck (M)																
Kudu (M)																
Kudu (F)																
Eland (M)											1					
Eland (F)																
Duiker	1		1			1				1		1				
Reedbuck																
Waterbuck (M)																
Waterbuck (F)																
Sable (M)																
Sable (F)																
Wildebeest																
Tsessebe																
Impala (M)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Impala (F)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Impala (cull)																
Klipspringer																
Steenbok																
Grysbok																
Lion (M)																
Lion (F)																
Leopard																
Wildcat																
Serval																
Genet																
Civet																
Hyaena																
Jackal																
Bat-eared Fox																
Porcupine																
Baboon		1		1		1		1		1		1		1		1
Crocodile																
Guinea Fowl	3	3	3	3	3	3	3	4	4	4	4	3	3	3	3	3
Francolin	3	3	3	3	3	3	3	4	4	4	4	3	3	3	3	3
Pigeon/Dove	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Sandgrouse																
Duck																

NOTES
DATA SOURCE: DNPWLM Licensing Office, Harare.
cross-check with permits and kill-returns at Kariba and Marongora

CHARARA SAFARI AREA:

YEAR: 1991

DATE from:	4.7	4.7	12.7	12.7	20.7	20.7	28.7	28.7	5.8	5.8	13.8	13.8	21.8	21.8	29.8	29.8
DATE to:	10.7	10.7	18.7	18.7	26.7	26.7	3.8	3.8	11.8	11.8	19.8	19.8	27.8	27.8	4.9	4.9
DRAW NO.	44	45	49	50	54	55	59	60	64	65	69	70	74	75	79	80
HUNT NO.	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32
SPECIES																
Elephant (M)	1								1							
Elephant (F)																
Elephant (F tl)																
Zebra																
Hippopotamus																
Bushpig																
Warthog			1				1				1				1	
Giraffe																
Buffalo (M)			1		1		1			1		1		1		1
Buffalo (F)		1		1		1		1			1		1		1	
Buffalo (NT)																
Nyala																
Bushbuck (M)																1
Kudu (M)																
Kudu (F)																
Eland (M)																
Eland (F)																
Duiker																
Reedbuck																
Waterbuck (M)																
Waterbuck (F)																
Sable (M)																
Sable (F)																
Wildebeest																
Tsessebe																
Impala (M)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Impala (F)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Impala (cull)																
Klipspringer																
Steenbok																
Grysbok																1
Lion (M)																
Lion (F)																
Leopard																
Wildcat																
Serval																
Genet																
Civet																
Hyaena																
Jackal																
Bat-eared Fox																
Porcupine																
Baboon		1		1		1		1		1		1		1		1
Crocodile																
Guinea Fowl	5	5	5	5	5	5	4	5	4	5	4	5	5	5	5	4
Francolin	5	5	5	5	5	5	4	5	4	5	4	5	5	5	5	4
Pigeon/Dove	8	8	8	8	8	8	8	8	8	8	8	8	8	8	9	9
Sandgrouse																
Duck																
NOTES																
DATA SOURCE																

CHARARA SAFARI AREA:

YEAR: 1991

DATE from:	6.9	6.9	14.9	14.9	22.9	22.9	30.9	30.9	1991 CHARARA	1991 MAKUTI	1991 CHARARA TOTAL
DATE to:	12.9	12.9	20.9	20.9	28.9	28.9	6.10	6.10			
DRAW NO.	84	85	89	90	94	95	99	100	AUTHORIZED QUOTA ALLOCATED	AUTHORIZED QUOTA ALLOCATED	AUTHORIZED QUOTA ALLOCATED
HUNT NO.	C33	C34	C35	C36	C37	C38	C39	C40			
SPECIES											
Elephant (M)									3	3	6
Elephant (F)									0	0	0
Elephant (F tl)									0	0	0
Zebra									0	0	0
Hippopotamus									0	0	0
Bushpig									0	1	1
Warthog		1			1			1	12	18	30
Giraffe									0	0	0
Buffalo (M)									15	23	38
Buffalo (F)	1								15	23	38
Buffalo (NT)									0	0	0
Nyala									0	0	0
Bushbuck (M)	1	1	1	1	1	1	1	1	9	0	9
Kudu (M)									0	15	15
Kudu (F)									0	0	0
Eland (M)									1	0	1
Eland (F)									0	0	0
Duiker									5	40	45
Reedbuck									0	0	0
Waterbuck (M)									0	5	5
Waterbuck (F)									0	0	0
Sable (M)									0	3	3
Sable (F)									0	0	0
Wildebeest									0	0	0
Tsessebe									0	0	0
Impala (M)	2	2	2	1	1	1	1	1	76	0	76
Impala (F)	2	2	2	1	1	1	1	1	72	0	72
Impala (cull)									0	0	0
Klipspringer									0	9	9
Steenbok									0	0	0
Grysbok		1		1		1		1	5	40	45
Lion (M)		1			1				2	3	5
Lion (F)									0	0	0
Leopard			1			1		1	3	5	8
Wildcat									0	0	0
Serval									0	0	0
Genet									0	0	0
Civet									0	2	2
Hyaena									0	5	5
Jackal									0	0	0
Bat-eared Fox									0	0	0
Porcupine									0	2	2
Baboon		1		1		1		1	20	39	59
Crocodile									0	0	0
Guinea Fowl	5	3	3	3	3	3	3	3	154	217	371
Francolin	5	3	3	3	3	3	3	3	154	217	371
Pigeon/Dove	9	7	7	7	7	7	7	7	300	434	734
Sandgrouse									0	0	0
Duck									0	0	0

NOTES
DATA SOURCE

Appendix 2.2 Quota allocation: Makuti section (Hurungwe Safari Area)

HURUNGWE SAFARI AREA — ALLOCATION OF QUOTA TO HUNTS
MAKUTI SECTION — *Citizen Hunting Area*
YEAR: 1991

DATE from:	1.5	1.5	1.5	9.5	9.5	9.5	17.5	17.5	17.5	25.5	25.5	25.5	2.6	2.6	2.6	10.6	10.6	10.6	18.6	18.6	18.6
DATE to:	7.5	7.5	7.5	15.5	15.5	15.5	23.5	23.5	23.5	31.5	31.5	31.5	8.6	8.6	8.6	16.6	16.6	16.6	24.6	24.6	24.6
DRAW NO.	1	2	3	6	7	8	11	12	13	16	17	18	21	22	23	36	27	28	31	32	33
HUNT NO.	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21
SPECIES																					
Elephant (M)																					
Elephant (F)																					
Elephant (F tl)																					
Zebra																					
Hippopotamus																					
Bushpig																					
Warthog	1				1				1								1				
Giraffe																					
Buffalo (M)	1		1		1		1		1		1		1		1		1		1		1
Buffalo (F)		1		1		1		1		1		1		1		1		1		1	
Buffalo (NT)																					
Nyala																					
Bushbuck (M)																					
Kudu (M)																					
Kudu (F)																					
Eland (M)																					
Eland (F)																					
Duiker		1		1		1		1		1		1		1		1		1		1	
Reedbuck																					
Waterbuck (M)																					
Waterbuck (F)																					
Sable (M)																					
Sable (F)																					
Wildebeest																					
Tsessebe																					
Impala (M)																					
Impala (F)																					
Impala (cull)																					
Klipspringer																					
Steenbok																					
Grysbok																					1
Lion (M)																					
Lion (F)																					
Leopard																					
Wildcat																					
Serval																					
Genet																					
Civet																					
Hyaena															1						1
Jackal																					
Bat-eared Fox																					
Porcupine																					
Baboon		1		1		1		1		1		1		1		1		1		1	
Crocodile																					
Guinea Fowl	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Francolin	3	3	4	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Pigeon/Dove	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Sandgrouse																					
Duck																					

NOTES
DATA SOURCE — DNPWLM Licensing Office, Harare.
cross-check with permits and kill-returns at Kariba and Marongora

HURUNGWE SAFARI AREA
MAKUTI SECTION
YEAR: 1991

DATE from:	26.6	26.6	26.6	4.7	4.7	4.7	12.7	12.7	12.7	20.7	20.7	20.7	28.7	28.7	28.7	5.8	5.8	5.8	13.8	13.8	13.8
DATE to:	2.7	2.7	2.7	10.7	10.7	10.7	18.7	18.7	18.7	26.7	26.7	26.7	3.8	3.8	3.8	11.8	11.8	11.8	19.8	19.8	19.8
DRAW NO.	36	37	38	41	42	43	46	47	48	51	52	53	56	57	58	61	62	63	66	67	68
HUNT NO.	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36	M37	M38	M39	M40	M41	M42
SPECIES																					
Elephant (M)				1																1	
Elephant (F)																					
Elephant (F tl)																					
Zebra																					
Hippopotamus																					
Bushpig																					
Warthog		1					1			1			1			1					1
Giraffe																					
Buffalo (M)		1			1		1		1		1		1		1		1		1		1
Buffalo (F)	1		1			1		1		1		1		1		1		1			
Buffalo (NT)																					
Nyala																					
Bushbuck (M)																					
Kudu (M)																					
Kudu (F)																					
Eland (M)																					
Eland (F)																					
Duiker	1		1		1			1			1	1		1			1	1	1	1	1
Reedbuck																					
Waterbuck (M)																					
Waterbuck (F)																					
Sable (M)																					
Sable (F)																					
Wildebeest																					
Tsessebe																					
Impala (M)																					
Impala (F)																					
Impala (cull)																					
Klipspringer																					1
Steenbok																					
Grysbok	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lion (M)																					
Lion (F)																					
Leopard																					
Wildcat																					
Serval																					
Genet																					
Civet																					
Hyaena						1							1					1			
Jackal																					
Bat-eared Fox																					
Porcupine																					1
Baboon	1				1		1		1		1		1		1		1		1	1	1
Crocodile																					
Guinea Fowl	3			4	5	5	5	4	5	4	4	5	5	4	5	5	4	5	5	5	4
Francolin	3			4	5	5	5	4	5	4	4	5	5	4	5	5	4	5	5	5	4
Pigeon/Dove	7			7	8	8	8	8	8	8	8	8	9	8	8	8	8	8	8	8	8
Sandgrouse																					
Duck																					

NOTES: M31 Permit has unallocated Klipspringer.
DATA SOURCE

HURUNGWE SAFARI AREA
MAKUTI SECTION
YEAR: 1991

DATE from:	21.8	21.8	21.8	29.8	29.8	29.8	6.9	6.9	6.9	14.9	14.9	14.9	22.9	22.9	22.9	30.9	30.9	30.9	1991 MAKUTI
DATE to:	27.8	27.8	27.8	4.9	4.9	4.9	12.9	12.9	12.9	20.9	20.9	20.9	28.9	28.9	28.9	6.10	6.10	6.10	
DRAW NO.	71	72	73	76	77	78	81	82	83	86	87	88	91	92	93	96	97	98	AUTHORIZED
HUNT NO.	M43	M44	M45	M46	M47	M48	M49	M50	M51	M52	M53	M54	M55	M56	M57	M58	M59	M60	QUOTA ALLOCATED
SPECIES																			
Elephant (M)						1													2
Elephant (F)																			0
Elephant (F tl)																			0
Zebra																			0
Hippopotamus																			0
Bushpig															1				1
Warthog		1			1		1		1		1			1			1	1	16
Giraffe																			0
Buffalo (M)		1		1															23
Buffalo (F)	1		1		1		1												23
Buffalo (NT)																			0
Nyala																			0
Bushbuck (M)																			0
Kudu (M)	1		1		1		1	1	1	1	1	1	1	1	1	1	1	1	15
Kudu (F)																			0
Eland (M)																			0
Eland (F)																			0
Duiker	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	40
Reedbuck																			0
Waterbuck (M)														1	1	1	1	1	5
Waterbuck (F)																			0
Sable (M)										1		1			1				3
Sable (F)																			0
Wildebeest																			0
Tsessebe																			0
Impala (M)																			0
Impala (F)																			0
Impala (cull)																			0
Klipspringer		1		1		1		1		1		1		1		1			6
Steenbok																			0
Grysbok	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	40
Lion (M)								1					1					1	3
Lion (F)																			0
Leopard									1		1			1		1	1		5
Wildcat																			0
Serval																			0
Genet																			0
Civet												1						1	3
Hyaena																			0
Jackal															1				0
Bat-eared Fox																			0
Porcupine						1													2
Baboon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	36
Crocodile																			0
Guinea Fowl	5	5	4	5	5	4	5	3	3	3	3	3	3	3	3	3	3	3	217
Francolin	5	5	4	5	5	4	5	3	3	3	3	3	3	3	3	3	3	3	217
Pigeon/Dove	8	8	8	8	9	9	9	7	7	7	7	7	7	7	7	7	7	7	434
Sandgrouse																			0
Duck																			0

NOTES
DATA SOURCE

Appendix 2.3 Quota allocation: Tuli Safari Area

TULI SAFARI AREA: ALLOCATION OF QUOTA TO HUNTS
Matabeleland Hunter's Association
YEAR: 1991

DATE from:	27.4	27.4	11.5	11.5	25.5	25.5	8.6	8.6	22.6	22.6	6.7	6.7	20.7	20.7	3.8	3.8	17.8	17.8
DATE to:	7.5	7.5	21.5	21.5	4.6	4.6	18.6	18.6	2.7	2.7	16.7	16.7	30.7	30.7	13.8	13.8	27.8	27.8
HUNT NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SPECIES	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
Elephant (M)	1		1															
Elephant (F)																		
Elephant (F tl)																		
Zebra						1		1		1		1		1		1		1
Hippopotamus																		
Bushpig																		
Warthog	1		1															
Giraffe																		
Buffalo (M)																		
Buffalo (F)																		
Buffalo (NT)																		
Nyala																		
Bushbuck (M)		1		1		1												
Kudu (M)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Kudu (F)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Eland (M)	1	1	1	1	1	1	1		1		1		1		1		1	
Eland (F)								1		1		1		1		1		1
Duiker		1		1		1		1		1		1		1		1		
Reedbuck																		
Waterbuck (M)																		
Waterbuck (F)																		
Sable (M)																		
Sable (F)																		
Wildebeest							1		1		1		1		1		1	
Tsessebe																		
Impala (M)	20	26	20	26	20	26	20	26	20	26	20	26	20	26	20	26	20	26
Impala (F)	20	26	20	26	20	26	20	26	20	26	20	26	20	26	20	26	20	26
Impala (cull)																		
Klipspringer																		
Steenbok		1		1		1		1		1		1		1		1		1
Grysbok																		
Lion (M)																		
Lion (F)																		
Leopard		1			1		1					1			1			
Wildcat																		
Serval																		
Genet																		
Civet																		
Hyaena	1		1		1													
Jackal							1		1		1		1					
Bat-eared Fox																		
Porcupine																		
Baboon	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Crocodile																		
Guinea Fowl	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Francolin	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5
Pigeon/Dove	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5
Sandgrouse	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5
Duck																		

NOTES
Lion (M) and Lion (F) were not allocated, by choice.
Dates are the actual hunting days. Hunter can enter/leave the camp 1 day before/after the date given above.
Full refund of $7500 will be given on unshot Elephant (M).
8 Bushpig are available on request at $75 each.

DATA SOURCE
ZHA allocation sheet, Harare.

TULI SAFARI AREA:

YEAR: 1991

DATE from:		31.8	31.8	14.9	14.9	28.9	28.9	12.10	12.10	1991 TULI
DATE to:		10.9	10.9	24.9	24.9	8.10	8.10	22.10	22.10	TOTAL
HUNT NO.		19 N	20 S	21 N	22 S	23 N	24 S	25 N	26 S	AUTHORIZED QUOTA
SPECIES										ALLOCATED
Elephant (M)										2
Elephant (F)										0
Elephant (F tl)										0
Zebra			1		1		1			10
Hippopotamus										0
Bushpig										0
Warthog										2
Giraffe										0
Buffalo (M)										0
Buffalo (F)										0
Buffalo (NT)										0
Nyala										0
Bushbuck (M)										3
Kudu (M)		1	1	1	1	1		1		24
Kudu (F)		1	1	1	1	1		1		24
Eland (M)		1		1		1		1		16
Eland (F)			1		1					8
Duiker										8
Reedbuck										0
Waterbuck (M)										0
Waterbuck (F)										0
Sable (M)										0
Sable (F)										0
Wildebeest		1		1		1		1		10
Tsessebe										0
Impala (M)		20	26	20	26	20	26	20		572
Impala (F)		20	26	20	26	20	26	20		572
Impala (cull)										0
Klipspringer										0
Steenbok			1		1		1			12
Grysbok										0
Lion (M)										0
Lion (F)										0
Leopard										5
Wildcat										0
Serval										0
Genet										0
Civet										0
Hyaena										3
Jackal										4
Bat-eared Fox										0
Porcupine										0
Baboon		2	2	2	2	2	2	2		50
Crocodile										0
Guinea Fowl		2	2	2	2	2	2	2		50
Francolin		10	5	10	5	10	5	10	5	195
Pigeon/Dove		10	5	10	5	10	5	10	5	195
Sandgrouse		10	5	10	5	10	5	10	5	195
Duck										0

NOTES

DATA SOURCE

Appendix 2.4 Quota allocation: Doma Safari Area

DOMA SAFARI AREA: ALLOCATION OF QUOTA TO HUNTS
Lomagundi Hunter's Association
YEAR: 1991

DATE from:	1.5	16.5	31.5	15.6	30.6	15.7	30.7	14.8	29.8	13.9	TOTAL DOMA
DATE to:	12.5	27.5	11.6	26.6	11.7	26.7	10.8	25.8	9.9	24.9	
HUNT NO.	1	2	3	4	5	6	7	8	9	10	AUTHORIZED QUOTA
SPECIES											ALLOCATED
Elephant (M)	1	1									2
Elephant (F)			1	1	1	1	1	1	1	1	8
Elephant (F tl)											0
Zebra		1		1		1					3
Hippopotamus											0
Bushpig	2	2	1	1	1	1	1	1	1	1	12
Warthog	2	2	2	2	2	2	2	2	2	2	20
Giraffe											0
Buffalo (M)	1	1	1	1	1	1	1	1	1	1	10
Buffalo (F)	1	1	1	1	1	1	1	1	1	1	10
Buffalo (NT)											0
Nyala											0
Bushbuck (M)	1		1		1		1		1		5
Kudu (M)	1	1		1		1		1		1	6
Kudu (F)											0
Eland (M)		1		1		1		1			4
Eland (F)			1		1		1		1		4
Duiker	1	1	1	1	1	1	1	1	1	1	10
Reedbuck											0
Waterbuck (M)											0
Waterbuck (F)											0
Sable (M)			1	1	1	1	1	1	1	1	8
Sable (F)											0
Wildebeest											0
Tsessebe											0
Impala (M)											0
Impala (F)											0
Impala (cull)											0
Klipspringer											0
Steenbok											0
Grysbok	1	1	1	1	1	1	1	1	1	1	10
Lion (M)											0
Lion (F)											0
Leopard			1		1		1				3
Wildcat											0
Serval											0
Genet											0
Civet											0
Hyaena											0
Jackal											0
Bat-eared Fox											0
Porcupine											0
Baboon	2	2	2	2	2	2	2	2	2	2	20
Crocodile											0
Guinea Fowl	10	10	10	10	10	10	10	10	10	10	100
Francolin	10	10	10	10	10	10	10	10	10	10	100
Pigeon/Dove	20	20	20	20	20	20	20	20	20	20	200
Sandgrouse											0
Duck											0

NOTES: LHA offers additional animals on application @ DNPWLM prices + 20%.
Dates are the actual hunting days. Hunter can enter or leave the camp 1 day before/after the date given above. Full refund of $7500 will be given on unshot Elephant (M).

DATA SOURCE: ZHA allocation sheet, Mhangura.

Appendix 2.5 Quota allocation: Rifa section (Hurungwe Safari Area)

HURUNGWE SAFARI AREA — ALLOCATION OF QUOTA TO HUNTS
RIFA SECTION — *Mashonaland Hunter's Association*
YEAR: 1991

DATE from:	27.4	27.4	27.4	11.5	11.5	11.5	25.5	25.5	25.5	8.6	8.6	8.6	22.6	22.6	22.6	6.7	6.7	6.7	20.7	20.7	20.7	3.8	3.8	3.8	17.8	17.8
DATE to:	7.5	7.5	7.5	21.5	21.5	21.5	4.6	4.6	4.6	18.6	18.6	18.6	2.7	2.7	2.7	16.7	16.7	16.7	30.7	30.7	30.7	13.8	13.8	13.8	27.8	27.8
HUNT NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
SPECIES	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B
Elephant (M)								1			1			1			1			1							
Elephant (F)																										
Elephant (F tl)																										
Zebra					1										1											
Hippopotamus				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1			1			1
Bushpig																										
Warthog	1	1	1	1	1	1	1		1	1		1	1		1	1		1	1		1	1	1	1	1	1
Giraffe																										
Buffalo (M)	1	1	1	1	1	1	1		1	1		1	1		1	1		1	1		1	1	1	1	1	1
Buffalo (F)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Buffalo (NT)																										
Nyala																										
Bushbuck (M)		1						1				1	1				1				1	1				1
Kudu (M)				1		1		1		1			1		1			1			1	1		1		
Kudu (F)	1				1				1		1			1			1		1	1			1		1	
Eland (M)										1																
Eland (F)																										
Duiker																										
Reedbuck																										
Waterbuck (M)					1							1									1				1	
Waterbuck (F)																										
Sable (M)																										
Sable (F)																										
Wildebeest																										
Tsessebe																										
Impala (M)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Impala (F)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Impala (cull)																										
Klipspringer																										
Steenbok																										
Grysbok	1	1	1	1	1																					
Lion (M)							1					1				1			1							
Lion (F)									1				1					1					1			
Leopard						1				1					1											1
Wildcat																										
Serval																										
Genet																										
Civet																										
Hyaena			1			1			1			1			1			1			1			1		
Jackal								1																		
Bat-eared Fox																										
Porcupine																										
Baboon	2	2	2	2	2	6	2	2	2	6	2	2	2	2	6	2	2	2	2	2	2	2	2	2	2	6
Crocodile																										
Guinea Fowl	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3
Francolin	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Pigeon/Dove	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sandgrouse																										
Duck																										

NOTES: Dates are the actual hunting days. Hunter can enter/leave the camp 1 day before/after the date given above.
One camp with elephant (M) is raffled to members each AGM.

DATA SOURCE: ZHA allocation sheet, Harare.

HURUNGWE SAFARI AREA
RIFA SECTION
YEAR: 1991

DATE from:	17.8	31.8	31.8	31.8	14.9	14.9	14.9	28.9	28.9	28.9	12.1	12.1	12.1	1991 RIFA
DATE to:	27.8	10.9	10.9	10.9	24.9	24.9	24.9	8.10	8.10	8.10	22.1	22.1	22.1	
HUNT NO.	27	28	29	30	31	32	33	34	35	36	37	38	39	AUTHORIZED
SPECIES	C	A	B	C	A	B	C	A	B	C	A	B	C	QUOTA ALLOCATED
Elephant (M)														5
Elephant (F)														0
Elephant (F tl)														0
Zebra														2
Hippopotamus			1			1								20
Bushpig														0
Warthog	1	1	1	1	1	1	1	1						29
Giraffe														0
Buffalo (M)	1	1	1	1	1	1	2	2	2	1	1	1	1	97
Buffalo (F)	1	1	1	1	1	1	1	1	1	1	1			37
Buffalo (NT)														0
Nyala														0
Bushbuck (M)				1		1								10
Kudu (M)	1				1									12
Kudu (F)		1												11
Eland (M)														1
Eland (F)														0
Duiker														0
Reedbuck														0
Waterbuck (M)			1				1							6
Waterbuck (F)														0
Sable (M)														0
Sable (F)														0
Wildebeest														0
Tsessebe														0
Impala (M)	12	12	12	12	12	12	12	12	12	12	10	10	10	462
Impala (F)	12	12	12	12	12	12	12	12	12	12	10	10	10	462
Impala (cull)														0
Klipspringer														0
Steenbok														0
Grysbok														5
Lion (M)														4
Lion (F)														4
Leopard														4
Wildcat														0
Serval														0
Genet														0
Civet														0
Hyaena	1			1			1			1				12
Jackal														1
Bat-eared Fox														0
Porcupine														0
Baboon	2	2	2	2	2	2	2	2	2	2	1	1	1	91
Crocodile														0
Guinea Fowl	3	3	3	2	2	2	2	2	2	2	2	2	2	122
Francolin	3	2	2	2	2	2	2	2	2	2	1	1	1	102
Pigeon/Dove	3	3	3	3	3	3	3	3	3	3	3	3	3	120
Sandgrouse														0
Duck														0

NOTES

DATA SOURCE

Appendix 2.6 Quota allocation: Dandawa impala hunts

HURUNGWE SAFARI AREA QUOTA ALLOCATION TO HUNTS
NYAKASANGA SECTION *Dandawa Impala Hunts*
YEAR 1991

DATE from		1.5	12.5	12.5	23.5	23.5	3.6	3.6	14.6	14.6	25.6	25.6	6.7	6.7	17.7	17.7	28.7	28.7	8.8	8.8	19.8	19.8	30.8	30.8	11.9	11.9	22.9	22.9	3.10	3.10	1991 DANDAWA TOTAL
DATE to		8.5	19.5	19.5	30.5	30.5	10.6	10.6	21.6	21.6	2.7	2.7	13.7	13.7	24.7	24.7	4.8	4.8	15.8	15.8	26.8	26.8	7.9	7.9	18.9	18.9	29.9	29.9	10.1	10.1	AUTHORIZED QUOTA ALLOCATED
HUNT NO		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	
SPECIES																															
Impala (M)		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	120
Impala (F)		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	60
NOTES																															
DATA SOURCE		DNPWLM Licensing Office, Harare																													

Appendix 2.7 Auction allocation result: Zambezi valley hunts

Appendix 2.7.1 Allocation result: Nyakasanga section (Hurungwe Safari Area)

HURUNGWE SAFARI AREA — ALLOCATION OF QUOTA TO HUNTS AS RESULT OF AUCTION
NYAKASANGA SECTION — *Zambezi Valley Auction Hunts*
YEAR: 1991

DATE from:	01.05	18.05	04.06	21.06	08.07	25.07	11.08	28.08	14.09	01.05	18.05	04.06	21.06	08.07	25.07	11.08	28.08	14.09
DATE to:	14.05	31.05	17.06	04.07	21.07	07.08	24.08	10.09	27.09	14.05	31.05	17.06	04.07	21.07	07.08	24.08	10.09	27.09
BUYER: Foreign/Local	F	F	F	F	F	F	F	F	L	F	F	F	F	F	L	F	L	L
HUNT NO.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18
CAMP	A	A	A	A	A	A	A	A	A	C	B	B	B	B	B	B	B	B
SPECIES																		
Elephant (M)																		
Elephant (F)																		
Elephant (F tl)																		
Zebra																		
Hippopotamus																		
Bushpig																		
Warthog	1	1	1	1	1	1	1	1	1									
Giraffe																		
Buffalo (M)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Buffalo (F)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Buffalo (NT)																		
Nyala																		
Bushbuck (M)																		
Kudu (M)	1	1	1	1	1	1	1	1	1	1								
Kudu (F)																		
Eland (M)																		
Eland (F)																		
Duiker	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Reedbuck																		
Waterbuck (M)																		
Waterbuck (F)																		
Sable (M)																		
Sable (F)																		
Wildebeest																		
Tsessebe																		
Impala (M)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Impala (F)	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Impala (cull)																		
Klipspringer																		
Steenbok																		
Grysbok	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lion (M)																		
Lion (F)																		
Leopard																		
Wildcat																		
Serval																		
Genet																		
Civet																		
Hyaena	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Jackal																		
Bat-eared Fox																		
Porcupine																		
Baboon	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Crocodile																		
Guinea Fowl	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Francolin	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Pigeon/Dove	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sandgrouse																		
Duck																		
SINGLE TROPHIES																		
Elephant (M)		1		1	1					1								
Elephant (F)																		
Zebra		1					1		1									
Hippopotamus									1				1		1			
Warthog			1															
Buffalo (M)											1							
Nyala																		
Bushbuck (M)			1				1											
Kudu (M)												1						
Waterbuck (M)		1					1		1				1		1			
Impala (M)																		
Impala (F)																	1	
Lion (M)	1	1				1	1											
Leopard					1			1	1			1	1					

NOTES — The Hunt allocation is pre-determined; the Single Trophies allocation shown, is the result of the auction.
DATA SOURCE — Sales Prospectus for 1991 Zambezi Vallez Hunting Camps, ABC Auctions

HURUNGWE SAFARI AREA
NYAKASANGA SECTION
YEAR: 1991

DATE from:	01.05	14.05	27.05	09.06	22.06	05.07	18.07	31.07	13.08	26.08	08.09	21.09	01.05	14.05	27.05	09.06	22.06	05.07
DATE to:	10.05	23.05	05.06	18.06	01.07	14.07	27.07	09.08	22.08	04.09	17.09	30.09	10.05	23.05	05.06	18.06	01.07	14.07
BUYER: Foreign/Local	F	L	L	F	F	F	F	F	F	F	F	F	F	F	F	L	L	F
HUNT NO.	N19	N20	N21	N22	N23	N24	N25	N26	N27	N28	N29	N30	N31	N32	N33	N34	N35	N36
CAMP	D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	E	E	E
SPECIES																		
Elephant (M)																		
Elephant (F)																		
Elephant (F tl)																		
Zebra																		
Hippopotamus																		
Bushpig																		
Warthog															1			
Giraffe																		
Buffalo (M)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Buffalo (F)	1	1	1	1	1	1	1	1	1	1	1	1						
Buffalo (NT)																		
Nyala																		
Bushbuck (M)																		
Kudu (M)																		
Kudu (F)																		
Eland (M)																		
Eland (F)																		
Duiker	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Reedbuck																		
Waterbuck (M)																		
Waterbuck (F)																		
Sable (M)																		
Sable (F)																		
Wildebeest																		
Tsessebe																		
Impala (M)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Impala (F)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Impala (cull)																		
Klipspringer																		
Steenbok																		
Grysbok	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lion (M)																		
Lion (F)																		
Leopard																		
Wildcat																		
Serval																		
Genet																		
Civet																		
Hyaena	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Jackal																		
Bat-eared Fox																		
Porcupine																		
Baboon	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Crocodile																		
Guinea Fowl	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Francolin	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Pigeon/Dove	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sandgrouse																		
Duck																		
SINGLE TROPHIES																		
Elephant (M)	1	1					1					1	1					
Elephant (F)																		
Zebra				1													1	
Hippopotamus											1			1				
Warthog						1											1	
Buffalo (M)										1								
Nyala																		
Bushbuck (M)						1												1
Kudu (M)				1		1								1				
Waterbuck (M)																1		
Impala (M)			1															
Impala (F)																	1	
Lion (M)																		
Leopard											1					1		1
NOTES																		
DATA SOURCE																		

HURUNGWE SAFARI AREA
NYAKASANGA SECTION
YEAR: 1991

DATE from:		18.07	31.07	13.08	26.08	08.09	21.09	1991 NYAKASANGA	1991 NYAKASANGA	1991 NYAKASANGA TOTAL
DATE to:		27.07	09.08	22.08	04.09	17.09	30.09			
BUYER: Foreign/Local		L	F	F	F	F	F			
HUNT NO.		N37	N38	N39	N40	N41	N42	AUCTIONED QUOTA HUNTS	AUCTIONED QUOTA TROPHIES	AUCTIONED QUOTA
CAMP		E	E	F	E	E	E			
SPECIES										
Elephant (M)								0	10	10
Elephant (F)								0	0	0
Elephant (F tl)								0		0
Zebra								0	5	5
Hippopotamus								0	5	5
Bushpig								0		0
Warthog				1				11	4	15
Giraffe								0		0
Buffalo (M)		1	1	1	1	1	1	42	2	44
Buffalo (F)								30		30
Buffalo (NT)								0		0
Nyala								0	0	0
Bushbuck (M)								0	5	5
Kudu (M)								10	5	15
Kudu (F)								0		0
Eland (M)								0		0
Eland (F)								0		0
Duiker		1	1	1	1	1	1	42		42
Reedbuck								0		0
Waterbuck (M)								0	6	6
Waterbuck (F)								0		0
Sable (M)								0		0
Sable (F)								0		0
Wildebeest								0		0
Tsessebe								0		0
Impala (M)		6	6	6	6	6	6	252	1	253
Impala (F)		7	7	7	7	7	7	312	3	315
Impala (cull)								0		0
Klipspringer								0		0
Steenbok								0		0
Grysbok		1	1	1	1	1	1	42		42
Lion (M)								0	4	4
Lion (F)								0		0
Leopard								0	10	10
Wildcat								0		0
Serval								0		0
Genet								0		0
Civet								0		0
Hyaena		1	1	1	1	1	1	42		42
Jackal								0		0
Bat-eared Fox								0		0
Porcupine								0		0
Baboon		4	4	4	4	4	4	168		168
Crocodile								0		0
Guinea Fowl		4	4	4	4	4	4	168		168
Francolin		4	4	4	4	4	4	168		168
Pigeon/Dove		12	12	12	12	12	12	504		504
Sandgrouse								0		0
Duck								0		0
SINGLE TROPIES										
Elephant (M)		1							10	
Elephant (F)									0	
Zebra									5	
Hippopotamus									5	
Warthog			1						4	
Buffalo (M)									2	
Nyala									0	
Bushbuck (M)			1						5	
Kudu (M)							1		5	
Waterbuck (M)									6	
Impala (M)									1	
Impala (F)					1				3	
Lion (M)									4	
Leopard			1		1				10	
NOTES										
DATA SOURCE										

Appendix 2.7.2 Allocation result: Sapi Safari Area

SAPI SAFARI AREA — ALLOCATION OF QUOTA TO HUNTS AS RESULT OF AUCTION
Zambezi Valley Auction Hunts
YEAR: 1991

DATE from:	01.05	18.05	04.06	21.06	08.07	25.07	11.08	28.08	14.09	01.05	18.05	04.06	21.06	08.07	25.07	11.08	28.08	14.09	01.05	14.05	27.05
DATE to:	14.05	31.05	17.06	04.07	21.07	07.08	24.08	10.09	27.09	14.05	31.05	17.06	04.07	21.07	07.08	24.08	10.09	27.09	10.05	23.05	05.06
BUYER: Foreign/Local	F	F	F	F	F	F	F	L	L	F	L	F	L	L	F	F	L	F	L	L	L
HUNT NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21
CAMP	G	G	G	G	G	G	G	G	G	H	H	H	H	H	H	H	H	H	CH-R	CH-R	CH-R
SPECIES																					
Elephant (M)																					
Elephant (F)																					
Elephant (F tl)																					
Zebra																					
Hippopotamus																					
Bushpig																					
Warthog			1				1		1												1
Giraffe																					
Buffalo (M)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Buffalo (F)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2
Buffalo (NT)																					
Nyala																					
Bushbuck (M)																					
Kudu (M)																				1	
Kudu (F)																					
Eland (M)																					
Eland (F)																					
Duiker	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Reedbuck																					
Waterbuck (M)																					
Waterbuck (F)																					
Sable (M)																					
Sable (F)																					
Wildebeest																					
Tsessebe																					
Impala (M)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Impala (F)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Impala (cull)																					
Klipspringer																					
Steenbok																					
Grysbok	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lion (M)																					
Lion (F)																					
Leopard																					
Wildcat																					
Serval																					
Genet																					
Civet																					
Hyaena										1	1	1	1	1	1	1	1	1			
Jackal																					
Bat-eared Fox																					
Porcupine																					
Baboon	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Crocodile																					
Guinea Fowl	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Francolin	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Pigeon/Dove	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sandgrouse																					
Duck																					
SINGLE TROPHIES																					
Elephant (M)			1				1					1						1			
Elephant (F)																					
Zebra	1										1										1
Hippopotamus	1										1	1				1					
Warthog		1						1			1	1	1					1			1
Buffalo (M)																					
Nyala										1	1		1								
Bushbuck (M)											1		1					1			
Kudu (M)																					
Waterbuck (M)	1				1		1				1							1			
Impala (M)																					
Impala (F)																					
Lion (M)										1		1			1						
Leopard	1	1								1											

NOTES — The Hunt allocation is pre-determined; the Single Trophies allocation shown, is the result of the auction.
DATA SOURCE — Sales Prospectus for 1991 Zambezi Vallez Hunting Camps, ABC Auctions

SAPI SAFARI AREA

YEAR: 1991

DATE from:	09.06	22.06	05.07	18.07	31.07	13.08	26.08	08.09	21.09	1991 SAPI	1991 SAPI	1991 SAPI TOTAL
DATE to:	18.06	01.07	14.07	27.07	09.08	22.08	04.09	17.09	30.09			
BUYER: Foreign/Local	F	L	F	F	F	F	L	L	F			
HUNT NO.	S22	S23	S24	S25	S26	S27	S28	S29	S30	AUCTIONED QUOTA HUNTS	AUCTIONED QUOTA TROPHIES	AUCTIONED QUOTA
CAMP	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R			
SPECIES												
Elephant (M)										0	4	4
Elephant (F)										0	0	0
Elephant (F tl)										0		0
Zebra										0	4	4
Hippopotamus										0	4	4
Bushpig										0		0
Warthog					1					5	10	15
Giraffe										0		0
Buffalo (M)	1	1	1	1	1	1	1	1	1	30	0	30
Buffalo (F)	1	2	1	2	1	2	1	2	1	36		36
Buffalo (NT)										0		0
Nyala										0	4	4
Bushbuck (M)										0	4	4
Kudu (M)	1		1		1		1		1	6	0	6
Kudu (F)										0		0
Eland (M)										0		0
Eland (F)										0		0
Duiker	1	1	1	1	1	1	1	1	1	30		30
Reedbuck										0		0
Waterbuck (M)										0	5	5
Waterbuck (F)										0		0
Sable (M)										0		0
Sable (F)										0		0
Wildebeest										0		0
Tsessebe										0		0
Impala (M)	7	7	7	7	7	7	7	7	7	210	0	210
Impala (F)	6	6	6	6	6	6	6	6	6	180	0	180
Impala (cull)										0		0
Klipspringer										0		0
Steenbok										0		0
Grysbok	1	1	1	1	1	1	1	1	1	30		30
Lion (M)										0	4	4
Lion (F)										0		0
Leopard										0	4	4
Wildcat										0		0
Serval										0		0
Genet										0		0
Civet										0		0
Hyaena										9		9
Jackal										0		0
Bat-eared Fox										0		0
Porcupine										0		0
Baboon	4	4	4	4	4	4	4	4	4	120		120
Crocodile										0		0
Guinea Fowl	4	4	4	4	4	4	4	4	4	120		120
Francolin	4	4	4	4	4	4	4	4	4	120		120
Pigeon/Dove	12	12	12	12	12	12	12	12	12	360		360
Sandgrouse										0		0
Duck										0		0
SINGLE TROPIES												
Elephant (M)											4	
Elephant (F)											0	
Zebra			1								4	
Hippopotamus											4	
Warthog		1	1						1		10	
Buffalo (M)											0	
Nyala		1									4	
Bushbuck (M)		1									4	
Kudu (M)											0	
Waterbuck (M)											5	
Impala (M)											0	
Impala (F)											0	
Lion (M)			1								4	
Leopard			1								4	

NOTES

DATA SOURCE

Appendix 3 Interviewed hunters

Chasura, L, Tatos Brothers, 77 Moffat Street, Harare, Zimbabwe (9.9.1991)

Mujuru, TSR, Commander, Zimbabwe Republic Army, KG6 Barracks, Harare, Zimbabwe (10.9.1991).

Sifeku, T, Harare Municipal Police, Gaul Avenue 5, Harare, Zimbabwe (12.9.1991).

Tavengwa, J, CID Firearms, Morris Depot, Harare, Zimbabwe (9.9.1991).

Appendix 4 Interview questions for hunters and non-hunters

1. Do you go and hunt wild animals?
2. Where do you hunt (communal/private/state land, other)?
3. Which animals would you prefer to hunt, in order of preference?
4. Would you prefer to choose the category of game yourself?
5. Would you like to choose when you would like to hunt?
6. How long would you like to hunt for?
7. What would you be prepared to pay for each animal?
8. Do you have any friends or relatives that you know would also like to hunt?
9. Are you a member of a hunter's association?
   9.1. If yes: What benefits do you have?
   9.2. If no: Why not?
10. Give your main reasons for going to hunt, in order of importance.
    10.1. For the game meat (and other products)?
    10.2. For the enjoyment of the sport of hunting, including the tracking and shooting of game, the bush life, and a holiday?
11. Can you suggest any way the hunting opportunities available for Zimbabweans could be improved?

Appendix 5 Computer simulation of DNPWLM lottery system for Charara/Makuti area

Appendix 5.1 Programme coding for simulating DNPWLM lottery system

The programme code below was written in Fortran 77 by statistical consultant L. McNiell. Her help is gratefully acknowledged. The programme simulates the lottery draw used by the DNPWLM for allocating hunts to hunting applicants in the Charara/Makuti study area during 1990 and 1991. The draw was simulated on a VAX computer, and due to the complex rules that govern the draw procedure, the programme used 10 hours of processing time. With suitable modification, processing time could be reduced. The simulation was based on actual data (see Appendix 5.2.1) from the applications in 1991, sourced at the DNPWLM licensing office in Harare, and additional data from hunting licences located at DNPWLM hunting offices in Marongora and Kariba. The random number generator used was Algorithm AS 183 (Wichmann and Hill, 1982).

```
C To simulate runs of lottery for DNPWLM
C
C np=no. of entrants, max 500
C nt=total no. of tickets purchased, max 3000
C nh=no. of hunts to be drawn
C ns= no. of simulations
C ix,iy,iz are seeds for the random number generator
C ftik(np)= number of first ticket for each entrant, assuming that
C       tickets are numbered sequentially, ie. if the first buyer buys
C       five tickets, he gets numbers one to five. In practice, it will
C       be simpler to allocate numbers in either increasing or decreasing
C       number of tickets eg. start with all the one-ticket buyers, then
C       the two-ticket buyers etc.
C wicd() = wins in current draw, for each entrant
C nw() = no of wins for each entrant
C new() = no of elephant wins
C nhun = number of hunt currently being drawn
C ic() = check of no of occurrences of each random no
C
C Note  This program is very inefficient in that numbers already drawn may be re-drawn. It would run a lot
C       faster if all tickets belonging to a winner were removed from the draw using a programming device
C       similar to subroutine SHUNT in program HUNTER, but note that a slightly more complex device is
C       required here since one applicant may have more than one ticket
C
      INTEGER np,nt,nh,ns,ftik(500),wicd(500),nw(500),new(500),
     &       ic(3000)
      COMMON/RAND/ix,iy,iz
      OPEN(unit=12,file='dnpwlm.par')
      open(unit=11,file='dnpwlm.out')

C Read input data
      read(12,*) ns,ix,iy,iz,np,nt,nh
      read(12,*) (ftik(i),i=1,np)
      ftik(np+1)=nt+1
      iix=ix
      iiy=iy
      iiz=iz

C Initialise number of wins for each entrant

      do 5 inp=1,np
        nw(inp)=0
        new(inp)=0
    5 continue

      do 6 i=1,nt
        ic(i)=0
    6 continue
```

```
C Main loop
      do 1000 ins=1,ns

C initialise wins in current draw, and no of wins
      do 10 inp=1,np
        wicd(inp)=0
   10 continue

      nhun=0

C start draw of next ticket, unless all hunts allocated
   12 nhun=nhun+1
      if(nhun.gt.nh) go to 1000

   15 ir=int((random(0)*nt)+1)
      ic(ir)=ic(ir)+1
C find who owns this ticket
      do 20 ip=1,np+1
        if(ir.ge.ftik(ip)) go to 20
        iwin=ip-1
        go to 22
   20 continue
C ticket holder iwin is the winner
C if he has won already, draw another ticket, else update
   22 if(wicd(iwin).eq.1) then
        go to 15
      else
        wicd(iwin)=1
        nw(iwin)=nw(iwin)+1
C check for elephants!
        if(nhun.eq.8 .or. nhun.eq.11 .or. nhun.eq.14 .or. nhun.eq.17
     &    .or. nhun.eq.20) new(iwin)=new(iwin)+1
        go to 12
      end if
 1000 continue

C ns simulations completed; print results
      write(11,1100) iix,iiy,iiz,np,nt,nh,ns,
     &  (ftik(i),ftik(i+1)-ftik(i),new(i),nw(i),i=1,np)

      stop

 1100 format(' rng seeds ', 3i6,/
     &       ' no entrants ',i6,/
     &       ' no tickets  ',i6,/
     &       ' no hunts    ',i6,/
     &       ' no simulations',i10,/
     &       ' first ticket  no tickets no elephants    no wins',/
     &       500(4i12/) )
      end

      function random(l)
C Algorithm AS 183
      common/rand/ix,iy,iz
      ix = 171 * mod(ix,177) -2  * (ix / 177)
      iy = 172 * mod(iy,176) -35 * (iy / 176)
      iz = 170 * mod(iz,178) -63 * (iz / 178)

      if (ix.lt.0) ix=ix+30269
      if (iy.lt.0) iy=iy+30307
      if (iz.lt.0) iz=iz+30323
      random=amod(float(ix)/30269.0 + float(iy)/30307.0 +
     &           float(iz)/30323.0, 1.0)
      return
      end
```

Appendix 5.2 Results of simulating DNPWLM lottery system: With actual number of applications in 1991, after 1'000'000 draws, and 100 hunts

Appendix 5.2.1 Probability of an applicant winning *Any Hunt*

RESULTS OF SIMULATION DNPWLM LOTTERY SYSTEM IN CHARARAVMAKUTI
WINS and PROBABILITY (p)
per 1'000'000 SIMULATED DRAWS

Programme Variables	
rng seeds	3, 33, 99
no entrants	196
no tickets	2,008
no hunts	100
no simulations	1,000,000
Based on Data from Year:	1991

Application Data			Results	
Applicant No.	First Ticket No.	No. Tickets	No. ANY HUNTS Won	p to win ANY HUNT
18	18	1	98,076	0.0981
21	21	1	98,249	0.0982
3	3	1	98,303	0.0983
27	27	1	98,354	0.0984
28	28	1	98,361	0.0984
20	20	1	98,463	0.0985
6	6	1	98,500	0.0985
9	9	1	98,530	0.0985
1	1	1	98,562	0.0986
23	23	1	98,588	0.0986
14	14	1	98,602	0.0986
12	12	1	98,613	0.0986
10	10	1	98,620	0.0986
19	19	1	98,661	0.0987
5	5	1	98,674	0.0987
26	26	1	98,787	0.0988
7	7	1	98,801	0.0988
13	13	1	98,810	0.0988
2	2	1	98,852	0.0989
15	15	1	98,873	0.0989
25	25	1	98,904	0.0989
16	16	1	98,911	0.0989
11	11	1	98,934	0.0989
29	29	1	99,013	0.0990
24	24	1	99,102	0.0991
8	8	1	99,140	0.0991
22	22	1	99,158	0.0992
4	4	1	99,234	0.0992
17	17	1	99,262	0.0993
44	58	2	187,262	0.1873
35	40	2	187,527	0.1875
32	34	2	187,544	0.1875
42	54	2	187,557	0.1876
34	38	2	187,714	0.1877
38	46	2	187,767	0.1878
33	36	2	187,811	0.1878
40	50	2	187,814	0.1878
41	52	2	187,927	0.1879
39	48	2	187,975	0.1880
31	32	2	188,008	0.1880
30	30	2	188,217	0.1882
36	42	2	188,276	0.1883
43	56	2	188,392	0.1884
37	44	2	188,495	0.1885
45	60	2	188,862	0.1889
48	68	3	267,645	0.2676
46	62	3	268,245	0.2682
47	65	3	268,322	0.2683
49	71	3	268,393	0.2684
50	74	3	268,537	0.2685
51	77	4	340,947	0.3409
53	86	5	405,198	0.4052
88	261	5	405,221	0.4052
58	111	5	405,539	0.4055
61	126	5	405,615	0.4056
95	296	5	405,628	0.4056
85	246	5	405,740	0.4057
57	106	5	405,772	0.4058
55	96	5	405,784	0.4058
93	286	5	405,866	0.4059
91	276	5	405,937	0.4059
99	316	5	405,940	0.4059
94	291	5	405,970	0.4060
98	311	5	405,978	0.4060
82	231	5	405,988	0.4060
74	191	5	405,990	0.4060
83	236	5	406,000	0.4060
97	306	5	406,001	0.4060
69	166	5	406,003	0.4060
86	251	5	406,056	0.4061
77	206	5	406,066	0.4061
64	141	5	406,066	0.4061
52	81	5	406,072	0.4061
76	201	5	406,079	0.4061
71	176	5	406,147	0.4061
70	171	5	406,205	0.4062
87	256	5	406,223	0.4062

RESULTS OF SIMULATION DNPWLM LOTTERY SYSTEM IN CHARARA/MAKUTI
WINS and PROBABILITY (p)
per 1'000'000 SIMULATED DRAWS

Programme Variables	
mg seeds	3, 33, 99
no entrants	196
no tickets	2,008
no hunts	100
no simulations	1,000,000
Based on Data from Year:	1991

Application Data			Results	
Applicant No.	First Ticket No.	No. Tickets	No. ANY HUNTS Won	p to win ANY HUNT
75	196	5	406,235	0.4062
81	226	5	406,239	0.4062
89	266	5	406,270	0.4063
84	241	5	406,278	0.4063
92	281	5	406,315	0.4063
56	101	5	406,369	0.4064
90	271	5	406,424	0.4064
66	151	5	406,464	0.4065
80	221	5	406,476	0.4065
63	136	5	406,547	0.4065
68	161	5	406,552	0.4066
78	211	5	406,556	0.4066
65	146	5	406,584	0.4066
59	116	5	406,641	0.4066
54	91	5	406,650	0.4067
79	216	5	406,727	0.4067
62	131	5	406,771	0.4066
72	181	5	406,846	0.4068
73	186	5	406,846	0.4068
60	121	5	406,898	0.4069
67	156	5	407,389	0.4074
96	301	5	407,455	0.4075
101	327	6	465,291	0.4653
100	321	6	465,606	0.4656
102	333	7	517,934	0.5179
103	340	7	518,375	0.5184
106	363	8	565,586	0.5656
104	347	8	566,480	0.5665
105	355	8	566,686	0.5667
132	621	10	647,252	0.6473
107	371	10	647,469	0.6475
109	391	10	647,524	0.6475
113	431	10	647,568	0.6476
123	531	10	647,622	0.6476
136	661	10	647,666	0.6477
128	581	10	647,673	0.6477
134	641	10	647,697	0.6477
117	471	10	647,717	0.6477
131	611	10	647,726	0.6477
119	491	10	647,781	0.6478
135	651	10	647,795	0.6478
125	551	10	647,841	0.6478
139	691	10	647,885	0.6479
115	451	10	647,933	0.6479
122	521	10	647,949	0.6479
112	421	10	647,955	0.6480
108	381	10	648,026	0.6480
140	701	10	648,029	0.6480
114	441	10	648,072	0.6481
124	541	10	648,093	0.6481
118	481	10	648,108	0.6481
126	561	10	648,157	0.6482
116	461	10	648,214	0.6482
110	401	10	648,237	0.6482
120	501	10	648,255	0.6483
133	631	10	648,312	0.6483
129	591	10	648,335	0.6483
130	601	10	648,374	0.6484
138	681	10	648,417	0.6484
111	411	10	648,477	0.6485
121	511	10	648,594	0.6486
127	571	10	648,625	0.6486
137	671	10	648,679	0.6487
148	795	12	713,317	0.7133
147	783	12	713,886	0.7139
146	771	12	714,070	0.7141
141	711	12	714,094	0.7141
145	759	12	714,109	0.7141
142	723	12	714,190	0.7142
144	747	12	714,651	0.7147
143	735	12	715,416	0.7154
153	859	13	741,805	0.7418
151	833	13	742,241	0.7422
149	807	13	742,410	0.7424
150	820	13	742,866	0.7429
152	846	13	742,972	0.7430
154	872	13	742,995	0.7430

RESULTS OF SIMULATION DNPWLM LOTTERY SYSTEM IN CHARARA/MAKUTI
WINS and PROBABILITY (p)
per 1'000'000 SIMULATED DRAWS

Programme Variables	
rng seeds	3, 33, 99
no entrants	196
no tickets	2,008
no hunts	100
no simulations	1,000,000
Based on Data from Year:	1991

Application Data			Results	
Applicant No.	First Ticket No.	No. Tickets	No. ANY HUNTS Won	p to win ANY HUNT
155	885	13	743,048	0.7430
156	898	14	767,867	0.7679
158	927	15	790,218	0.7902
157	912	15	790,401	0.7904
163	1,002	15	790,410	0.7904
165	1,032	15	790,648	0.7906
162	987	15	790,704	0.7907
167	1,062	15	790,830	0.7908
159	942	15	790,846	0.7908
161	972	15	790,876	0.7909
160	957	15	790,980	0.7910
164	1,017	15	790,993	0.7910
166	1,047	15	791,112	0.7911
168	1,077	19	861,628	0.8616
173	1,176	20	874,894	0.8749
171	1,136	20	875,064	0.8751
175	1,216	20	875,125	0.8751
172	1,156	20	875,148	0.8751
170	1,116	20	875,210	0.8752
174	1,196	20	875,354	0.8754
169	1,096	20	875,372	0.8754
179	1,296	20	875,644	0.8756
178	1,276	20	875,781	0.8758
176	1,236	20	875,816	0.8758
177	1,256	20	875,899	0.8759
180	1,316	23	908,834	0.9088
182	1,364	25	925,163	0.9252
181	1,339	25	925,665	0.9257
183	1,389	25	925,673	0.9257
184	1,414	26	932,535	0.9325
185	1,440	26	933,020	0.9330
187	1,496	30	955,363	0.9554
186	1,466	30	955,567	0.9556
188	1,526	33	967,231	0.9672
189	1,559	41	985,510	0.9855
190	1,600	49	993,450	0.9935
192	1,699	50	993,943	0.9939
191	1,649	50	993,949	0.9939
193	1,749	50	994,020	0.9940
194	1,799	51	994,696	0.9947
195	1,850	80	997,732	0.9977
196	1,910	99	999,954	1.0000
MAXIMUM WINS			999,954	1.0000
MEAN WINS (Equality)			510,204	0.5102
MINIMUM WINS			98,076	0.0981
STD			274,955	0.2750
n			196	196

Notes: Application data and results sorted according to the number of tickets each applicant bought.

Appendix 5.2.2 Mean probability per applicant ticket class of winning *Any Hunt*

RESULTS OF SIMULATION DNPWLM LOTTERY SYSTEM IN CHARARA/MAKUTI
Mean WINS and Mean PROBABILITY (p) per APPLICANT TICKET CLASS
per 1'000'000 SIMULATED DRAWS

TICKETS per APPLICANT Ticket Class	APPLICANTS No.	Cumulative Descending	Mean Results No. ANY HUNTS Won	p to win ANY HUNT
1	29	196	98,722	0.0987
2	16	167	187,947	0.1879
3	5	151	268,228	0.2682
4	1	146	340,947	0.3409
5	49	145	406,221	0.4062
6	2	97	465,449	0.4654
7	2	95	518,154	0.5182
8	3	93	566,251	0.5663
10	34	90	648,002	0.6480
12	8	56	714,217	0.7142
13	7	48	742,620	0.7426
14	1	41	767,867	0.7679
15	11	40	790,729	0.7907
19	1	29	861,628	0.8616
20	11	28	875,392	0.8754
23	1	17	908,834	0.9088
25	3	16	925,500	0.9255
26	2	13	932,778	0.9328
30	2	11	955,465	0.9555
33	1	9	967,231	0.9672
41	1	8	985,510	0.9855
49	1	7	993,450	0.9935
50	3	6	993,971	0.9940
51	1	3	994,696	0.9947
60	1	2	997,732	0.9977
99	1	1	999,954	1.0000
TOTALS	196			
MAXIMUM p				1.0000
MEAN p				0.7272
MINIMUM p				0.0987
Standard Deviation				0.2768

100 Hunts (Winners) in the ticket class

Appendix 5.2.3 Calculations for Lorenz diagram for results: Applicant and probability proportions for equality and inequality of winning *Any Hunt*

Lorenz Diagram Calculations
Proportion of Appliants versus
Proportion of Probability for Equality, and Inequality

Applicants sorted in ascending order by no wins (or p-values) Applicant No.

Applicants		Inequality			Equality		
Applicant No.	Proportion of No.	Inequality of p	Proportion of p	Cumulative	Equality of p	Proportion of p	Cumulative
A	B	C	D	E	F	G	H
1	0.0051	0.0981	0.0010	0.0010	0.5102	0.0051	0.0051
2	0.0102	0.0982	0.0010	0.0020	0.5102	0.0051	0.0102
3	0.0153	0.0983	0.0010	0.0029	0.5102	0.0051	0.0153
4	0.0204	0.0984	0.0010	0.0039	0.5102	0.0051	0.0204
5	0.0255	0.0984	0.0010	0.0049	0.5102	0.0051	0.0255
6	0.0306	0.0985	0.0010	0.0059	0.5102	0.0051	0.0306
7	0.0357	0.0985	0.0010	0.0069	0.5102	0.0051	0.0357
8	0.0408	0.0985	0.0010	0.0079	0.5102	0.0051	0.0408
9	0.0459	0.0986	0.0010	0.0089	0.5102	0.0051	0.0459
10	0.0510	0.0986	0.0010	0.0098	0.5102	0.0051	0.0510
11	0.0561	0.0986	0.0010	0.0108	0.5102	0.0051	0.0561
12	0.0612	0.0986	0.0010	0.0118	0.5102	0.0051	0.0612
13	0.0663	0.0986	0.0010	0.0128	0.5102	0.0051	0.0663
14	0.0714	0.0987	0.0010	0.0138	0.5102	0.0051	0.0714
15	0.0765	0.0987	0.0010	0.0148	0.5102	0.0051	0.0765
16	0.0816	0.0988	0.0010	0.0158	0.5102	0.0051	0.0816
17	0.0867	0.0988	0.0010	0.0167	0.5102	0.0051	0.0867
18	0.0918	0.0988	0.0010	0.0177	0.5102	0.0051	0.0918
19	0.0969	0.0989	0.0010	0.0187	0.5102	0.0051	0.0969
20	0.1020	0.0989	0.0010	0.0197	0.5102	0.0051	0.1020
21	0.1071	0.0989	0.0010	0.0207	0.5102	0.0051	0.1071
22	0.1122	0.0989	0.0010	0.0217	0.5102	0.0051	0.1122
23	0.1173	0.0989	0.0010	0.0227	0.5102	0.0051	0.1173
24	0.1224	0.0990	0.0010	0.0237	0.5102	0.0051	0.1224
25	0.1276	0.0991	0.0010	0.0247	0.5102	0.0051	0.1276
26	0.1327	0.0991	0.0010	0.0257	0.5102	0.0051	0.1327
27	0.1378	0.0992	0.0010	0.0266	0.5102	0.0051	0.1378
28	0.1429	0.0992	0.0010	0.0276	0.5102	0.0051	0.1429
29	0.1480	0.0993	0.0010	0.0286	0.5102	0.0051	0.1480
30	0.1531	0.1873	0.0019	0.0305	0.5102	0.0051	0.1531
31	0.1582	0.1875	0.0019	0.0324	0.5102	0.0051	0.1582
32	0.1633	0.1875	0.0019	0.0343	0.5102	0.0051	0.1633
33	0.1684	0.1876	0.0019	0.0361	0.5102	0.0051	0.1684
34	0.1735	0.1877	0.0019	0.0380	0.5102	0.0051	0.1735
35	0.1786	0.1878	0.0019	0.0399	0.5102	0.0051	0.1786
36	0.1837	0.1878	0.0019	0.0418	0.5102	0.0051	0.1837
37	0.1888	0.1878	0.0019	0.0436	0.5102	0.0051	0.1888
38	0.1939	0.1879	0.0019	0.0455	0.5102	0.0051	0.1939
39	0.1990	0.1880	0.0019	0.0474	0.5102	0.0051	0.1990
40	0.2041	0.1880	0.0019	0.0493	0.5102	0.0051	0.2041
41	0.2092	0.1882	0.0019	0.0512	0.5102	0.0051	0.2092
42	0.2143	0.1883	0.0019	0.0530	0.5102	0.0051	0.2143
43	0.2194	0.1884	0.0019	0.0549	0.5102	0.0051	0.2194
44	0.2245	0.1885	0.0019	0.0568	0.5102	0.0051	0.2245
45	0.2296	0.1889	0.0019	0.0587	0.5102	0.0051	0.2296
46	0.2347	0.2676	0.0027	0.0614	0.5102	0.0051	0.2347
47	0.2398	0.2682	0.0027	0.0641	0.5102	0.0051	0.2398
48	0.2449	0.2683	0.0027	0.0667	0.5102	0.0051	0.2449
49	0.2500	0.2684	0.0027	0.0694	0.5102	0.0051	0.2500
50	0.2551	0.2685	0.0027	0.0721	0.5102	0.0051	0.2551
51	0.2602	0.3409	0.0034	0.0755	0.5102	0.0051	0.2602
52	0.2653	0.4052	0.0041	0.0796	0.5102	0.0051	0.2653
53	0.2704	0.4052	0.0041	0.0836	0.5102	0.0051	0.2704
54	0.2755	0.4055	0.0041	0.0877	0.5102	0.0051	0.2755
55	0.2806	0.4056	0.0041	0.0917	0.5102	0.0051	0.2806
56	0.2857	0.4056	0.0041	0.0958	0.5102	0.0051	0.2857
57	0.2908	0.4057	0.0041	0.0999	0.5102	0.0051	0.2908
58	0.2959	0.4058	0.0041	0.1039	0.5102	0.0051	0.2959
59	0.3010	0.4058	0.0041	0.1080	0.5102	0.0051	0.3010
60	0.3061	0.4059	0.0041	0.1120	0.5102	0.0051	0.3061
61	0.3112	0.4059	0.0041	0.1161	0.5102	0.0051	0.3112
62	0.3163	0.4059	0.0041	0.1201	0.5102	0.0051	0.3163
63	0.3214	0.4060	0.0041	0.1242	0.5102	0.0051	0.3214
64	0.3265	0.4060	0.0041	0.1283	0.5102	0.0051	0.3265
65	0.3316	0.4060	0.0041	0.1323	0.5102	0.0051	0.3316
66	0.3367	0.4060	0.0041	0.1364	0.5102	0.0051	0.3367
67	0.3418	0.4060	0.0041	0.1404	0.5102	0.0051	0.3418
68	0.3469	0.4060	0.0041	0.1445	0.5102	0.0051	0.3469
69	0.3520	0.4060	0.0041	0.1486	0.5102	0.0051	0.3520
70	0.3571	0.4061	0.0041	0.1526	0.5102	0.0051	0.3571
71	0.3622	0.4061	0.0041	0.1567	0.5102	0.0051	0.3622
72	0.3673	0.4061	0.0041	0.1607	0.5102	0.0051	0.3673
73	0.3724	0.4061	0.0041	0.1648	0.5102	0.0051	0.3724
74	0.3776	0.4061	0.0041	0.1689	0.5102	0.0051	0.3776
75	0.3827	0.4061	0.0041	0.1729	0.5102	0.0051	0.3827
76	0.3878	0.4062	0.0041	0.1770	0.5102	0.0051	0.3878
77	0.3929	0.4062	0.0041	0.1811	0.5102	0.0051	0.3929
78	0.3980	0.4062	0.0041	0.1851	0.5102	0.0051	0.3980
79	0.4031	0.4062	0.0041	0.1892	0.5102	0.0051	0.4031
80	0.4082	0.4063	0.0041	0.1932	0.5102	0.0051	0.4082
81	0.4133	0.4063	0.0041	0.1973	0.5102	0.0051	0.4133
82	0.4184	0.4063	0.0041	0.2014	0.5102	0.0051	0.4184
83	0.4235	0.4064	0.0041	0.2054	0.5102	0.0051	0.4235
84	0.4286	0.4064	0.0041	0.2095	0.5102	0.0051	0.4286
85	0.4337	0.4065	0.0041	0.2136	0.5102	0.0051	0.4337
86	0.4388	0.4065	0.0041	0.2176	0.5102	0.0051	0.4388
87	0.4439	0.4065	0.0041	0.2217	0.5102	0.0051	0.4439
88	0.4490	0.4066	0.0041	0.2258	0.5102	0.0051	0.4490
89	0.4541	0.4066	0.0041	0.2298	0.5102	0.0051	0.4541
90	0.4592	0.4066	0.0041	0.2339	0.5102	0.0051	0.4592
91	0.4643	0.4066	0.0041	0.2380	0.5102	0.0051	0.4643
92	0.4694	0.4067	0.0041	0.2420	0.5102	0.0051	0.4694
93	0.4745	0.4067	0.0041	0.2461	0.5102	0.0051	0.4745

Lorenz Diagram Calculations
Proportion of Applants versus
Proportion of Probability for Equality, and Inequality

Applicants sorted in ascending order by no wins (or p-values) Applicant No.

Applicants		Inequality			Equality		
Applicant No.	Proportion of No.	Inequality of p	Proportion of p	Cumulative	Equality of p	Proportion of p	Cumulative
A	B	C	D	E	F	G	H
94	0.4796	0.4068	0.0041	0.2502	0.5102	0.0051	0.4796
95	0.4847	0.4068	0.0041	0.2542	0.5102	0.0051	0.4847
96	0.4898	0.4068	0.0041	0.2583	0.5102	0.0051	0.4898
97	0.4949	0.4069	0.0041	0.2624	0.5102	0.0051	0.4949
98	0.5000	0.4074	0.0041	0.2664	0.5102	0.0051	0.5000
99	0.5051	0.4075	0.0041	0.2705	0.5102	0.0051	0.5051
100	0.5102	0.4653	0.0047	0.2752	0.5102	0.0051	0.5102
101	0.5153	0.4656	0.0047	0.2798	0.5102	0.0051	0.5153
102	0.5204	0.5179	0.0052	0.2850	0.5102	0.0051	0.5204
103	0.5255	0.5184	0.0052	0.2902	0.5102	0.0051	0.5255
104	0.5306	0.5656	0.0057	0.2958	0.5102	0.0051	0.5306
105	0.5357	0.5665	0.0057	0.3015	0.5102	0.0051	0.5357
106	0.5408	0.5667	0.0057	0.3072	0.5102	0.0051	0.5408
107	0.5459	0.6473	0.0065	0.3136	0.5102	0.0051	0.5459
108	0.5510	0.6475	0.0065	0.3201	0.5102	0.0051	0.5510
109	0.5561	0.6475	0.0065	0.3266	0.5102	0.0051	0.5561
110	0.5612	0.6476	0.0065	0.3331	0.5102	0.0051	0.5612
111	0.5663	0.6476	0.0065	0.3395	0.5102	0.0051	0.5663
112	0.5714	0.6477	0.0065	0.3460	0.5102	0.0051	0.5714
113	0.5765	0.6477	0.0065	0.3525	0.5102	0.0051	0.5765
114	0.5816	0.6477	0.0065	0.3590	0.5102	0.0051	0.5816
115	0.5867	0.6477	0.0065	0.3654	0.5102	0.0051	0.5867
116	0.5918	0.6477	0.0065	0.3719	0.5102	0.0051	0.5918
117	0.5969	0.6478	0.0065	0.3784	0.5102	0.0051	0.5969
118	0.6020	0.6478	0.0065	0.3849	0.5102	0.0051	0.6020
119	0.6071	0.6478	0.0065	0.3914	0.5102	0.0051	0.6071
120	0.6122	0.6479	0.0065	0.3978	0.5102	0.0051	0.6122
121	0.6173	0.6479	0.0065	0.4043	0.5102	0.0051	0.6173
122	0.6224	0.6479	0.0065	0.4108	0.5102	0.0051	0.6224
123	0.6276	0.6480	0.0065	0.4173	0.5102	0.0051	0.6276
124	0.6327	0.6480	0.0065	0.4238	0.5102	0.0051	0.6327
125	0.6378	0.6480	0.0065	0.4302	0.5102	0.0051	0.6378
126	0.6429	0.6481	0.0065	0.4367	0.5102	0.0051	0.6429
127	0.6480	0.6481	0.0065	0.4432	0.5102	0.0051	0.6480
128	0.6531	0.6481	0.0065	0.4497	0.5102	0.0051	0.6531
129	0.6582	0.6482	0.0065	0.4562	0.5102	0.0051	0.6582
130	0.6633	0.6482	0.0065	0.4626	0.5102	0.0051	0.6633
131	0.6684	0.6482	0.0065	0.4691	0.5102	0.0051	0.6684
132	0.6735	0.6483	0.0065	0.4756	0.5102	0.0051	0.6735
133	0.6786	0.6483	0.0065	0.4821	0.5102	0.0051	0.6786
134	0.6837	0.6483	0.0065	0.4886	0.5102	0.0051	0.6837
135	0.6888	0.6484	0.0065	0.4951	0.5102	0.0051	0.6888
136	0.6939	0.6484	0.0065	0.5015	0.5102	0.0051	0.6939
137	0.6990	0.6485	0.0065	0.5080	0.5102	0.0051	0.6990
138	0.7041	0.6486	0.0065	0.5145	0.5102	0.0051	0.7041
139	0.7092	0.6486	0.0065	0.5210	0.5102	0.0051	0.7092
140	0.7143	0.6487	0.0065	0.5275	0.5102	0.0051	0.7143
141	0.7194	0.7133	0.0071	0.5346	0.5102	0.0051	0.7194
142	0.7245	0.7139	0.0071	0.5418	0.5102	0.0051	0.7245
143	0.7296	0.7141	0.0071	0.5489	0.5102	0.0051	0.7296
144	0.7347	0.7141	0.0071	0.5560	0.5102	0.0051	0.7347
145	0.7398	0.7141	0.0071	0.5632	0.5102	0.0051	0.7398
146	0.7449	0.7142	0.0071	0.5703	0.5102	0.0051	0.7449
147	0.7500	0.7147	0.0071	0.5775	0.5102	0.0051	0.7500
148	0.7551	0.7154	0.0072	0.5846	0.5102	0.0051	0.7551
149	0.7602	0.7418	0.0074	0.5920	0.5102	0.0051	0.7602
150	0.7653	0.7422	0.0074	0.5995	0.5102	0.0051	0.7653
151	0.7704	0.7424	0.0074	0.6069	0.5102	0.0051	0.7704
152	0.7755	0.7429	0.0074	0.6143	0.5102	0.0051	0.7755
153	0.7806	0.7430	0.0074	0.6217	0.5102	0.0051	0.7806
154	0.7857	0.7430	0.0074	0.6292	0.5102	0.0051	0.7857
155	0.7908	0.7430	0.0074	0.6366	0.5102	0.0051	0.7908
156	0.7959	0.7679	0.0077	0.6443	0.5102	0.0051	0.7959
157	0.6010	0.7902	0.0079	0.6522	0.5102	0.0051	0.6010
158	0.8061	0.7904	0.0079	0.6601	0.5102	0.0051	0.8061
159	0.8112	0.7904	0.0079	0.6680	0.5102	0.0051	0.8112
160	0.8163	0.7906	0.0079	0.6759	0.5102	0.0051	0.8163
161	0.8214	0.7907	0.0079	0.6838	0.5102	0.0051	0.8214
162	0.8265	0.7908	0.0079	0.6917	0.5102	0.0051	0.8265
163	0.8316	0.7908	0.0079	0.6996	0.5102	0.0051	0.8316
164	0.8367	0.7909	0.0079	0.7075	0.5102	0.0051	0.8367
165	0.8418	0.7910	0.0079	0.7154	0.5102	0.0051	0.8418
166	0.8469	0.7910	0.0079	0.7234	0.5102	0.0051	0.8469
167	0.8520	0.7911	0.0079	0.7313	0.5102	0.0051	0.8520
168	0.8571	0.8616	0.0086	0.7399	0.5102	0.0051	0.8571
169	0.8622	0.8749	0.0087	0.7486	0.5102	0.0051	0.8622
170	0.8673	0.8751	0.0088	0.7574	0.5102	0.0051	0.8673
171	0.8724	0.8751	0.0088	0.7661	0.5102	0.0051	0.8724
172	0.8776	0.8751	0.0088	0.7749	0.5102	0.0051	0.8776
173	0.8827	0.8752	0.0088	0.7836	0.5102	0.0051	0.8827
174	0.8878	0.8754	0.0088	0.7924	0.5102	0.0051	0.8878
175	0.8929	0.8754	0.0088	0.8011	0.5102	0.0051	0.8929
176	0.8980	0.8756	0.0088	0.8099	0.5102	0.0051	0.8980
177	0.9031	0.8758	0.0088	0.8187	0.5102	0.0051	0.9031
178	0.9082	0.8758	0.0088	0.8274	0.5102	0.0051	0.9082
179	0.9133	0.8759	0.0088	0.8362	0.5102	0.0051	0.9133
180	0.9184	0.9088	0.0091	0.8453	0.5102	0.0051	0.9184
181	0.9235	0.9252	0.0093	0.8545	0.5102	0.0051	0.9235
182	0.9286	0.9257	0.0093	0.8638	0.5102	0.0051	0.9286
183	0.9337	0.9257	0.0093	0.8730	0.5102	0.0051	0.9337
184	0.9388	0.9325	0.0093	0.8824	0.5102	0.0051	0.9388
185	0.9439	0.9330	0.0093	0.8917	0.5102	0.0051	0.9439
186	0.9490	0.9554	0.0096	0.9012	0.5102	0.0051	0.9490
187	0.9541	0.9556	0.0096	0.9108	0.5102	0.0051	0.9541

Lorenz Diagram Calculations
Proportion of Appliants versus
Proportion of Probability for Equality, and Inequality

Applicants sorted in ascending order by no wins (or p-values) Applicant No.

Applicants		Inequality			Equality		
Applicant No.	Proportion of No.	Inequality of p	Proportion of p	Cumulative	Equality of p	Proportion of p	Cumulative
A	B	C	D	E	F	G	H
188	0.9592	0.9672	0.0097	0.9205	0.5102	0.0051	0.9592
189	0.9643	0.9855	0.0099	0.9303	0.5102	0.0051	0.9643
190	0.9694	0.9935	0.0099	0.9403	0.5102	0.0051	0.9694
191	0.9745	0.9939	0.0099	0.9502	0.5102	0.0051	0.9745
192	0.9796	0.9939	0.0099	0.9601	0.5102	0.0051	0.9796
193	0.9847	0.9940	0.0099	0.9701	0.5102	0.0051	0.9847
194	0.9898	0.9947	0.0099	0.9800	0.5102	0.0051	0.9898
195	0.9949	0.9977	0.0100	0.9900	0.5102	0.0051	0.9949
196	1.0000	1.0000	0.0100	1.0000	0.5102	0.0051	1.0000

Notes on Calculation of Columns:

B = Column A/ Sum of Column A (196)
C = Simulation result (p)
D = Column C/ Sum of Column C (1,0) x 100
E1 = D1
E2 = E1 + D2
F = 100/ Sum of column A (196) for all applicants equally.
G = Column F/ Sum of Column F (1,0) x 100
H1 = G1
H2 = H1 + G2

Applendix 6 Applicants' hunt preferences for ZHA hunting areas: 1991

Appendix 6.1 Applicants' hunt preferences: Tuli Safari Area

APPLICANT'S HUNTING PREFERENCES for TULI SAFARI AREA
YEAR: 1991
ZIMBABWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st,2nd,..26th)																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	9	11	13	17	19	21	23	24	25	26	8	10	14	16	18	20	22									
2	1	3	7	12	14	2	5	6	8	9	10	11	13	4	15	16	17	18	19	20	21	22	23	24	25	
3	6	7	5	12	17	For explanation, see example after Applicant No. 182																				
4	3	1	4	7	12	15	2	5	16	17	21	22	23	20	19	18	24	25	14	13	11	10	9	8	6	26
5	3	1	6	7	9	11	13	15	17	8	10	12	14	16	18	5										
6	12	14	10	8	13	7	9	11	13	15	18	17	20	19	6	8	21	22	23	24	25	26	4	3	2	1
7	4	7	12	15	25	23	21	19	17	13	11	9	6	5	3	2	1	18	20	22	24	16	14	10	8	26
8	1	3	2	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	4	5	6			
9	1	3	2	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	4	5	6			
10	17	19	18	20	1	2	16	15	4	6	9	11	13	21	5	8	10	14	22	23	25	3	7	12	24	26
11	12	13	14	15	16	17	18																			
12	10	12	14	16	18	20	22	9	11	13	15	17	19	21	8	7	6	5	4	3						
13	4	6	17	19	18	20	7	9	11	13	15	8	10	12	14	16	21	23	25	22	24	26	5	3	2	1
14	1	3	2	4	7	12	15	5	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
15	14	12	10	8	6	4	13	11	9	7	5	16	18	20	22	15	17	19	21	2	1	3	23	24	25	
16	2	17	18	19	15	16	20	10	11	12	13															
17	6	7	5	4	3	10	9	11	12	14	13	22	21	23	24	25	26									
18	1	3	6	7	9	11	13	15	4	10	12	14	16	2	5	8										
19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
20	3	1	2	5	4	7	12	15																		
21	17	18	19	20	15	16	9	10	11	12	13	14	7	8	21	22	23	24								
22	17	18	19	20	15	16	9	10	11	12	13	14	7	8	21	22	23	24								
23	3	1	6	7	9	11	13	15	17	8	10	12	14	16	18	5										
24	3	1	6	7	9	11	13	15	17	8	10	12	14	16	18	5										
25	3	1	6	7	9	11	13	15	17	8	10	12	14	16	18	5										
26	5	6	7	9	11	13	15	17	19	21	8	10	12	14	16	18	20	1	2	3	4	23	22	24	25	26
27	7	9	11	13	15	8	10	12	14	16	17	18	19	20	21	22	6	5								
28	1	3	2	6	4	5	17	19	21	23	25	7	8	10	12	14	17	18	20	22	24	9	11	13	15	16
29	19	21	18	20	22	1	3	17	23	16	24	5	6	8	10	14	12	2	4	7	9	11	13	15	25	26
30	15	17	19	16	18	20	1	2	4	5	6	7	8	9	10	11	12	13	14	21	22	23	24	25	26	3
31	15	16	17	18	19	20	21	22	23	24	25	26	14	13	12	11	10	9	8	7	6	5	4	3	2	1
32	15	16	17	18	19	20	21	22	23	24	25	26	14	13	12	11	10	9	8	7	6	5	4	3	2	1
33	12	15	7	16	14	17	18	13	20	19	10	11	8	9	4	5	6	3	2	1						
34	9	13	17	19	21	23	25	10	11	20	22	24														
35	2	6	4	3	1	5	15																			
36	5	2	6	7	8	9	10	11	12	13	14	15	17	18	19	20	21	22								
37	5	2	6	7	8	9	10	11	12	13	14	15	17	18	19	20	21	22								
38	17	19	21	23	25																					
39	1	3	2	5	4	9	11	15	17	23	25	10	12	16	18											
40	7	5	12	8	9	10	12	6	14	13	15	16	17	18	19	20	21	22	23	24	25	4	26	2	3	1
41	7	5	12	8	9	10	12	6	14	13	15	16	17	18	19	20	21	22	23	24	25	4	26	2	3	1
42	2	7	12	15	9	11	13	17	19	21	23	8	10	14	16	18	20	22	24							
43	17	18	19	20	21	16	22	15	23	24	26	14	13	3	12	11	10	9	8	7	6	5	4	2	1	
44	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
45	14	16	18	17	10	9	4	1	3	13	20	19	15	22	21	12	11	23	25	24	6	8	7			
46	11	13	12	14	7	9	15	17	19	21	8	10	16	20												
47	1	3	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
48	2	4	6	8	10	12	14	16	18	20	22	24	26	1	3	5	7	9	11	13	15	17	19	21	23	25
49	2	5	7	12	15	4	6	8	9	10	11	13	14	16	17	18	19	20	21	22	1	23	24	3		
50	2	5	7	12	15	4	6	8	9	10	11	13	14	16	17	18	19	20	21	22	1	23	24	3		
51	2	5	1	3	4	7	12	15	18	17	19	20	6	8	10	14	9	11	13	15	22	24	21	23	25	26
52	2	5	4	7	12	6	8	1	14	3	9	11	13	1												
53	2	5	4	7	12	6	8	10	14	3	9	11	13	1												
54	2	4	6	8	10	12	14	16	18	20	22	24	26	1	3	5	7	9	11	13	15	17	19	21	23	25
55	12	11	13	14	3	1	6	7	8	9	10	4	5	2	22	21	24	23	25	16	18	20	15	17	19	26
56	12	11	13	14																						
57	6	8	4	5	7	3	2	1																		
58	4	16	15	2	6	7	5	9	10	8	11	12	13	14	23											
59	7	9	11	13	15	8	10	12	14	16	17	18	19	20	21	22	6	5								
60	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5								
61	8	9	10	11	12	13	14	15	16	17	18	2	5	1	3	4	6	7	19	20	21	22	23	24	25	26
62	17	20	14	11	8	23	26	24	22	10	12	13	15	16	18	19	21	25								
63	2	4	5	7	12	15	1	3	6	9	11	13	17	19	8	10	14	16	18	21	23	25	20	22	24	26
64	6	11	16	15	14	13	12	10	9	8	7	5														
65	10	12	9	11																						
66	17	18	19	20	21	22	3	4	5	6	7	8	9	10	11	12	13	14	16	23	24	25	26			
67	1	3	2	4	7	12	15	5	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
68	11	12	13	14	21	22																				
69	7	9	11	13	8	10	12	14	15	16	21	23	22	25												
70	21	19	17	15	13	11	20	18	16	14	12	9	7	5	3	4	6	8	2	1	22	23	24	25	26	
71	23	24	25	26																						
72	20	17	14	11	8	10																				
73	9	10	11	12	13	14	15	6	16	16	18	19	20	21	22	23	24	25	26	5	4	3	2	1		
74	3	7	8	9	10	11	12	15	16	17	18	19	20	6	5	4										
75	3	1																								
76	1	2	17	18	19	20	3	5	4	7	12	15	6	9	11	13	21	23	25	8	10	16	22	24	26	14
77	1	2	17	18	19	20	3	5	4	7	12	15	6	9	11	13	21	23	25	8	10	16	22	24	26	14
78	1	3	2	5	4	7	12	15	6	8	10	12	14	16	18	21	22	24	9							

APPLICANT'S HUNTING PREFERENCES for TULI SAFARI AREA
YEAR: 1991
ZIMBABWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st,2nd,..26th)																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
79	17	18	19	20																						
80	5	13	17	15																						
81	15	16	5	6	13	14	17	18																		
82	1	3	5	4	12	15	7	2	6	9	11	13	17	19	21	23	25	8	10	14	16	18	20	22	24	26
83	11	12	13	14	15	16	17	18	19	20	21	8	7	6	5	4										
84	3	17	18	16	15	14	13	12	11	10	9	8	7	6	5	4	2	1	19	20	21	22	23	24	25	26
85	1	2	3	4	5	6	7	8	9	10	11	12	13	14												
86	9	13	17	19	21	23	25	10	11	20	22	24														
87	1	3	2	5	4	6	7	9	11	13	15	17	19	21	23	25	8	10	12	14	16	18	20	22	24	26
88	1	3	2	5	4	6	7	9	11	13	15	17	19	21	23	25	8	10	12	14	16	18	20	22	24	26
89	9	10	11	12	13	14	8	7	6	15	16	17	18	19	20	21	22	23	24	25	26	5	4	3	2	1
90	1	3	2	8	6	9	10	11	13	16	17	14	18	5	19											
91	20	18	19	21	22	23	24	25	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	17	26	6
92	20	18	19	21	22	23	24	25	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	17	26	6
93	1	2	4	6	3	5	7	9	11	13	15	17	19	21	23	25	8	10	12	14	16	18	20	22	24	26
94	1	2	3	4	5	6	7	8	9	10	11	12	13	14												
95	1	2	3	4	5	6	7	8	9	10	11	12	13	14												
96	9	11	17	19	21	23	25																			
97	20	18	19	21	22	23	24	25	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	17	26	6
98	1	2	3	4	16	15	17	18																		
99	1	3	2	5	4	7	12	15	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
100	1	3	2	5	4	7	12	15	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
101	1	3	2	5	4	7	12	15	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
102	1	3	2	5	4	6	7	9	11	13	15	17	19	21	23	25	8	10	12	14	16	18	20	22	24	26
103	3	1	16	15	14	13	12	11	10	9	8	7	6													
104	2	4	7	12	15	5	6																			
105	1	2	3	4	5	6	7	9	11	12	13	15														
106	9	5	6	13	7	14	10	8																		
107	17	18	15	16	21	22	23	24	25																	
108	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
109	2	4	6	8	10	12	14	16	18	20																
110	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					
111	1	3	2	5	7	15	4	12	9	11	13	17	19	21	23	25	6	8	10	14	16	18	20	22	24	26
112	18	20	17	19	16	15	2	1																		
113	2	5	4	12	7	6	3	9	11	13	14	8	10	1												
114	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	10	9	8	7						
115	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	10	9	8	7						
116	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	10	9	8	7						
117	1	3	2	5	12	7	4	6	9	11	13	15	17	8	10	14	16	18								
118	6	8	10	12																						
119	1	3	2	5																						
120	3	13	7	9	6	11	12	19	21	20	23	22	24	4	5	8	10	14	15	17	16	18				
121	4	9	10	11	13	14	16																			
122	13	14	17	18	19	20																				
123	4	6	7	5	8	9	10	11	12	13	14	15	16	17	18	19	3	20	21							
124	4	6	7	5	8	9	10	11	12	13	14	15	16	17	18	19	3	20	21							
125	1	3	2	5	4	7	12	15	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
126	1	3	2	5	4	7	12	15	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
127	1	3	2	5	4	7	12	15	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26
128	1	3	2	5	4	6	7	9	11	13	15	17	19	21	23	25	8	10	12	14	16	18	20	22	24	26
129	9	10	11	7	8	12	13	14	15	16	17	18														
130	1	3	2	5	4	6	7	9	11	13	17	19	21	23	25	8	10	12	14	16	18	20	22	24	26	
131	4	6	7	5	8	9	10	11	12	13	14	15	16	17	18	19	3	20	21							
132	18	20	17	19	22	21	2	1	4	3	16	15	14	13	12	11	10	9	8	7	6	5	24	23	26	25
133	1	3	2	5	7	15	4	12	9	11	13	17	19	21	23	25										
134	2	4	7	12	5	15	6	9	11	8	10	14	16	18	20	22	24	13	17	19	21					
135	4	16	15	2	6	7	5	9	10	8	11	12	13	14	23											
136	2	5	9	11	13	15	17	19	21	23	25	6	8	10	12	14	16	18	20	22	24	26	7			
137	2	5	9	11	13	15	17	19	21	23	25	6	8	10	12	14	16	18	20	22	24	26	17			
138	17	19	21	23	24																					
139	1	3	15	12	13	17	18	16	14	11	2	19	20	21	22	23	24	25	26							
140	9	11	13	17	25																					
141	1	2	3	4	6	5	7	8	9	11	13	15	17	19	21	23	25	10	12	14	16	18	20	22	24	26
142	19	17	18	20	11	12	11	9	24	23	6	5	4	3	2	1	14	13	8	7	16	15	22	21	26	25
143	19	17	18	20	11	12	11	9	24	23	6	5	4	3	2	1	14	13	8	7	16	15	22	21	26	25
144	9	5	6	13	7	14																				
145	11	12	13	14	15	16	17	18	19	20	21	10	9	8	7	6	5	4	22	23	24	25	26	3	2	1
146	11	12	13	14	15	16	17	10	19	20	21	22	23	24	25	26	5	9	1	2	3	4	6	7	8	10
147	8	10	14	18	20	22	9	11	13	17	19	21														
148	18	20	22	12	10	8	6	4	2	16	14	19	21	23	11	9	7	5	3	1	13	15	17	24	25	26
149	8	10	14	18	20	22	9	11	13	17	19	21														
150	8	10	14	18	20	22	9	11	13	17	19	21														
151	18	17	20	19	16	15	14	13	12	11	22	21	24	23	26	25	10	9	8	7	6	5	4	3	2	1
152	18	17	20	19	16	15	14	13	12	11	22	21	24	23	26	25	10	9	8	7	6	5	4	3	2	1
153	24	22	20	18	16	14	12	10	8	7	9	11	13	15	17	19	21									
154	13	14	15	16	5	6																				
155	4	7	12	15	2	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	24	25	26			
156	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	1	2

APPLICANT'S HUNTING PREFERENCES for TULI SAFARI AREA
YEAR: 1991
ZIMBABWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st,2nd,..26th)																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
157	25	26	24	23	21	19	17	13	11	9	20	22	18	15	12	16	10	7	6	2	1	3	4	5	8	
158	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					
159	1	3	2	4	9	10	13	14	15	16	21	22	23	24	25	11										
160	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26						
161	1	3	2	5	12	7	4	15	6	16	8	10	14	18	20	9	11	13	17	21	23	24	25	26		
162	1	3	2	5	12	7	4	15	6	16	8	10	14	18	20	9	11	13	17	21	23	24	25	26		
163	1	3	5	7	9	11	13	15	17	19	21	23	25	2	4	6	8	10	12	14	16	18	20	22	24	26
164	1	3	2	4	9	10	13	14	15	16	21	22	23	24	25	11										
165	3	4	5	8	11	14	17	20	23																	
166	1	3	5	7	2	4	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
167	1	3	5	7	2	4	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
168	6	8	9	10	11	13	14	16	17	18	19	20	21	22	23	25										
169	12	15	9	10	11	13	14	16	17	18	19	20	21	22	8	7										
170	12	13	14	15	16	17	8	19	20	21	22	23	24	25	26	1	2	3	4	5	6	7	8	9	10	11
171	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	1	2	3	4
172	2	4	5	7	12	15	1	3	6	9	11	13	17	19	8	10	14	16	18	21	23	25	20	22	26	
173	1	3	19	20	17	18	2	9	10	11	12	13	14	15	16	7	8	21	22							
174	7	9	11	5																						
175	2	3	4	8	9	10	11	13	17	18	19	20	21	22	23	24	25	26								
176	2	3	4	8	9	10	11	13	17	18	19	20	21	22	23	24	25	26								
177	19	20	16	7	8																					
178	17	19	21	24	23	13	11	9	20	18	14	10	8	16	22	15	7	4	5	6	12	2	25	26	3	1
179	11	3	14	9																						
180	1	3	2	25	6	4	5	18	19	24	13	11	10	23	24	12	6	8	9	7	14	16	17	20	21	22
181	7	8	9	10	11	12	13	14	15	16	6	5	4	3	2	1	17	18	19	20	21	22	23	24	25	26
182	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Example: Applicant No. 3's first Hunt preference was Hunt No. 6, then then Hunt No. 7, 5, 12, and 17 in order from most to least preferred.

Source: Hunting records, Matabeleland Hunter's Association, Harare, Zimbabwe.

Appendix 6.2 Applicants' hunt preferences: Doma Safari Area

APPLICANT'S HUNT PREFERENCES for DOMA SAFARI ARE
YEAR: 1991
ZIMBABAWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st, 2nd,...39th)									
	1	2	3	4	5	6	7	8	9	10
1	2	1	3	4	5	6	7	8	9	10
2	6	8	4	9	7	5	10	3		
3	8	9	10	7						
4	1	2	4	3	5	10	9			
5	8	9	1	10	3	7	6	5	4	2
6	5	6								
7	3	5	7	4	6	8	9	10	2	1
8	4	10	7	5	1					
9	5	7	4	6	8	9	10			
10	7	5	6	10	8	4	3	2		
11	8	9	10	7	6	5	4	3	2	1
12	4	3	7	9	10					
13	9	10								
14	6	4	8	5	3	7	9	10		
15	8	9	1	2	7	6	5	4	10	3
16	7	8	9	10	6	5	4	3	2	1
17	10	9	8	7	6	5	4	3	2	1
18	10	9	8	7	6	5	4	3	2	1
19	6	7	8	5	4	3	9	10	1	
20	6	7	8	5	4	3	9	10	1	
21	4	6	8	9	10					
22	5	6	7	8	9	10	1	2	3	4
23	5	6	7	8	9	10	1	2	3	4
24	5	6	7	8	9	10	1	2	3	4
25	1	2	3	4	5	6	7	8	9	10
26	3	5	7	4	5	1	2	8	9	10
27	7	8	9	10	3	2	1	6	4	5
28	3	5	7	4	6	8	9	10	1	2
29	5	6	7	8	9	10				
30	6	4	8	5	7	9	10	3	2	1
31	3	4	5							
32	8	9	10	7	6	5				
33	3	5	7	4	5	1	2	8	9	10
34	7	8	9	10	6	5	4	3	2	1
35	1	3	5	7	9	2	4	6	8	10
36	4	6	1	2	5	3	7	8	10	9
37	6	5	2	3	4	10	9	8	7	1
38	6	5								
39	8	9	7							
40	7	8	10	6	5	4	3	2	1	
41	7	8	10	6	5	4	3	2	1	
42	8	9	10							
43	3	7	5	8	4	6	9	10	2	1
44	6	5	8	10	4	1	2			
45	7	3	8	9	10	4	2	1		
46	3	5	4	10						
47	3	4	5	6	7	8	9	10		
48	8	5	3							
49	9	8	10	7	6	5	4	3	2	1
50	9	8	10	7	6	5	4	3	2	1
51	3	4	5	6	7	8	9	10	1	2
52	8	7								
53	2	1	5	6	7	8	3	4	9	10
54	2	1	4	6	8	3	5	7	9	10
55	7	6	8	9	5	4	10	3	2	1
56	4	5	6	7	8					

For explanation, see example after Applicant No. 56.

Example: Applicant No. 3's first preference was Hunt No. 8, then Nos. 9, 10, and 7 in order from most to least preferred.

Source: Hunting Records, Lomagundi Hunter's Association, Mhangura, Zimbabwe.

Appendix 6.3 Applicants' hunt preferences: Rifa section (Hurungwe Safari Area)

APPLICANTS' HUNTING PREFERENCES for RIFA SECTION of HURUNGWE SAFARI AREA
YEAR: 1991
ZIMBABAWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st, 2nd,...39th) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
1	11	24	18	27	15	12	30	9	33	6	3	20	13	17	26	14	29	11	32	5	2	19	22	16	25	13	28	10	7	31	4	1	36	35	34	39	38	37	
2	11	24	18	27	15	12	30	9	33	6	3	20	13	17	26	14	29	11	32	5	2	19	22	16	25	13	28	10	7	31	4	1	36	35	34	39	38	37	
3	33	31	35	For explanation, see example after Applicant No. 300																																			
4	20	17	14	11	8	19	16	12	7	26	15	10	6	23	18	13	9	21	22	24	25	33	34	35	27	28	29	30	31	32	5	36	37	38	39	1	2	3	4
5	20	17	14	11	8	7	12	16	19	21	22	23	24	19	18	16	15	13	12	10	9																		
6	14	17	20	11	8	12	13	15	16	18	19	21	22	10	9	7	6	5	23	24	25	26	27	28	4	3	2	1	29	30	31	32	33	34	35	36	37	38	39
7	14	17	20	11	8	12	13	15	16	18	19	21	22	10	9	7	6	5	23	24	25	26	27	28	4	3	2	1	29	30	31	32	33	34	35	36	37	38	39
8	20	17	14	11	8	6	10	15	26	7	12	16	19	9	13	18	23	33	34	35	5	22	25	29	2	21	30	32	27	37	36	31	28	24	4	3	1	38	39
9	11	14	17	20	23	26	29	22	25	28	24	27	30	33	24	35	5	12	21	31	32	10	13	15	16	18	19	1	2	3	4	6	7	8	9	36	37	38	39
10	8	11	14	17	20	7	12	16	19	9	13	18	23	6	10	15	26	3	21	24	27	33	5	29	32	4	22	28	30	31	25	2	34	35	36	37	38	1	39
11	17	8	20	14	11	21	22	26	29	32	30	28	27	25	24	23	31	16	18	19	35	34	33	36	13	12	10	9	7	15	6	5	4	37	38	39	3	2	1
12	17	8	20	14	11	21	22	26	29	32	30	28	27	25	24	23	31	16	18	19	35	34	33	36	13	12	10	9	7	15	6	5	4	37	38	39	3	2	1
13	17	8	20	14	11	21	22	26	29	32	30	28	27	25	24	23	31	16	18	19	35	34	33	36	13	12	10	9	7	15	6	5	4	37	38	39	3	2	1
14	18	19	21	22	23	24	31	32	33	34	35	36	37	38	39	13	4	16	18	20																			
15	18	19	21	22	23	24	31	32	33	34	35	36	37	38	39	13	4	16	18	20																			
16	20	17	14	11	8	7	13	18	9	10	15	16	19	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	6	5	4	3	2	1	12			
17	7	9	12	13	15	16	18	19	23																														
18	21	33	22	25	34	35	2	30	24	27	31	1	28	36	3																								
19	8	17	14	11	20	10	12	7	19	16	6	15	26	9	13	18	23	33	29	21	25	35	34	24	22	27	36	28	37	38	39	5	4	3	2	1			
20	31	32	33	34	35	36	37	38	39	22	23	24																											
21	20	17	14	11	8	19	16	12	7	26	15	10	6	9	13	18	21	22	23	24	25	27	28	29	30	31	32	33	34	35	36	37	38	39	5	4	3	2	1
22	1	2	3	4	21	22	24	25	27	28	29	30	31	32	33	34	35	36	37	38	39	5	6	7	9	18	10	16	23	26									
23	20	17	14	11	8	19	21	22	16	18	12	13	15	9	10	26	27	24	23	25	30	32	28	29	31	33	3	4	5	6	7	2	1	34	35	36	37	38	39
24	21	22	24	31	33	39																																	
25	20	17	14	19	18	16	13	23	15	26	21	22	24	27	25	28	29	30																					
26	17	20	14	16	19	12	11	18	13	15	23	22	21	25	27	33	7	9	10	26	24	8	28	31	30	32	29												
27	26	21	25	28	30	29																																	
28	8	11	26	7	10	16	19	7	12	10	14	21	22	24	25	27	9	13	18	23	28	29	30	31	32	33	34	35	36	37	38	39	1	2	3	4	5	6	
29	8	11	14	17	20	1	2	3	4	5	6	15	22	21	24	23	7	9	10	12	13	16	18	19															
30	8	11	14	17	20	1	2	3	4	5	6	7	9	10	12	13	15	16	18	19	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
31	17	20	14	11	8	19	16	12	7	23	18	13	9	21	22	15	10	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	1	2	3	4	5	6
32	23	26	29	22	24	25	27	28	30	11	14	17	20	32	10	12	13	15	16	18	19	21	31	33	34	35	36	37	38	39									
33	23	26	29	22	24	25	27	28	30	11	14	17	20	32	10	12	13	15	16	18	19	21	31	33	34	35	36	37	38	39									
34	20	17	14	11	8	7	12	16	19	21	22	23	24	19	18	16	15	13	12	10	9																		
35	21	24	27	30	3	2	22	25	28	31	33	35	36	38	39	34	37	1																					
36	20	17	14	11	8	19	16	12	7	23	18	13	9	10	26	15	6	21	22	24	27	25	31	28	29	30	32	33	5	4	3	2	1	34	35	36	37	38	39
37	10	12	13	15	16	18	19	21	22	23	24	25	26	21	28	29	30	9	8	31	32	33																	
38	8	11	14	17	20	6	33	35	24	27	30	34	32	29	26	23	21	18	15	12	9	36	31	28	25	22	19	16	13	10	7	5	4	3	2	1	37	38	39
39	8	11	14	17	20	6	33	35	24	27	30	34	32	29	26	23	21	18	15	12	9	36	31	28	25	22	19	16	13	10	7	5	4	3	2	1	37	38	39
40	27	26	25	24	28	30	21	33	18	35	22	29	31	37	36	34	32	23	16	13	7	6	5	4	9	10	12	15	19	23	39	3	2	1	8	11	14	17	20
41	13	18	23	5	21	9	5	22	24	25	27	28	14	17	20	29	6	7	10	11	12	15	16	19	26	30	31	32	4										
42	13	18	23	5	21	9	5	22	24	25	27	28	14	17	20	29	6	7	10	11	12	15	16	19	26	30	31	32	4										
43	13	18	8	23	5	21	9	22	24	25	27	28	14	17	20	29	6	7	10	11	12	15	16	19	26	30	31	32	7										
44	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
45	20	17	14	11	8	23	26	12	9	15	18	21	16	13	10	19	29	24	25	22	27	28	30	5	6	2	3	7	4	1	32	33	35	36	34	31	38	39	37
46	33	34	35	36	37	38	39	31	30	28	27	25	24	22	21	2	1	3																					
47	5	12	21	25	7	16	19	6	10	15	26	9	13	18	22	23	24	27	28	29	1	2	3	4	30	31	32	33	34	35	36	37	38	39					
48	5	12	21	25	7	16	19	6	10	15	26	9	13	18	22	23	24	27	28	29	1	2	3	4	30	31	32	33	34	35	36	37	38	39					
49	13	15	21	12	16	19	7	6	26	4	10	18	22	24	27	33	5	30	31	32	34	35	29	28															
50	29	30	27	24	28	25	22	26	23	32	33	21	31	35	34	36	37	38	39	18	19	15	12	16	13	4	9	10	7	5	6	20	17	14	11	8	2	3	1
51	29	30	27	24	28	25	22	26	23	32	33	21	31	35	34	36	37	38	39	18	19	15	12	16	13	4	9	10	7	5	6	20	17	14	11	8	2	3	1
52	16	6	13	18	23	7	12	19	9	15	26	10	34	35	22	24	27	25	5	4	2	36	37	38	39	3	1	21	33	31	28	29	30	32	8	11	14	17	20
53	21	22	23	24	25	26	27	28	29	30	4	1	2	3	5	19	7	6	9	13	16	18	10	12	19	31	32	33	34	35	36	37	38	39	20	17	14	11	8
54	20	17	14	11	8	21	18	15	12	9	6	24	30	27	3	33	1	2	4	5	7	10	13	16	19	22	23	25	26	28	29	31	32	34	35	36	37	38	39
55	20	17	14	11	23	19	18	16	13	12	26	22	21	15	10	24	25	32	31	29	33	35	34	30	27	28	36	37	38	39	2	3	1						
56	33	34	35	32	36	37	31	30	29	28	27	26	25	24	23	22	21	38	39	19	18	16	15	13	12	10	9	7	6	5	4	3	2	1	20	17	14	11	8
57	22	24	25	27	28	30	31	36																															
58	24	27	22	25	28	29	26	23	33	34	35	13	10	15	14	17	20	21	8	11	12	6	30	31	32	19	18	16	9	7	36	37	38	39	5	4	3	2	1
59	33	34	35	4	6	3	5	8	11	12	14	17	31	29	25	26	19	32	30	28	23	16	7	9	5	10	36	37	38	39	8	11	14	17	20	2	3	1	
60	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7																			
61	5	4	21	33	34	35	1	2	3	6	25	24	22																										
62	7	10	6	8	9	11	14	12	13	15	22	23	24	25	26	27	28	29																					
63	8	11	14	17	20	5	1	2	11	8	16	3	4	6	7	9	10	1	12	13	15	9	21	22	24	15	26	27	28	29	39	31	32	33	34	35	36	37	38
64	8	11	14	17	20	7	12	16	19	13	23	18	9	10	22	25	26	2	1	3	5	4	15	6	24	29	32	35	38	28	31	34	37	27	30	33	36	39	21
65	8	11	14	17	20	6	5	4	2	1	3	7	12	16	19	9	13	18	23	10		15	21	22	24	31	32	33	34	35	36	25	26	27	28	29	30		
66	8	11	14	17	20	6	5	4	2	1	3	7	12	16	19	9	13	18	23	10																			
67	8	11	14	17	20	6	5	4	2	1	3	25	26	27	28	29	30	7	12	16	19	9	13	18	23	10	15	21	22	24	31	32	33	34	35	36			
68	8	11	14	17	20	6	5	4	2	1	3	25	26	27	28	29	30	7	12	16	19	9	13	18	23	10	15	21	22	24	31	32	33	34	35	36			
69	7	16	19	12	8	11	14	17	20	10	26	13	23	9	18	6	2	1	3	25	28	29	27	30	5	4	22	15	21	24	31	32	33	34	35	36	37	38	39
70	7	16	19	12	8	11	14	17	20	10	26	13	23	9	18	6	2	1	3	25	28	29	27	30	5	4	22	15	21	24	31	32	33	34	35	36	37	38	39
71	8	11	14	17	20	23	26	5	2	7	10	13	16	19	22	25	1	3	4	6	9	12	15	18	21	24	27	28	29	30	31	32	33						
72	23	26	5	2	7	10	13	16	19	22	25	1	3	4	6	9	12	15	18	21	24	27	28	29	30	31	32	33											
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89	17	20	16	21	18	19																																	

APPLICANTS' HUNTING PREFERENCES for RIFA SECTION of HURUNGWE SAFARI AREA
YEAR: 1991
ZIMBABAWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st, 2nd,...39th)																																						
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APPLICANTS' HUNTING PREFERENCES for RIFA SECTION of HURUNGWE SAFARI AREA
YEAR: 1991
ZIMBABAWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st, 2nd,...39th)																																							
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196	8	7	4	20	11	12	16	19	10	15	26	9	13	23	18	5	33	34	35	29	32	2	6	21	25	27	28	22	24	30	31	4	3	36	37	1	38	39	1
197	7	19	21	2	13	10	22	4																															
198	17	20	18	15	23	26	29	21	24	27	30	32	33	16	19	22	25	28	31	34																			
199	6	10	15	26	7	12	16	19	9	13	18	23																											
200	26	25	27	23	22	24	8	7	9	11	10	12	14	13	15	17	16	18	20	19	21	5	4	6	29	28	30	35	34	36	38	37	39						
201	26	25	27	23	22	24	8	7	9	11	10	12	14	13	15	17	16	18	20	19	21	5	4	6	29	28	30	35	34	36	38	37	39						
202	20	17	14	11	19	8	16	12	7	18	13	9	23	15	10	6	26	21	5	25	27	24	22	4	3	2	1	28	29	30	31	32	33	34	35	36	37	38	39
203	20	17	14	11	19	8	16	12	7	18	13	9	23	15	10	6	26	21	5	25	27	24	22	4	3	2	1	28	29	30	31	32	33	34	35	36	37	38	39
204	14	17	20	8	11	7	12	16	19	6	15	26	10	23	18	13	9	3	21	24	27	30	33	36	22	25	28	29	31	32	34	35	37	38	39	4	5	2	1
205	11	14	17	20	8	33	34	35	12	16	19																												
206	8	11	14	17	20	1	2	3	4	5	6	7	9	10	12	13	15	16	18	19	21	22	23	24	25	26	27	28	29	30	31	32	33						
207	16	12	23	18	13	9	26	15	10	21	22	24	25	27	28	29	30	31	32	33	34	35	36	7	19														
208	16	12	23	18	13	9	26	15	10	21	22	24	25	27	28	29	30	31	32	33	34	35	36	7	19														
209	20	11	8	14	17	21	19	12	5	4	6	15	13	10	9	16	18	7	33	32	31	34	36	35	22	23	24	25	26	27									
210	38	39																																					
211	17	20	14	16	18	19	21	13	15																														
212	14	17	20	13	15	16	18	19	21	11	8	7	9	33	14	35	36	37	38	39	32	31	30	29	28	27	1	2	3	4	5	6							
213	22	21	30	2	24	25	27	28	31	3	1	34	35	36	37	38	39	33																					
214	22	21	30	2	24	25	27	28	31	3	1	34	35	36	37	38	39	33																					
215	8	17	11	14	20	12	19	7	16	13	18	23	9	10	6	15	5	21	33	34	35	4	1	2	3	29	22	24	31	32	30	28	36	37	38	39			
216	9	21	25	26	27																																		
217	33	34	35	21	25	5	19	22	28	31	3	24	27	29	30	36	32	1	17																				
218	8	14	17	20	11	1	2	3	4	5	6	9	13	15	16	18	19	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39			
219	7	9	10	11	12	13	15	16	17	18	19	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	1	2	3	4	5	6	38	39				
220	7	9	10	11	12	13	15	16	17	18	19	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	1	2	3	4	5	6	38	39				
221	11	14	17	20	33	26	10	15	12	16	19	13	18	23	29	32	22	25	28	31	21	24	27	30															
222	14	17	20	8																																			
223	21	25	5	19	22	28	31	3	24	27	30	32	36	1	2	4																							
224	21	25	5	19	22	28	31	3	24	27	30	32	36	1	2	4																							
225	11	14	17	20	8	10	15	26	12	23	9	22	21	18	24	25	27	28	6	7	29	5																	
226	11	14	17	20	8	10	15	26	12	23	9	22	21	18	24	25	27	28	6	7	29	5																	
227	7	9	12	16	19	13	18	23	4	6	10	15	5	26	29	32	33	34	35	21	22	24	27	31	25	2	1	3	30	28	36	37	38	39	8	11	14	17	20
228	11	14	17	20	8	10	15	26	12	23	9	22	21	18	24	25	27	28	6	7	29	5																	
229	7	9	12	16	19	13	18	23	4	6	10	15	5	26	29	32	33	34	35	21	22	24	27	31	25	2	1	3	30	28	36	37	38	39	8	11	14	17	20
230	11	14	17	20	33	34	35	26	23	19																													
231	20	17	14	11	8	19	16	12	7	13	18	13	9	35	34	36	26	15	10	6	33	32	31	30	29	28	27	25	24	22	21	38	37	39	5	4	3	2	1
232	35	34	33	32	31	30	29	28	27	25	24	22	21	20	17	14	11	8	5	26	23	19	18	16	15	13	12	10	9	7									
233	35	34	33	32	31	30	29	28	27	25	24	22	21	20	17	14	11	8	5	26	23	19	18	16	15	13	12	10	9	7									
234	35	34	33	32	31	30	29	28	27	25	24	22	21	20	17	14	11	8	5	26	23	19	18	16	15	13	12	10	9	7									
235	5	13	15	22	18	12	10	21	6	4	19	9	7	16	23																								
236	2	1	3	6	21	10	18	19	15	13	12	9	16	7	34	35	36																						
237	12	10	6	7	15	16	35	34																															
238	20	17	14	11	8	19	26	18	15	12	10	9	6	7	11	22	23	24	25	27	1	2	3	4	5	28	29	30	31	32	33	34	35	36	37	38	39		
239	21	12	33	5	1	2	3	22	24	25	27	28	29	30	31	34	35	36	37	16	9	18	7	4	23														
240	12	33	35	36	16	9	34	29	18	21	23	24	25	27	30	32	38	39	37	31	28	22	19	13	7	5	4	3	2	1									
241	20	17	14	11	8	15	13	12	10	9	16	18	19	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	7	6	5	4	3	2	1
242	25	27	18	16	13	12	9	3	2	1	5	4	7	34	35	36	37	38	39	26	6	10	15	19	21	22	23	24	28	29	30	31	32	33					
243	25	27	18	16	13	12	9	3	2	1	5	4	7	34	35	36	37	38	39	26	6	10	15	19	21	22	23	24	28	29	30	31	32	33					
244	8	7	11	14	12	23	25	26	27																														
245	14	11	8	20	17	27	26	25	24	23	22	3	2	1	15	10	6	33	32	31	12	7	9	13	4	5	36	35	34	21	18	19	16	37	39	38	30	29	28
246	14	11	8	20	17	27	26	25	24	23	22	3	2	1	15	10	6	33	32	31	12	7	9	13	4	5	36	35	34	21	18	19	16	37	39	38	30	29	28
247	14	11	8	20	17	27	26	25	24	23	22	3	2	1	15	10	6	33	32	31	12	7	9	13	4	5	36	35	34	21	18	19	16	37	39	38	30	29	28
248	29	30	27	24	28	25	22	26	23	32	33	21	31	35	34	36	37	38	39	18	19	15	12	16	13	4	9	10	7	5	6	20	17	14	11	8	2	3	1
249	8	17	11	14	20	12	7	16	19	13	18	9	23	15	10	6	26	5	4	21	22	24	25	27	33	32	31	34	35	1	2	3	36	37	38	39			
250	8	17	11	14	20	12	7	16	19	13	18	9	23	15	10	6	26	5	4	21	22	24	25	27	33	32	31	34	35	1	2	3	36	37	38	39			
251	11	12	10	14	13	15	8	7	9	5	6	4	17	16	18	20	19	21	23	22	24	31	33	32	34	35	36	37	26	25	27	29	28	30	38	39			
252	8	11	14	17	20	12	7	19	13	21	16	18	15	10	9	6	22	23	24	5	26	27	28	29	30	4	33	34	35	32	31	3	2	1	36	37	38	39	
253	20	11	17	8	14	2	3	6	26	5	21	23	24	27	12	32	33	35	36	34	31	4																	
254	8	5	7	12	15	19	20	23	26	27	25	29	30	32	31	1	2	3	4	6	9	10	11	13	14	16	17	18	21	22	24	28	31	34	35	36	37	38	39
255	21	33	22	25	34	35	2	30	24	27	31	1	28	36	3																								
256	8	11	14	17	20	5	12	21	25	29	33	7	16	19	32	34	35	1	2	3	4	6	9	10	13	15	18	22	23	24	26	27	28	30	31	36	37	38	39
257	8	11	14	17	20	7	12	16	19	33	9	13	18	23	4	6	10	3	2	1	15	21	22	24	25	26	27	28	29	30	31	32	34	35	36	37	5	38	39
258	8	11	14	17	20	7	12	16	19	33	9	13	18	23	4	6	10	3	2	1	15	21	22	24	25	26	27	28	29	30	31	32	34	35	36	37	5	38	39
259	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
260	14	11	17	20	8	15	26	12	16	19	21	22																											
261	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	36	37	38	39	1	2	3	4	5	6	7	8	9	35
262	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	36	37	38	39	1	2	3	4	5	6	7	8	9	35
263	33	34	35	31	32	36	27	29	28	30	37	38	39																										
264	33	34	35	31	32	36	27	29	28	30	37	38	39																										
265	33	34	35	31	32	36	27	29	28	30	37	38	39																										
266	33	34	35	31	32	36	27	29	28	30	37	38	39																										
267	16	18	19	21	22	23	24	25	26	27	28	29	15	13																									

APPLICANTS' HUNTING PREFERENCES for RIFA SECTION of HURUNGWE SAFARI AREA
YEAR: 1991
ZIMBABAWE HUNTER'S ASSOCIATION

APPLICANT NO.	PREFERENCES (1st, 2nd,...39th)																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
268	17	12	8	7	10	15	14	11	16	26	18	13	9	19	20	29	33																						
269	4	5	6	7	10	11	13	15	21	22	24	25	26	27	28	29	30	31	32	33	1	2	3	14	15														
270	26	23	6	9	32	5	2	38	12	14	18	20	7	27	29	37	31	22	16	25	1	3	4	10	13	15	19	21	39	24	30	33	17	28	11	8	34	35	36
271	23	26	6	29	32	5	2	8	11	17	20	7	27	16	12	18	21	4	14	35	31	25	24	19	22	15	9	10	30	33	34	36	3	37	38	39	1	28	13
272	10	11	13	17	23	7	29	16	39	21	38	22	24	28	37	34	14	9	20	6	33	5	35	1	19	25	18	36	31	10	4	2	3	32	15	8			
273	8	11	14	17	20	32	30	26	22	21	12	13	2	33	35	34	36	37	31	38	39	9	10	15	16	18	19	23	24	25	27	28	29	7	6	5	4	3	1
274	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
275	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
276	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	1	2	3	4	5	6
277	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
278	25	26	27	28	29	30	1	2	3																														
279	1	2	6	4	5	6	7	9	10	12	13	15	16	18	19	21	22	23	24	25	26	27	28	29	30	31													
280	20	11	17	8	14	2	3	6	26	5	21	23	24	27	12	32	33	35	36	34	31	1																	
281	26	19	6	21	24	27	30	22	25	3	28	15	16	7	2	12																							
282	19	18	22	21	20	16	17																																
283	26	19	6	21	24	27	30	22	25	3	28	15	16	7	2	12																							
284	26	19	6	21	24	27	30	22	25	3	28	15	16	7	2	12																							
285	29	28	30	2	1	3	26	25	27	8	11	14	17	20	23	22	24	19	16	13	10	12	15	18	21	31	32	33											
286	29	28	30	2	1	3	26	25	27	8	11	14	17	20	23	22	24	19	16	13	10	12	15	18	21	31	32	33											
287	14	17	11	8	10	26	15	12	27	25	30	29	28																										
288	21	22	23	24	25	26	27	28	29	30	31	20	19	18	17	14	11	8																					
289	11	8	14	17	20	9	12	15	18	21	6	7	10	13	16	19	22	24	23																				
290	11	8	14	17	20	9	12	15	18	21	6	7	10	13	16	19	22	24	23																				
291	10	18	6	7	8	11	12	14	17	19	20	21																											
292	10	18	6	7	8	11	12	14	17	19	20	21																											
293	10	18	6	7	8	11	12	14	17	19	20	21																											
294	34	35	1	2	3	21	22	24	25	27	28	30	31	36	37	38	39	8	11	14	20																		
295	1	2	3	8	11	14	17	20	21	22	24	25	27	28	30	31	34	35	36	37	38	39																	
296	12	16	7	6	9	10	15	26	13	18	23	19	5	21	29	32	33	34	35	22	24	25	30	27	28	36	37	2	4	1	3	31							
297	26	27	25	2	3	1	23	24	22	29	30	28	32	33	31	35	36	34	38	39	37	20	21	19	17	18	16	14	15	13	11	12	10	8	9	7	5	6	4
298	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	5	4	3	2	1	32	33	34	35	36	37	38	39
299	8	11	14	17	26	15	16	7	12	10	22	24	25	27	9	13	18	23	28	29	30																		
300	26	27	25	5	2	1	3	4	6	33	34	35	29	30	28	8	9	7	11	12	10	14	15	13	17	18	16	20	31	19	23	24	22	31	36	37	38	39	

Example: Applicant No. 3 had Hunt No. 33 as first preference, then Hunt Nos. 31 and 35 in order from most, to least preferred.

Source: Hunting records of Mashonaland Hunter's Association, Harare, Zimbabwe.

Appendix 7 Value of quota allocation for Zimbabwe hunting areas: 1991; valued at the public retail price.

Appendix 7.1 Value of allocation: Charara Safari Area

CHARARA SAFARI AREA:		VALUATION OF ALLOCATED HUNTING QUOTAS *Citizen Hunting Area (includes Makuti Totals)*																	
YEAR:	1991																		
TROPHY FEE TYPE:	LOCAL																		
DATE from:		1.5	1.5	9.5	9.5	17.5	17.5	25.5	25.5	2.6	2.6	10.6	10.6	18.6	18.6	26.6	26.6	4.7	4.7
DATE to:		7.5	7.5	15.5	15.5	23.5	23.5	31.5	31.5	8.6	8.6	16.6	16.6	24.6	24.6	2.7	2.7	10.7	10.7
DRAW NO.		4	5	9	10	14	15	19	20	24	25	29	30	34	35	39	40	44	45
HUNT NO.		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
SPECIES	TROPHY FEE																		
Elephant (M)	7500								7500									7500	
Elephant (F)	2000																		
Elephant (F tl)	1000																		
Zebra	450																		
Hippopotamus	800																		
Bushpig	75																		
Warthog	75		75				75			75			75				75		
Giraffe	800																		
Buffalo (M)	600	600		600		600		600			600		600		600		600		
Buffalo (F)	450		450		450		450			450		450		450		450			450
Buffalo (NT)	450																		
Nyala	500																		
Bushbuck (M)	150																		
Kudu (M)	300																		
Kudu (F)	200																		
Eland (M)	500											500							
Eland (F)	400																		
Duiker	25	25		25			25				25		25						
Reedbuck	100																		
Waterbuck (M)	350																		
Waterbuck (F)	200																		
Sable (M)	800																		
Sable (F)	400																		
Wildebeest	200																		
Tsessebe	300																		
Impala (M)	60	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Impala (F)	40	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Impala (cull)	40																		
Klipspringer	100																		
Steenbok	25																		
Grysbok	25																		
Lion (M)	1500																		
Lion (F)	1000																		
Leopard	1000																		
Wildcat	25																		
Serval	50																		
Genet	25																		
Civet	50																		
Hyaena	50																		
Jackal	25																		
Bat-eared Fox	50																		
Porcupine	25																		
Baboon	10		10		10		10		10		10		10		10		10		10
Crocodile	500																		
Guinea Fowl	5	15	15	15	15	15	15	15	20	20	20	20	15	15	15	15	15	25	25
Francolin	3	9	9	9	9	9	9	9	12	12	12	12	9	9	9	9	9	15	15
Pigeon/Dove	1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8
Sandgrouse	1																		
Duck	0																		
TOTAL TROPHY VALUE		856	766	856	691	831	791	831	7,749	764	874	1,189	941	681	841	681	916	7,748	708
NOTES																			
DATA SOURCE		DNPWLM Licensing Office, Harare. Permits DNPWLM Peter's Point, Kariba. Permits DNPWLM, Marongora.																	

CHARARA SAFARI AREA:

YEAR: 1991
TROPHY FEE TYPE: LOCAL

DATE from:		12.7	12.7	20.7	20.7	28.7	28.7	5.8	5.8	13.8	13.8	21.8	21.8	29.8	29.8	6.9	6.9	14.9	14.9
DATE to:		18.7	18.7	26.7	26.7	3.8	3.8	11.8	11.8	19.8	19.8	27.8	27.8	4.9	4.9	12.9	12.9	20.9	20.9
DRAW NO.		49	50	54	55	59	60	64	65	69	70	74	75	79	80	84	85	89	90
HUNT NO.		C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32	C33	C34	C35	C36
SPECIES	TROPHY FEE																		
Elephant (M)	7500							7500											
Elephant (F)	2000																		
Elephant (F tl)	1000																		
Zebra	450																		
Hippopotamus	800																		
Bushpig	75																		
Warthog	75	75				75				75				75			75		
Giraffe	800																		
Buffalo (M)	600	600		600		600			600		600		600		600				
Buffalo (F)	450		450		450		450			450		450		450		450			
Buffalo (NT)	450																		
Nyala	500																		
Bushbuck (M)	150														150	150	150	150	150
Kudu (M)	300																		
Kudu (F)	200																		
Eland (M)	500																		
Eland (F)	400																		
Duiker	25																		
Reedbuck	100																		
Waterbuck (M)	350																		
Waterbuck (F)	200																		
Sable (M)	800																		
Sable (F)	400																		
Wildebeest	200																		
Tsessebe	300																		
Impala (M)	60	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	60
Impala (F)	40	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	40
Impala (cull)	40																		
Klipspringer	100																		
Steenbok	25																		
Grysbok	25														25		25		25
Lion (M)	1500																1500		
Lion (F)	1000																		
Leopard	1000																	1000	
Wildcat	25																		
Serval	50																		
Genet	25																		
Civet	50																		
Hyaena	50																		
Jackal	25																		
Bat-eared Fox	50																		
Porcupine	25																		
Baboon	10		10		10		10		10		10		10		10		10		10
Crocodile	500																		
Guinea Fowl	5	25	25	25	25	20	25	20	25	20	25	25	25	25	20	25	15	15	15
Francolin	3	15	15	15	15	12	15	12	15	12	15	15	15	15	12	15	9	9	9
Pigeon/Dove	1	8	8	8	8	8	8	8	8	8	8	8	8	9	9	9	7	7	7
Sandgrouse	1																		
Duck	0																		
TOTAL TROPHY VALUE		923	708	848	708	915	708	7,740	858	765	858	698	858	774	1,026	849	1,991	1,381	316

NOTES
DATA SOURCE

CHARARA SAFARI AREA:

YEAR: 1991
TROPHY FEE TYPE: LOCAL

SPECIES	TROPHY FEE	DATE from: 22.9 / DATE to: 28.9 / DRAW NO. 94 / HUNT NO. C37	22.9 / 28.9 / 95 / C38	30.9 / 6.10 / 99 / C39	30.9 / 6.10 / 100 / C40	1991 ALLOCATIO VALUE TOTAL CHARARA	1991 ALLOCATION VALUE TOTAL MAKUTI	1991 ALLOCATION VALUE TOTAL CHARARA & MAKUTI
Elephant (M)	7500					22,500	22,500	45,000
Elephant (F)	2000					0	0	0
Elephant (F tl)	1000					0	0	0
Zebra	450					0	0	0
Hippopotamus	800					0	0	0
Bushpig	75					0	75	75
Warthog	75	75			75	900	1,350	2,250
Giraffe	800					0	0	0
Buffalo (M)	600					9,000	13,800	22,800
Buffalo (F)	450					6,750	10,350	17,100
Buffalo (NT)	450					0	0	0
Nyala	500					0	0	0
Bushbuck (M)	150	150	150	150	150	1,350	0	1,350
Kudu (M)	300					0	4,500	4,500
Kudu (F)	200					0	0	0
Eland (M)	500					500	0	500
Eland (F)	400					0	0	0
Duiker	25					125	1,000	1,125
Reedbuck	100					0	0	0
Waterbuck (M)	350					0	1,750	1,750
Waterbuck (F)	200					0	0	0
Sable (M)	800					0	2,400	2,400
Sable (F)	400					0	0	0
Wildebeest	200					0	0	0
Tsessebe	300					0	0	0
Impala (M)	60	60	60	60	60	4,500	0	4,500
Impala (F)	40	40	40	40	40	3,000	0	3,000
Impala (cull)	40					0	0	0
Klipspringer	100					0	900	900
Steenbok	25					0	0	0
Grysbok	25		25		25	125	1,000	1,125
Lion (M)	1500	1500				3,000	4,500	7,500
Lion (F)	1000					0	0	0
Leopard	1000		1000		1000	3,000	5,000	8,000
Wildcat	25					0	0	0
Serval	50					0	0	0
Genet	25					0	0	0
Civet	50					0	100	100
Hyaena	50					0	250	250
Jackal	25					0	0	0
Bat-eared Fox	50					0	0	0
Porcupine	25					0	50	50
Baboon	10		10		10	200	390	590
Crocodile	500					0	0	0
Guinea Fowl	5	15	15	15	15	770	1,085	1,855
Francolin	3	9	9	9	9	462	651	1,113
Pigeon/Dove	1	7	7	7	7	300	434	734
Sandgrouse	1					0	0	0
Duck	0					0	0	0
TOTAL TROPHY VALUE		1,856	1,316	281	1,391	56,482	72,085	128,567

NOTES
DATA SOURCE

Appendix 7.2 Value of allocation: Makuti section (Hurungwe Safari Area)

HURUNGWE SAFARI AREA:		VALUATION OF ALLOCATED QUOTAS																			
MAKUTI SECTION		*Citizen Hunting Area*																			
YEAR:	1991																				
TROPHY FEE TYPE:	LOCAL																				
DATE from:		1.5	1.5	1.5	9.5	9.5	9.5	17.5	17.5	17.5	25.5	25.5	25.5	2.6	2.6	2.6	10.6	10.6	10.6	18.6	18.6	18.6
DATE to:		7.5	7.5	7.5	15.5	15.5	15.5	23.5	23.5	23.5	31.5	31.5	31.5	8.6	8.6	8.6	16.6	16.6	16.6	24.6	24.6	24.6
DRAW NO.		1	2	3	6	7	8	11	12	13	16	17	18	21	22	23	36	27	28	31	32	33
HUNT NO.		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21
SPECIES	TROPHY FEE																					
Elephant (M)	7500																					
Elephant (F)	2000																					
Elephant (F tl)	1000																					
Zebra	450																					
Hippopotamus	800																					
Bushpig	75																					
Warthog	75	75				75				75								75				
Giraffe	800																					
Buffalo (M)	600	600		600		600		600		600		600		600		600		600		600		600
Buffalo (F)	450		450		450		450		450		450		450		450		450		450		450	
Buffalo (NT)	450																					
Nyala	500																					
Bushbuck (M)	150																					
Kudu (M)	300																					
Kudu (F)	200																					
Eland (M)	500																					
Eland (F)	400																					
Duiker	25		25		25		25		25		25		25		25		25		25		25	
Reedbuck	100																					
Waterbuck (M)	350																					
Waterbuck (F)	200																					
Sable (M)	800																					
Sable (F)	400																					
Wildebeest	200																					
Tsessebe	300																					
Impala (M)	60																					
Impala (F)	40																					
Impala (cull)	40																					
Klipspringer	100																					
Steenbok	25																					
Grysbok	25																					25
Lion (M)	1500																					
Lion (F)	1000																					
Leopard	1000																					
Wildcat	25																					
Serval	50																					
Genet	25																					
Civet	50																					
Hyaena	50															50						50
Jackal	25																					
Bat-eared Fox	50																					
Porcupine	25																					
Baboon	10		10		10		10		10		10		10		10		10		10		10	
Crocodile	500																					
Guinea Fowl	5	15	15	20	15	15	20	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Francolin	3	9	9	12	9	9	12	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Pigeon/Dove	1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Sandgrouse	1																					
Duck	0																					
TOTAL TROPHY VALUE		706	516	639	516	706	524	631	516	706	516	631	516	631	516	681	516	706	516	631	516	706
NOTES																						
DATA SOURCE		DNPWLM Licensing Office, Harare																				

HURUNGWE SAFARI AREA:
MAKUTI SECTION
YEAR: 1991
TROPHY FEE TYPE: LOCAL

SPECIES	TROPHY FEE																				
DATE from:		26.6	26.6	26.6	4.7	4.7	4.7	12.7	12.7	12.7	20.7	20.7	20.7	28.7	28.7	28.7	5.8	5.8	5.8	13.8	13.8	13.8
DATE to:		2.7	2.7	2.7	10.7	10.7	10.7	18.7	18.7	18.7	26.7	26.7	26.7	3.8	3.8	3.8	11.8	11.8	11.8	19.8	19.8	19.8
DRAW NO.		36	37	38	41	42	43	46	47	48	51	52	53	56	57	58	61	62	63	66	67	68
HUNT NO.		M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36	M37	M38	M39	M40	M41	M42
Elephant (M)	7500				7500																7500	
Elephant (F)	2000																					
Elephant (F tl)	1000																					
Zebra	450																					
Hippopotamus	800																					
Bushpig	75																					
Warthog	75		75					75			75			75			75					75
Giraffe	800																					
Buffalo (M)	600		600			600		600		600		600		600		600		600		600		600
Buffalo (F)	450	450		450			450		450		450		450		450		450		450			
Buffalo (NT)	450																					
Nyala	500																					
Bushbuck (M)	150																					
Kudu (M)	300																					
Kudu (F)	200																					
Eland (M)	500																					
Eland (F)	400																					
Duiker	25	25		25		25			25			25	25		25			25	25	25	25	25
Reedbuck	100																					
Waterbuck (M)	350																					
Waterbuck (F)	200																					
Sable (M)	800																					
Sable (F)	400																					
Wildebeest	200																					
Tsessebe	300																					
Impala (M)	60																					
Impala (F)	40																					
Impala (cull)	40																					
Klipspringer	100																					100
Steenbok	25																					
Grysbok	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Lion (M)	1500																					
Lion (F)	1000																					
Leopard	1000																					
Wildcat	25																					
Serval	50																					
Genet	25																					
Civet	50																					
Hyaena	50						50							50					50			
Jackal	25																					
Bat-eared Fox	50																					
Porcupine	25																					25
Baboon	10	10				10		10		10		10		10		10		10		10	10	10
Crocodile	500																					
Guinea Fowl	5	15			20	25	25	25	20	25	20	20	25	25	20	25	25	20	25	25	25	20
Francolin	3	9			12	15	15	15	12	15	12	12	15	15	12	15	15	12	15	15	15	12
Pigeon/Dove	1	7			7	8	8	8	8	8	8	8	8	9	8	8	8	8	8	8	8	8
Sandgrouse	1																					
Duck	0																					
TOTAL TROPHY VALUE		541	700	500	7,564	708	573	758	540	683	590	700	548	809	540	683	598	700	598	708	7,608	900

NOTES
DATA SOURCE

HURUNGWE SAFARI AREA:
MAKUTI SECTION
YEAR: 1991
TROPHY FEE TYPE: LOCAL

DATE from:		21.8	21.8	21.8	29.8	29.8	29.8	6.9	6.9	6.9	14.9	14.9	14.9	22.9	22.9	22.9	30.9	30.9	30.9	1991 ALLOCATION
DATE to:		27.8	27.8	27.8	4.9	4.9	4.9	12.9	12.9	12.9	20.9	20.9	20.9	28.9	28.9	28.9	6.10	6.10	6.10	VALUE
DRAW NO.		71	72	73	76	77	78	81	82	83	86	87	88	91	92	93	96	97	98	MAKUTI
HUNT NO.		M43	M44	M45	M46	M47	M48	M49	M50	M51	M52	M53	M54	M55	M56	M57	M58	M59	M60	TOTAL
SPECIES	TROPHY FEE																			
Elephant (M)	7500						7500													22,500
Elephant (F)	2000																			0
Elephant (F tl)	1000																			0
Zebra	450																			0
Hippopotamus	800																			0
Bushpig	75															75				75
Warthog	75		75			75		75		75		75			75			75	75	1,350
Giraffe	800																			0
Buffalo (M)	600		600		600															13,800
Buffalo (F)	450	450		450		450		450												10,350
Buffalo (NT)	450																			0
Nyala	500																			0
Bushbuck (M)	150																			0
Kudu (M)	300	300		300		300		300	300	300	300	300	300	300	300	300	300	300	300	4,500
Kudu (F)	200																			0
Eland (M)	500																			0
Eland (F)	400																			0
Duiker	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	1,000
Reedbuck	100																			0
Waterbuck (M)	350														350	350	350	350	350	1,750
Waterbuck (F)	200																			0
Sable (M)	800										800		800			800				2,400
Sable (F)	400																			0
Wildebeest	200																			0
Tsessebe	300																			0
Impala (M)	60																			0
Impala (F)	40																			0
Impala (cull)	40																			0
Klipspringer	100		100		100		100		100		100		100		100		100			900
Steenbok	25																			0
Grysbok	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	1,000
Lion (M)	1500								1500					1500					1500	4,500
Lion (F)	1000																			0
Leopard	1000									1000		1000			1000		1000	1000		5,000
Wildcat	25																			0
Serval	50																			0
Genet	25																			0
Civet	50												50						50	100
Hyaena	50																			250
Jackal	25																			0
Bat-eared Fox	50																			0
Porcupine	25						25													50
Baboon	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	300
Crocodile	500																			0
Guinea Fowl	5	25	25	20	25	25	20	25	15	15	15	15	15	15	15	15	15	15	15	1,085
Francolin	3	15	15	12	15	15	12	15	9	9	9	9	9	9	9	9	9	9	9	651
Pigeon/Dove	1	8	8	8	8	9	9	9	7	7	7	7	7	7	7	7	7	7	7	434
Sandgrouse	1																			0
Duck	0																			0
TOTAL TROPHY VALUE		858	883	850	808	934	7,726	934	1,991	1,466	1,291	1,466	1,341	1,891	1,916	1,616	1,841	1,816	2,366	72,095

NOTES
DATA SOURCE

Appendix 7.3 Value of allocation: Tuli Safari Area

TULI SAFARI AREA:		VALUE OF ALLOCATED HUNTS 1991																	
		Matabeleland Hunter's Association																	
YEAR:		1991		LEVY in % of DNPWLM Trophy Fee															
TROPHY FEE TYPE:		LOCAL		170%															
DATE from:		27.4	27.4	11.5	11.5	25.5	25.5	8.6	8.6	22.6	22.6	6.7	6.7	20.7	20.7	3.8	3.8	17.8	17.8
DATE to:		7.5	7.5	21.5	21.5	4.6	4.6	18.6	18.6	2.7	2.7	16.7	16.7	30.7	30.7	13.8	13.8	27.8	27.8
HUNT NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
SPECIES	TROPHY FEE																		
Elephant (M)	7500	7500		7500															
Elephant (F)	2000																		
Elephant (F tl)	1700																		
Zebra	765						765		765		765		765		765		765		765
Hippopotamus	1360																		
Bushpig	127.5																		
Warthog	127.5	128		128															
Giraffe	1360																		
Buffalo (M)	1020																		
Buffalo (F)	765																		
Buffalo (NT)	765																		
Nyala	850																		
Bushbuck (M)	255		255		255		255												
Kudu (M)	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510
Kudu (F)	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340
Eland (M)	850	850	850	850	850	850	850	850		850		850		850		850		850	
Eland (F)	680								680		680		680		680		680		680
Duiker	42.5		43		43		43		43		43		43		43		43		
Reedbuck	170																		
Waterbuck (M)	595																		
Waterbuck (F)	340																		
Sable (M)	1360																		
Sable (F)	680																		
Wildebeest	340							340		340		340		340		340		340	
Tsessebe	510																		
Impala (M)	102	2040	2652	2040	2652	2040	2652	2040	2652	2040	2652	2040	2652	2040	2652	2040	2652	2040	2652
Impala (F)	68	1360	1768	1360	1768	1360	1768	1360	1768	1360	1768	1360	1768	1360	1768	1360	1768	1360	1768
Impala (cull)	68																		
Klipspringer	170																		
Steenbok	42.5		43		43		43		43		43		43		43		43		43
Grysbok	42.5																		
Lion (M)	2550																		
Lion (F)	1700																		
Leopard	1700		1700			1700		1700					1700			1700			
Wildcat	42.5																		
Serval	85																		
Genet	42.5																		
Civet	85																		
Hyaena	85	85		85		85													
Jackal	42.5							43		43		43		43					
Bat-eared Fox	85																		
Porcupine	42.5																		
Baboon	17	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
Crocodile	850																		
Guinea Fowl	8.5	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Francolin	5.1	51	26	51	26	51	26	51	26	51	26	51	26	51	26	51	26	51	26
Pigeon/Dove	1.7	17	9	17	9	17	9	17	9	17	9	17	9	17	9	17	9	17	9
Sandgrouse	1.7	17	9	17	9	17	9	17	9	17	9	17	9	17	9	17	9	17	9
Duck	0																		
TOTAL TROPHY VALUE		12,949	8,254	12,949	6,554	7,021	7,319	7,319	6,894	5,619	6,894	5,619	8,594	5,619	6,894	7,276	6,894	5,576	6,851

TULI SAFARI AREA:

YEAR:
TROPHY FEE TYPE:

DATE from:		31.8	31.8	14.9	14.9	28.9	28.9	12.10	12.10	1991 TULI TOTAL ALLOCATED QUOTA VALUE
DATE to:		10.9	10.9	24.9	24.9	8.10	8.10	22.10	22.10	
HUNT NO.		19	20	21	22	23	24	25	26	
		N	S	N	S	N	S	N	S	
SPECIES	TROPHY FEE									
Elephant (M)	7500									15,000
Elephant (F)	2000									0
Elephant (F tl)	1700									0
Zebra	765		765		765		765			7,650
Hippopotamus	1360									0
Bushpig	127.5									0
Warthog	127.5									255
Giraffe	1360									0
Buffalo (M)	1020									0
Buffalo (F)	765									0
Buffalo (NT)	765									0
Nyala	850									0
Bushbuck (M)	255									765
Kudu (M)	510	510	510	510	510	510		510		12,240
Kudu (F)	340	340	340	340	340	340		340		8,160
Eland (M)	850	850		850		850		850		13,600
Eland (F)	680		680		680					5,440
Duiker	42.5									340
Reedbuck	170									0
Waterbuck (M)	595									0
Waterbuck (F)	340									0
Sable (M)	1360									0
Sable (F)	680									0
Wildebeest	340	340		340		340		340		3,400
Tsessebe	510									0
Impala (M)	102	2040	2652	2040	2652	2040	2652	2040		58,344
Impala (F)	68	1360	1768	1360	1768	1360	1768	1360		38,896
Impala (cull)	68									0
Klipspringer	170									0
Steenbok	42.5		43		43		43			510
Grysbok	42.5									0
Lion (M)	2550									0
Lion (F)	1700									0
Leopard	1700									8,500
Wildcat	42.5									0
Serval	85									0
Genet	42.5									0
Civet	85									0
Hyaena	85									255
Jackal	42.5									170
Bat-eared Fox	85									0
Porcupine	42.5									0
Baboon	17	34	34	34	34	34	34	34		850
Crocodile	850									0
Guinea Fowl	8.5	17	17	17	17	17	17	17		425
Francolin	5.1	51	26	51	26	51	26	51	26	995
Pigeon/Dove	1.7	17	9	17	9	17	9	17	9	332
Sandgrouse	1.7	17	9	17	9	17	9	17	9	332
Duck	0									0
TOTAL TROPHY VALUE		5,576	6,851	5,576	6,851	5,576	5,321	5,576	4,442	180,857

Appendix 7.4 Value of allocation: Doma Safari Area

DOMA SAFARI AREA		VALUE OF ALLOCATED HUNTING QUOTAS 1991										
		Lomagundi Hunter's Association										
YEAR:	1991	LEVY in (%) of DNPWLM Trophy Fee										
TROPHY FEE TY	LOCAL	20%										
DATE from:		1.5	16.5	31.5	15.6	30.6	15.7	30.7	14.8	29.8	13.9	1991 DOMA TOTAL VALUE ALLOCATED QUOTA
DATE to:		12.5	27.5	11.6	26.6	11.7	26.7	10.8	25.8	9.9	24.9	
HUNT NO.		1	2	3	4	5	6	7	8	9	10	
SPECIES	TROPHY FEE											
Elephant (M)	7500	7500	7500									15,000
Elephant (F)	2000			2000	2000	2000	2000	2000	2000	2000	2000	16,000
Elephant (F tl)	1200											0
Zebra	540		540		540		540					1,620
Hippopotamus	960											0
Bushpig	90	180	180	90	90	90	90	90	90	90	90	1,080
Warthog	90	180	180	180	180	180	180	180	180	180	180	1,800
Giraffe	960											0
Buffalo (M)	720	720	720	720	720	720	720	720	720	720	720	7,200
Buffalo (F)	540	540	540	540	540	540	540	540	540	540	540	5,400
Buffalo (NT)	540											0
Nyala	600											0
Bushbuck (M)	180	180		180		180		180		180		900
Kudu (M)	360	360	360		360		360		360		360	2,160
Kudu (F)	240											0
Eland (M)	600		600		600		600		600			2,400
Eland (F)	480			480		480		480		480		1,920
Duiker	30	30	30	30	30	30	30	30	30	30	30	300
Reedbuck	120											0
Waterbuck (M)	420											0
Waterbuck (F)	240											0
Sable (M)	960			960	960	960	960	960	960	960	960	7,680
Sable (F)	480											0
Wildebeest	240											0
Tsessebe	360											0
Impala (M)	72											0
Impala (F)	48											0
Impala (cull)	48											0
Klipspringer	120											0
Steenbok	30											0
Grysbok	30	30	30	30	30	30	30	30	30	30	30	300
Lion (M)	1800											0
Lion (F)	1200											0
Leopard	1200			1200		1200		1200				3,600
Wildcat	30											0
Serval	60											0
Genet	30											0
Civet	60											0
Hyaena	60											0
Jackal	30											0
Bat-eared Fox	60											0
Porcupine	30											0
Baboon	12	24	24	24	24	24	24	24	24	24	24	240
Crocodile	600											0
Guinea Fowl	6	60	60	60	60	60	60	60	60	60	60	600
Francolin	4	36	36	36	36	36	36	36	36	36	36	360
Pigeon/Dove	1	24	24	24	24	24	24	24	24	24	24	240
Sandgrouse	1											0
Duck	0											0
TOTAL QUOTA VALUE		9,864	10,824	6,554	6,194	6,554	6,194	6,554	5,654	5,354	5,054	68,900
DATA SOURCE		Lomagundi Hunter's Association, Mhangura.										

Appendix 7.5 Value of allocation: Rifa section (Hurungwe Safari Area)

HURUNGWE SAFARI AREA		VALUE OF ALLOCATED HUNTING QUOTAS														
RIFA SECTION		Mashonaland Hunter's Association														
YEAR:	1991	LEVY in % of DNPWLM Troph Fee														
TROPHY FEE TYPE:	LOCAL	170%														
DATE from:		27.4	27.4	27.4	11.5	11.5	11.5	25.5	25.5	25.5	8.6	8.6	8.6	22.6	22.6	22.6
DATE to:		7.5	7.5	7.5	21.5	21.5	21.5	4.6	4.6	4.6	18.6	18.6	18.6	2.7	2.7	2.7
HUNT NO.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SPECIES	TROPHY FEE	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Elephant (M)	12,750								12,750			12,750			12,750	
Elephant (F)	3,400															
Elephant (F tl)	1,700															
Zebra	765					765										765
Hippopotamus	1,360				1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360
Bushpig	128															
Warthog	128	128	128	128	128	128	128	128		128	128		128	128		128
Giraffe	1,360															
Buffalo (M)	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020		1,020	1,020		1,020	1,020		1,020
Buffalo (F)	765	765	765	765	765	765	765	765	765	765	765	765	765	765	765	765
Buffalo (NT)	765															
Nyala	850															
Bushbuck (M)	255		255						255				255	255		
Kudu (M)	510				510		510		510		510			510		510
Kudu (F)	340	340				340				340		340			340	
Eland (M)	850										850					
Eland (F)	680															
Duiker	43															
Reedbuck	170															
Waterbuck (M)	595					595							595			
Waterbuck (F)	340															
Sable (M)	1,360															
Sable (F)	680															
Wildebeest	340															
Tsessebe	510															
Impala (M)	102	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224
Impala (F)	68	816	816	816	816	816	816	816	816	816	816	816	816	816	816	816
Impala (cull)	68															
Klipspringer	170															
Steenbok	43															
Grysbok	43	43	43	43	43	43										
Lion (M)	2,550							2,550					2,550			
Lion (F)	1,700									1,700				1,700		
Leopard	1,700						1,700				1,700					1,700
Wildcat	43															
Serval	85															
Genet	43															
Civet	85															
Hyaena	85			85			85			85			85			85
Jackal	43								43							
Bat-eared Fox	85															
Porcupine	43															
Baboon	17	34	34	34	34	34	102	34	34	34	102	34	34	34	34	102
Crocodile	850															
Guinea Fowl	9	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
Francolin	5	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Pigeon/Dove	2	7	7	7	5	5	5	5	5	5	5	5	5	5	5	5
Sandgrouse	2															
Duck	0															
TOTAL TROPHY VALUE		4,425	4,340	4,170	5,953	7,143	7,764	7,951	17,811	7,526	8,529	17,343	8,886	7,866	17,343	8,529

HURUNGWE SAFARI AREA
RIFA SECTION
YEAR: 1991
TROPHY FEE TYPE: LOCAL

DATE from:		6.7	6.7	6.7	20.7	20.7	20.7	3.8	3.8	3.8	17.8	17.8	17.8	31.8	31.8	31.8
DATE to:		16.7	16.7	16.7	30.7	30.7	30.7	13.8	13.8	13.8	27.8	27.8	27.8	10.9	10.9	10.9
HUNT NO.		16 A	17 B	18 C	19 A	20 B	21 C	22 A	23 B	24 C	25 A	26 B	27 C	28 A	29 B	30 C
SPECIES	TROPHY FEE															
Elephant (M)	12,750		12,750			12,750										
Elephant (F)	3,400															
Elephant (F tl)	1,700															
Zebra	765															
Hippopotamus	1,360	1,360	1,360	1,360		1,360			1,360			1,360			1,360	
Bushpig	128															
Warthog	128	128		128	128		128	128	128	128	128	128	128	128	128	128
Giraffe	1,360															
Buffalo (M)	1,020	1,020		1,020	1,020		1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020	1,020
Buffalo (F)	765	765	765	765	765	765	765	765	765	765	765	765	765	765	765	765
Buffalo (NT)	765															
Nyala	850															
Bushbuck (M)	255		255				255	255				255				255
Kudu (M)	510			510			510	510		510			510			
Kudu (F)	340		340		340	340			340		340			340		
Eland (M)	850															
Eland (F)	680															
Duiker	43															
Reedbuck	170															
Waterbuck (M)	595						595				595				595	
Waterbuck (F)	340															
Sable (M)	1,360															
Sable (F)	680															
Wildebeest	340															
Tsessebe	510															
Impala (M)	102	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224
Impala (F)	68	816	816	816	816	816	816	816	816	816	816	816	816	816	816	816
Impala (cull)	68															
Klipspringer	170															
Steenbok	43															
Grysbok	43															
Lion (M)	2,550	2,550			2,550											
Lion (F)	1,700			1,700					1,700							
Leopard	1,700											1,700				
Wildcat	43															
Serval	85															
Genet	43															
Civet	85															
Hyaena	85			85			85			85			85			85
Jackal	43															
Bat-eared Fox	85															
Porcupine	43															
Baboon	17	34	34	34	34	34	34	34	34	34	34	102	34	34	34	34
Crocodile	850															
Guinea Fowl	9	26	26	26	26	26	26	26	26	26	26	26	26	26	26	17
Francolin	5	15	15	15	15	15	15	15	15	15	15	15	15	10	10	10
Pigeon/Dove	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Sandgrouse	2															
Duck	0															
TOTAL TROPHY VALUE		7,942	17,590	7,687	6,922	17,335	5,477	4,797	7,432	4,627	4,967	7,415	4,627	4,367	5,982	4,359

HURUNGWE SAFARI AREA
RIFA SECTION
YEAR: 1991
TROPHY FEE TYPE: LOCAL

SPECIES	TROPHY FEE	DATE from: 14.9 / DATE to 24.9 / HUNT NO 31 A	14.9 / 24.9 / 32 B	14.9 / 24.9 / 33 C	28.9 / 8.10 / 34 A	28.9 / 8.10 / 35 B	28.9 / 8.10 / 36 C	12.10 / 22.10 / 37 A	12.10 / 22.10 / 38 B	12.10 / 22.10 / 39 C	1991 RIFA TOTAL VALUE ALLOCATED QUOTA
Elephant (M)	12,750										63,750
Elephant (F)	3,400										0
Elephant (F tl)	1,700										0
Zebra	765										1,530
Hippopotamus	1,360		1,360								27,200
Bushpig	128										0
Warthog	128	128	128	128	128						3,698
Giraffe	1,360										0
Buffalo (M)	1,020	1,020	1,020	2,040	2,040	2,040	1,020	1,020	1,020	1,020	37,740
Buffalo (F)	765	765	765	765	765	765	765	765			28,305
Buffalo (NT)	765										0
Nyala	850										0
Bushbuck (M)	255		255								2,550
Kudu (M)	510	510									6,120
Kudu (F)	340										3,740
Eland (M)	850										850
Eland (F)	680										0
Duiker	43										0
Reedbuck	170										0
Waterbuck (M)	595			595							3,570
Waterbuck (F)	340										0
Sable (M)	1,360										0
Sable (F)	680										0
Wildebeest	340										0
Tsessebe	510										0
Impala (M)	102	1,224	1,224	1,224	1,224	1,224	1,224	1,020	1,020	1,020	47,124
Impala (F)	68	816	816	816	816	816	816	680	680	680	31,416
Impala (cull)	68										0
Klipspringer	170										0
Steenbok	43										0
Grysbok	43										213
Lion (M)	2,550										10,200
Lion (F)	1,700										6,800
Leopard	1,700										6,800
Wildcat	43										0
Serval	85										0
Genet	43										0
Civet	85										0
Hyaena	85			85			85				1,020
Jackal	43										43
Bat-eared Fox	85										0
Porcupine	43										0
Baboon	17	34	34	34	34	34	34	17	17	17	1,547
Crocodile	850										0
Guinea Fowl	9	17	17	17	17	17	17	17	17	17	1,037
Francolin	5	10	10	10	10	10	10	5	5	5	520
Pigeon/Dove	2	5	5	5	5	5	5	5	5	5	204
Sandgrouse	2										0
Duck	0										0
TOTAL TROPHY VALUE		4,529	5,634	5,719	5,039	4,911	3,976	3,529	2,764	2,764	285,976

Appendix 7.6 Tender values: Dandawa impala hunts

HURUNGWE SAFARI AREA: VALUTION OF QUOTA ALLOCATION (Trophy Fee & Prices Tendered)
NYAKASANGA SECTION *Dandawa Impala Hunts*
Date of Hunt: 1991
TROPHY FEE TYPE LOCAL

																													1991 DANDAWA
DATE from		1 5	1.5	12 5																									
DATE to																													
HUNT NO		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	TOTAL TENDER VALUES
SPECIES	TROPHY FEE																															
Impala (M)	60	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	7,200
Impala (F)	40	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	2,400
Impala (cull)	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL TROPHY VALUE		320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	9,600
WINNING TENDER VALUE		1,500	750	1,420	1,001	1,425	1,500	1,020	650	1,011	1,011	1,000	750	800	710	1,000	810	1,550	856	2,000	2,000	1,551	1,551	1,668	1,750	1,420	606	1,550	600	600	1,500	35,500

NOTES
DATA SOURCE DNPWLM Licensing Office, Harare

Appendix 7.7 Value of auction: Zambezi valley hunt results: 1991

Appendix 7.7.1 Auction values: Nyakasanga section (Hurungwe Safari Area) and Sapi Safari Area: Hunt values

ZAMBEZI VALLEY HUNTING CAMPS SOLD BY AUCTION
DATE: 1991
HURUNGWE SAFARI AREA: NYAKASANGA SECTION and SAPI SAFARI AREA
HUNTS: NYAKASANGA AND SAPI

HUNT NO	CAMP	H-DATES FROM:	H-DATES TO:	HUNT DAYS	1991 BID Z$	(L)/(F) NATIONAL	NYAKASANG FOREIGN	NYAKASANG LOCAL	SAPI FOREIGN	SAPI LOCAL
N1	D	01-May	14-May	14	19,000	F	19,000			
N2	D	18-May	31-May	14	19,500	F	19,500			
N3	D	04-Jun	17-Jun	14	16,000	F	16,000			
N4	D	21-Jun	04-Jul	14	19,500	F	19,500			
N5	D	08-Jul	21-Jul	14	24,000	F	24,000			
N6	D	25-Jul	07-Aug	14	17,000	F	17,000			
N7	D	11-Aug	24-Aug	14	19,000	F	19,000			
N8	D	28-Aug	10-Sep	14	20,000	F	20,000			
N9	D	14-Sep	27-Sep	14	19,000	L		19,000		
N10	E	01-May	14-May	14	16,000	F	16,000			
N11	E	18-May	31-May	14	18,000	F	18,000			
N12	E	04-Jun	17-Jun	14	14,500	F	14,500			
N13	E	21-Jun	04-Jul	14	19,000	F	19,000			
N14	E	08-Jul	21-Jul	14	24,000	F	24,000			
N15	E	25-Jul	07-Aug	14	18,000	L		18,000		
N16	E	11-Aug	24-Aug	14	21,000	F	21,000			
N17	E	28-Aug	10-Sep	14	20,000	L		20,000		
N18	E	14-Sep	27-Sep	14	17,000	L		17,000		
N19	CH-N	01-May	10-May	10	12,500	F	12,500			
N20	CH-N	14-May	23-May	10	13,000	L		13,000		
N21	CH-N	27-May	05-Jun	10	10,500	L		10,500		
N22	CH-N	09-Jun	18-Jun	10	10,000	F	10,000			
N23	CH-N	22-Jun	01-Jul	10	10,500	F	10,500			
N24	CH-N	05-Jul	14-Jul	10	12,500	F	12,500			
N25	CH-N	18-Jul	27-Jul	10	12,500	F	12,500			
N26	CH-N	31-Jul	09-Aug	10	11,500	F	11,500			
N27	CH-N	13-Aug	22-Aug	10	12,000	F	12,000			
N28	CH-N	26-Aug	04-Sep	10	11,500	F	11,500			
N29	CH-N	08-Sep	17-Sep	10	11,000	F	11,000			
N30	CH-N	21-Sep	30-Sep	10	11,500	F	11,500			
N31	CH-W	01-May	10-May	10	7,500	F	7,500			
N32	CH-W	14-May	23-May	10	7,000	F	7,000			
N33	CH-W	27-May	05-Jun	10	5,000	F	5,000			
N34	CH-W	09-Jun	18-Jun	10	6,500	L		6,500		
N35	CH-W	22-Jun	01-Jul	10	4,500	L		4,500		
N36	CH-W	05-Jul	14-Jul	10	8,500	F	8,500			
N37	CH-W	18-Jul	27-Jul	10	10,000	L		10,000		
N38	CH-W	31-Jul	09-Aug	10	7,000	F	7,000			
N39	CH-W	13-Aug	22-Aug	10	8,500	F	8,500			
N40	CH-W	26-Aug	04-Sep	10	5,250	F	5,250			
N41	CH-W	08-Sep	17-Sep	10	5,250	F	5,250			
N42	CH-W	21-Sep	30-Sep	10	5,750	F	5,750			
S1	G	01-May	14-May	14	19,500	F			19,500	
S2	G	18-May	31-May	14	16,000	F			16,000	
S3	G	04-Jun	17-Jun	14	18,000	F			18,000	
S4	G	21-Jun	04-Jul	14	19,000	F			19,000	
S5	G	08-Jul	21-Jul	14	17,000	F			17,000	
S6	G	25-Jul	07-Aug	14	17,500	F			17,500	
S7	G	11-Aug	24-Aug	14	18,000	F			18,000	
S8	G	28-Aug	10-Sep	14	17,000	L				17,000
S9	G	14-Sep	27-Sep	14	21,000	L				21,000
S10	H	01-May	14-May	14	16,000	F			16,000	
S11	H	18-May	31-May	14	17,000	L				17,000
S12	H	04-Jun	17-Jun	14	18,000	F			18,000	
S13	H	21-Jun	04-Jul	14	19,000	L				19,000
S14	H	08-Jul	21-Jul	14	20,000	L				20,000
S15	H	25-Jul	07-Aug	14	20,000	F			20,000	
S16	H	11-Aug	24-Aug	14	23,000	F			23,000	
S17	H	28-Aug	10-Sep	14	20,000	L				20,000
S18	H	14-Sep	27-Sep	14	21,000	F			21,000	
S19	CR-S	01-May	10-May	10	12,000	L				12,000
S20	CR-S	14-May	23-May	10	11,000	L				11,000
S21	CR-S	27-May	05-Jun	10	13,500	L				13,500
S22	CR-S	09-Jun	18-Jun	10	12,500	F			12,500	
S23	CR-S	22-Jun	01-Jul	10	17,500	L				17,500
S24	CR-S	05-Jul	14-Jul	10	16,500	F			16,500	
S25	CR-S	18-Jul	27-Jul	10	16,000	F			16,000	
S26	CR-S	31-Jul	09-Aug	10	17,000	F			17,000	
S27	CR-S	13-Aug	22-Aug	10	18,000	F			18,000	
S28	CR-S	26-Aug	04-Sep	10	19,500	L				19,500
S29	CR-S	08-Sep	17-Sep	10	19,000	L				19,000
S30	CR-S	21-Sep	30-Sep	10	19,000	F			19,000	
TOTALS		TOTAL		864	1,088,750		441,750	118,500	322,000	206,500
		AREAS						560,250		528,500
		ZVA HUNTS 1991								1,088,750

Appendix 7.7.2 Auction values: Nyakasanga section (Hurungwe Safari Area) and Sapi Safari Area: Individual trophy animal values

INDIVIDUAL TROPHY ANIMALS: NYAKASANGA AND SAPI								
HUNT	LOT	SPECIES	1991 BID Z$	(L/F) NATIONAL	NYAKASANG FOREIGN	NYAKASANG LOCAL	SAPI FOREIGN	SAPI LOCAL
N30	1	Elephant (M)	33,500	F	33,500			
N5	2	Elephant (M)	34,000	F	34,000			
N4	3	Elephant (M)	32,000	F	32,000			
N2	4	Elephant (M)	27,000	F	27,000			
N37	5	Elephant (M)	26,000	L		26,000		
N10	6	Elephant (M)	25,000	F	25,000			
N25	7	Elephant (M)	27,000	F	27,000			
N19	8	Elephant (M)	28,000	F	28,000			
N31	9	Elephant (M)	29,000	F	29,000			
N20	10	Elephant (M)	30,000	L		30,000		
N12	11	Leopard	4,500	F	4,500			
N18	12	Leopard	3,500	L		3,500		
N13	13	Leopard	3,750	F	3,750			
N9	14	Leopard	3,000	L		3,000		
N40	15	Leopard	2,900	F	2,900			
N5	16	Leopard	3,000	F	3,000			
N38	17	Leopard	3,000	F	3,000			
N34	18	Leopard	2,800	L		2,800		
N36	19	Leopard	2,750	F	2,750			
N29	20	Leopard	2,750	F	2,750			
N7	21	Lion (M)	14,000	F	14,000			
N1	22	Lion (M)	16,500	F	16,500			
N2	23	Lion (M)	23,000	F	23,000			
N6	24	Lion (M)	24,000	F	24,000			
N9	25	Waterbuck (M)	3,500	L		3,500		
N13	26	Waterbuck (M)	2,750	F	2,750			
N34	27	Waterbuck (M)	2,400	L		2,400		
N7	28	Waterbuck (M)	2,700	F	2,700			
N2	29	Waterbuck (M)	3,100	F	3,100			
N15	30	Waterbuck (M)	2,500	L		2,500		
N36	31	Bushbuck	600	F	600			
N24	32	Bushbuck	650	F	650			
N3	33	Bushbuck	750	F	750			
N7	34	Bushbuck	600	F	600			
N38	35	Bushbuck	650	F	650			
N22	36	Kudu (M)	700	F	700			
N12	37	Kudu (M)	600	F	600			
N32	38	Kudu (M)	550	F	550			
N42	39	Kudu (M)	575	F	575			
N24	40	Kudu (M)	775	F	775			
N32	41	Hippopotamus	2,500	F	2,500			
N13	42	Hippopotamus	2,300	F	2,300			
N15	43	Hippopotamus	2,400	L		2,400		
N29	44	Hippopotamus	2,100	F	2,100			
N9	45	Hippopotamus	1,900	L		1,900		
N38	46	Buffalo (M)	8,250	F	8,250			
N11	47	Buffalo (M)	7,750	F	7,750			
N28	48	Buffalo (M)	8,250	F	8,250			
N24	49	Warthog	325	F	325			
N3	50	Warthog	275	F	275			
N35	51	Warthog	275	L		275		
N38	52	Warthog	325	F	325			
N40	53	Impala (M)	80	F	80			
N35	54	Impala (M)	70	L		70		
N17	55	Impala (M)	50	L		50		
N21	56	Impala (F)	40	L		40		
W/DRAWN	57	Impala (F)				0		
W/DRAWN	58	Impala (F)				0		
N2	59	Zebra	1,000	F	1,000			
N7	60	Zebra	1,200	F	1,200			
N35	61	Zebra	1,100	L		1,100		
N22	62	Zebra	1,300	F	1,300			
N9	63	Zebra	1,400	L		1,400		
S3	64	Elephant (M)	26,000	F			26,000	
S7	65	Elephant (M)	26,000	F			26,000	
S12	66	Elephant (M)	23,000	F			23,000	
S18	67	Elephant (M)	22,000	F			22,000	
S10	68	Lion (M)	15,000	F			15,000	
S24	69	Lion (M)	9,000	F			9,000	
S12	70	Lion (M)	9,500	F			9,500	
S15	71	Lion (M)	10,500	F			10,500	
S1	72	Leopard	7,000	F			7,000	
S24	73	Leopard	9,000	F			9,000	
S10	74	Leopard	9,000	F			9,000	
S2	75	Leopard	9,000	F			9,000	
S11	76	Nyala	1,500	L				1,500
S13	77	Nyala	1,700	L				1,700
S23	78	Nyala	1,800	L				1,800
S10	79	Nyala	1,500	F			1,500	
S1	80	Hippopotamus	1,800	F			1,800	
S12	81	Hippopotamus	1,600	F			1,600	
S16	82	Hippopotamus	1,500	F			1,500	
S11	83	Hippopotamus	1,600	L				1,600
S19	84	Warthog	150	L				150
S8	85	Warthog	175	L				175
S11	86	Warthog	175	L				175
S30	87	Warthog	175	F			175	

INDIVIDUAL TROPHY ANIMALS: NYAKASANGA AND SAPI								
HUNT	LOT	SPECIES	1991 BID Z$	(L/F) NATIONAL	NYAKASANG FOREIGN	NYAKASANG LOCAL	SAPI FOREIGN	SAPI LOCAL
S13	88	Warthog	150	L				150
S2	89	Warthog	200	F			200	
S21	90	Warthog	150	L				150
S12	91	Warthog	175	F			175	
S24	92	Warthog	200	F			200	
S23	93	Warthog	200	L				200
S11	94	Bushbuck	600	L				600
S13	95	Bushbuck	625	L				625
S23	96	Bushbuck	625	L				625
S19	97	Bushbuck	650	L				650
S1	98	Zebra	1,500	F			1,500	
S24	99	Zebra	1,650	F			1,650	
S11	100	Zebra	1,500	L				1,500
S21	101	Zebra	1,800	L				1,800
S5	102	Waterbuck (M)	2,200	F			2,200	
S7	103	Waterbuck (M)	2,100	F			2,100	
S11	104	Waterbuck (M)	2,200	L				2,200
S19	105	Waterbuck (M)	2,200	L				2,200
S1	106	Waterbuck (M)	1,800	F			1,800	
TOTALS		TOTAL	676,440		386,305	80,935	191,400	17,800
		AREAS				467,240		209,200
		ZVA TROPHIES 1991						676,440
GRAND TOTALS			1,765,190		828,055	199,435	513,400	224,300
						1,027,490		737,700
								1,765,190

Appendix 7.7.3 Total Auction values: Nyakasanga section (Hurungwe Safari Area): Hunt and Individual trophy values

HURUNGWE SAFARI AREA		VALUATION OF QUOTA																	
NYAKASANGA SECTION		Zambezi Valley Auction Hunts																	
YEAR:	1991																		
HUNT TYPE:	FOREIGN																		
DATE from:		1.5	18.5	4.6	21.6														
DATE to:		14.5	31.5	17.6	4.7														
BUYER (Foreign/Local):		F	F	F	F	F	F	F	F	L	F	F	F	F	F	L	F	L	L
CAMP		A	A	A	A	A	A	A	A	A	C	B	B	B	B	B	B	B	B
HUNT NO.		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18
SPECIES	TROPHY FEE																		
Elephant (M)	7500																		
Elephant (F)	2500																		
Elephant (F tl)	1000																		
Zebra	600																		
Hippopotamus	1500																		
Bushpig	100																		
Warthog	100	100	100	100	100	100	100	100	100	100									
Giraffe	1000																		
Buffalo (M)	1000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Buffalo (NT)	500																		
Nyala	1200																		
Bushbuck (M)	300																		
Kudu (M)	400	400	400	400	400	400	400	400	400	400	400								
Kudu (F)	250																		
Eland (M)	900																		
Eland (F)	500																		
Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Reedbuck	300																		
Waterbuck (M)	700																		
Waterbuck (F)	350																		
Sable (M)	1200																		
Sable (F)	600																		
Wildebeest	400																		
Tsessebe	600																		
Impala (M)	75	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
Impala (F)	50	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Impala (cull)	0																		
Klipspringer	200																		
Steenbok	75																		
Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Lion (M)	2500																		
Lion (F)	1500																		
Leopard	2000																		
Wildcat	50																		
Serval	75																		
Genet	50																		
Civet	75																		
Hyaena	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Jackal	25																		
Bat-eared Fox	75																		
Porcupine	25																		
Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Crocodile	1000																		
Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sandgrouse	1																		
Duck	0																		
SINGLE TROPIES																			
Elephant (M)	7500		7,500		7,500	7,500					7,500								
Elephant (F)	2500																		
Leopard	2000		2,000					2,000		2,000									
Lion (M)	2500									2,500				2,500		2,500			
Buffalo (M)	1000			1,000															
Waterbuck (M)	700											700							
Nyala	1200																		
Hippopotamus	1500			1,500				1,500											
Warthog	100												100						
Bushbuck (M)	300		300					300		300				300		300			
Kudu (M)	400																		
Impala (M)	75																	75	
Impala (F)	50	50	50				50	50											
Zebra	600					600			600	600			600	600					
TROPHY VALUE BAG		3,184	3,184	3,184	3,184	3,184	3,184	3,184	3,184	3,184	3,084	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684
AUCTION VALUE	*BAG*	*19,000*	*19,500*	*16,000*	*19,500*	*24,000*	*17,000*	*19,000*	*20,000*	*19,000*	*16,000*	*18,000*	*14,500*	*19,000*	*24,000*	*18,000*	*21,000*	*20,000*	*17,000*
VALUE TROPIES		50	9,850	2,500	7,500	8,100	50	3,850	600	5,400	7,500	700	700	3,400	0	2,800	0	75	0
AUCTION VALUE	*TROPHIES*	*16,500*	*54,100*	*1,025*	*32,000*	*37,000*	*24,000*	*18,500*	*0*	*9,800*	*25,000*	*7,750*	*5,100*	*8,800*	*0*	*4,900*	*0*	*50*	*3,500*
TOTAL TROPHY VALUE		3,234	13,034	5,684	10,684	11,284	3,234	7,034	3,784	8,584	10,584	3,384	3,384	6,084	2,684	5,484	2,684	2,759	2,684
AUCTION VALUE	*TOTAL*	*35,500*	*73,600*	*17,025*	*51,500*	*61,000*	*41,000*	*37,500*	*20,000*	*28,800*	*41,000*	*25,750*	*19,600*	*27,800*	*24,000*	*22,900*	*21,000*	*20,050*	*20,500*
	FOREIGN	35,500	73,600	17,025	51,500	61,000	41,000	37,500	20,000		41,000	25,750	19,600	27,800	24,000		21,000		
	LOCAL									28,800						22,900		20,050	20,500
DATA SOURCE		Sales Prospectus for 1991 Zambezi Vallez Hunting Camps, ABC Auctions																	

HURUNGWE SAFARI AREA
NYAKASANGA SECTION
YEAR: 1991
HUNT TYPE: FOREIGN

DATE from:																				
DATE to:																				
BUYER (Foreign/Local):		F	L	L	F	F	F	F	F	F	F	F	F	F	F	F	L	L	F
CAMP		D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	E	E	E
HUNT NO		N19	N20	N21	N22	N23	N24	N25	N26	N27	N28	N29	N30	N31	N32	N33	N34	N35	N36
SPECIES	TROPHY FEE																		
Elephant (M)	7500																		
Elephant (F)	2500																		
Elephant (F tl)	1000																		
Zebra	600																		
Hippopotamus	1500																		
Bushpig	100																		
Warthog	100															100			
Giraffe	1000																		
Buffalo (M)	1000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500						
Buffalo (NT)	500																		
Nyala	1200																		
Bushbuck (M)	300																		
Kudu (M)	400																		
Kudu (F)	250																		
Eland (M)	900																		
Eland (F)	500																		
Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Reedbuck	300																		
Waterbuck (M)	700																		
Waterbuck (F)	350																		
Sable (M)	1200																		
Sable (F)	600																		
Wildebeest	400																		
Tsessebe	600																		
Impala (M)	75	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
Impala (F)	50	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Impala (cull)	0																		
Klipspringer	200																		
Steenbok	75																		
Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Lion (M)	2500																		
Lion (F)	1500																		
Leopard	2000																		
Wildcat	50																		
Serval	75																		
Genet	50																		
Civet	75																		
Hyaena	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Jackal	25																		
Bat-eared Fox	75																		
Porcupine	25																		
Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Crocodile	1000																		
Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sandgrouse	1																		
Duck	0																		
SINGLE TROPIES																			
Elephant (M)	7500	7,500	7,500					7,500					7,500	7,500					
Elephant (F)	2500																		
Leopard	2000				2,000													2,000	
Lion (M)	2500											2,500			2,500				
Buffalo (M)	1000						1,000											1,000	
Waterbuck (M)	700										700								
Nyala	1200																		
Hippopotamus	1500						1,500												1,500
Warthog	100				100		100								100				
Bushbuck (M)	300																300		
Kudu (M)	400			400															
Impala (M)	75																	75	
Impala (F)	50																		
Zebra	600											600					600		600
TROPHY VALUE BAG		2,634	2,634	2,634	2,634	2,634	2,634	2,634	2,634	2,634	2,634	2,634	2,634	2,134	2,134	2,234	2,134	2,134	2,134
AUCTION VALUE	*BAG*	*12,500*	*13,000*	*10,500*	*10,000*	*10,500*	*12,500*	*12,500*	*11,500*	*12,000*	*11,500*	*11,000*	*11,500*	*7,500*	*7,000*	*5,000*	*6,500*	*4,500*	*8,500*
VALUE TROPIES		7,500	7,500	400	2,100	0	2,600	7,500	0	0	700	3,100	7,500	7,500	2,600	0	900	3,075	2,100
AUCTION VALUE	*TROPHIES*	*28,000*	*30,000*	*40*	*2,000*	*0*	*1,750*	*27,000*	*0*	*0*	*8,250*	*4,850*	*33,500*	*29,000*	*3,050*	*0*	*5,200*	*1,445*	*3,350*
TOTAL TROPHY VALUE		10,134	10,134	3,034	4,734	2,634	5,234	10,134	2,634	2,634	3,334	5,734	10,134	9,634	4,734	2,234	3,034	5,209	4,234
AUCTION VALUE:	*TOTAL*	*40,500*	*43,000*	*10,540*	*12,000*	*10,500*	*14,250*	*39,500*	*11,500*	*12,000*	*19,750*	*15,850*	*45,000*	*36,500*	*10,050*	*5,000*	*11,700*	*5,945*	*11,850*
	FOREIGN	40,500			12,000	10,500	14,250	39,500	11,500	12,000	19,750	15,850	45,000	36,500	10,050	5,000			11,850
	LOCAL		43,000	10,540													11,700	5,945	
DATA SOURCE																			

HURUNGWE SAFARI AREA
NYAKASANGA SECTION
YEAR: 1991
HUNT TYPE: FOREIGN

DATE from: / DATE to:								NYAKASANGA SECTION 1991	NYAKASANGA SECTION 1991	NYAKASANGA SECTION 1991
BUYER (Foreign/Local):		L	F	F	F	F	F			
CAMP		E	E	F	E	E	E	AUCTION	AUCTION	AUCTION
HUNT NO		N37	N38	N39	N40	N41	N42	VALUE	VALUE	VALUE
SPECIES	TROPHY FEE							HUNTS	TROPIES	TOTAL
Elephant (M)	7500							0	75,000	75,000
Elephant (F)	2500							0	0	0
Elephant (F tl)	1000							0		0
Zebra	600							0	6,000	6,000
Hippopotamus	1500							0	7,500	7,500
Bushpig	100							0		0
Warthog	100			100				1,100	500	1,600
Giraffe	1000							0		0
Buffalo (M)	1000	1,000	1,000	1,000	1,000	1,000	1,000	42,000	4,000	46,000
Buffalo (F)	500							15,000		15,000
Buffalo (NT)	500							0		0
Nyala	1200							0	0	0
Bushbuck (M)	300							0	1,800	1,800
Kudu (M)	400							4,000	400	4,400
Kudu (F)	250							0		0
Eland (M)	900							0		0
Eland (F)	500							0		0
Duiker	75	75	75	75	75	75	75	3,150		3,150
Reedbuck	300							0		0
Waterbuck (M)	700							0	1,400	1,400
Waterbuck (F)	350							0		0
Sable (M)	1200							0		0
Sable (F)	600							0		0
Wildebeest	400							0		0
Tsessebe	600							0		0
Impala (M)	75	450	450	450	450	450	450	18,900	225	19,125
Impala (F)	50	350	350	350	350	350	350	15,600	200	15,800
Impala (cull)	0							0		0
Klipspringer	200							0		0
Steenbok	75							0		0
Grysbok	75	75	75	75	75	75	75	3,150		3,150
Lion (M)	2500							0	12,500	12,500
Lion (F)	1500							0		0
Leopard	2000							0	10,000	10,000
Wildcat	50							0		0
Serval	75							0		0
Genet	50							0		0
Civet	75							0		0
Hyaena	100	100	100	100	100	100	100	4,200		4,200
Jackal	25							0		0
Bat-eared Fox	75							0		0
Porcupine	25							0		0
Baboon	10	40	40	40	40	40	40	1,680		1,680
Crocodile	1000							0		0
Guinea Fowl	5	20	20	20	20	20	20	840		840
Francolin	3	12	12	12	12	12	12	504		504
Pigeon/Dove	1	12	12	12	12	12	12	504		504
Sandgrouse	1							0		0
Duck	0							0		0
SINGLE TROPIES										
Elephant (M)	7500	7,500							75,000	
Elephant (F)	2500								0	
Leopard	2000								10,000	
Lion (M)	2500								12,500	
Buffalo (M)	1000		1,000						4,000	
Waterbuck (M)	700								1,400	
Nyala	1200								0	
Hippopotamus	1500		1,500						7,500	
Warthog	100						100		500	
Bushbuck (M)	300								1,800	
Kudu (M)	400								400	
Impala (M)	75				75				225	
Impala (F)	50								200	
Zebra	600		600		600				6,000	
TROPHY VALUE BAG		2,134	2,134	2,234	2,134	2,134	2,134	110,628		
AUCTION VALUE	*BAG*	*10,000*	*7,000*	*8,500*	*5,250*	*5,250*	*5,750*	*560,250*		
VALUE TROPIES		7,500	3,100	0	675	0	100		119,525	
AUCTION VALUE	*TROPHIES*	*26,000*	*12,225*	*0*	*2,980*	*0*	*575*		*467,240*	
TOTAL TROPHY VALUE		9,634	5,234	2,234	2,809	2,134	2,234			230,153
AUCTION VALUE	*TOTAL*	*36,000*	*19,225*	*8,500*	*8,230*	*5,250*	*6,325*			*1,027,490*
	FOREIGN		19,225	8,500	8,230	5,250	6,325			828,055
	LOCAL	36,000								199,436
DATA SOURCE										

Appendix 7.7.4 Total Auction values: Sapi Safari Area: Hunt and Individual trophy values

SAPI SAFARI AREA:		VALUE OF ALLOCATED HUNTING QUOTAS Zambezi Valley Auction Hunts																		
YEAR:	1991																			
TROPHY FEE TY	FOREIGN																			
DATE from:		1.5	18.5	4.6	21.6															
DATE to:		14.5	31.5	17.6	4.7															
BUYER (Foreign/Local):		F	F	F	F	F	F	F	L	L	F	L	F	L	L	F	F	L	F	
HUNT NO.		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	
CAMP		G	G	G	G	G	G	G	G	G	H	H	H	H	H	H	H	H	H	
SPECIES	TROHPY FEE																			
Elephant (M)	7,500																			
Elephant (F)	2,500																			
Elephant (F tl)	1,000																			
Zebra	600																			
Hippopotamus	1,500																			
Bushpig	100																			
Warthog	100			100				100		100										
Giraffe	1,000																			
Buffalo (M)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	
Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	
Buffalo (NT)	500																			
Nyala	1,200																			
Bushbuck (M)	300																			
Kudu (M)	400																			
Kudu (F)	250																			
Eland (M)	900																			
Eland (F)	500																			
Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	
Reedbuck	300																			
Waterbuck (M)	700																			
Waterbuck (F)	350																			
Sable (M)	1,200																			
Sable (F)	600																			
Wildebeest	400																			
Tsessebe	600																			
Impala (M)	75	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	
Impala (F)	50	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	
Impala (cull)	0																			
Klipspringer	200																			
Steenbok	75																			
Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	
Lion (M)	2,500																			
Lion (F)	1,500																			
Leopard	2,000																			
Wildcat	50																			
Serval	75																			
Genet	50																			
Civet	75																			
Hyaena	100										100	100	100	100	100	100	100	100	100	
Jackal	25																			
Bat-eared Fox	75																			
Porcupine	25																			
Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
Crocodile	1,000																			
Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	
Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
Sandgrouse	1																			
Duck	0																			
SINGLE TROPIES																				
Elephant (M)	7,500			7,500				7,500					7,500						7,500	
Elephant (F)	2,500																			
Zebra	600	600										600								
Hippopotamus	1,500	1,500										1,500	1,500				1,500			
Warthog	100		100						100			100	100	100					100	
Buffalo (M)	1,000																			
Nyala	1,200										1,200	1,200		1,200						
Bushbuck (M)	300											300		300					300	
Kudu (M)	400																			
Waterbuck (M)	700	700				700		700				700							700	
Impala (M)	75																			
Impala (F)	50																			
Lion (M)	2,500										2,500		2,500			2,500				
Leopard	2,000	2,000	2,000								2,000									
TROPHY VALUE BAG		2,559	2,559	2,659	2,559	2,559	2,559	2,659	2,559	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	
AUCTION VALUE	*BAG*	*19,500*	*16,000*	*18,000*	*19,000*	*17,000*	*17,500*	*18,000*	*17,000*	*21,000*	*16,000*	*17,000*	*18,000*	*19,000*	*20,000*	*20,000*	*23,000*	*20,000*	*21,000*	
VALUE TROPIES		4,800	2,100	7,500	0	700	0	8,200	100	0	5,700	4,400	11,600	1,600	0	2,500	1,500	0	8,600	
AUCTION VALUE	*TROPHIES*	*12,100*	*9,200*	*26,000*	*0*	*2,200*	*0*	*28,100*	*175*	*0*	*25,500*	*7,575*	*34,275*	*2,475*	*0*	*10,500*	*1,500*	*0*	*22,000*	
TOTAL TROPHY VALUE		7,359	4,659	10,159	2,559	3,259	2,559	10,859	2,659	2,659	8,359	7,059	14,259	4,259	2,659	5,159	4,159	2,659	11,259	
AUCTION VALUE	*TOTAL*	*31,600*	*25,200*	*44,000*	*19,000*	*19,200*	*17,500*	*46,100*	*17,175*	*21,000*	*41,500*	*24,575*	*52,275*	*21,475*	*20,000*	*30,500*	*24,500*	*20,000*	*43,000*	
	FOREIGN	31,600	25,200	44,000	19,000	19,200	17,500	46,100			41,500		52,275			30,500	24,500		43,000	
	LOCAL								17,175	21,000		24,575		21,475	20,000			20,000		
DATA SOURCE		Sales Prospectus for 1991 Zambezi Vallez Hunting Camps, ABC Auctions																		

SAPI SAFARI AREA:

YEAR: 1991
TROPHY FEE TY FOREIGN

DATE from: / DATE to:														1991 SAPI	1991 SAPI	1991 SAPI
BUYER (Foreign/Local):		L	L	L	F	L	F	F	F	F	L	L	F			
HUNT NO. / CAMP / SPECIES	TROHPY FEE	S19 CH-R	S20 CH-R	S21 CH-R	S22 CH-R	S23 CH-R	S24 CH-R	S25 CH-R	S26 CH-R	S27 CH-R	S28 CH-R	S29 CH-R	S30 CH-R	AUCTION VALUE HUNT	AUCTION VALUE TROPHY	AUCTION VALUE TOTAL
Elephant (M)	7,500													0	30,000	30,000
Elephant (F)	2,500													0	0	0
Elephant (F tl)	1,000													0		0
Zebra	600													0	2,400	2,400
Hippopotamus	1,500													0	6,000	6,000
Bushpig	100													0		0
Warthog	100			100					100					500	1,000	1,500
Giraffe	1,000													0		0
Buffalo (M)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	30,000	0	30,000
Buffalo (F)	500	1,000	500	1,000	500	1,000	500	1,000	500	1,000	500	1,000	500	18,000		18,000
Buffalo (NT)	500													0		0
Nyala	1,200													0	4,800	4,800
Bushbuck (M)	300													0	1,200	1,200
Kudu (M)	400		400		400		400		400		400		400	2,400	0	2,400
Kudu (F)	250													0		0
Eland (M)	900													0		0
Eland (F)	500													0		0
Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	2,250		2,250
Reedbuck	300													0		0
Waterbuck (M)	700													0	3,500	3,500
Waterbuck (F)	350													0		0
Sable (M)	1,200													0		0
Sable (F)	600													0		0
Wildebeest	400													0		0
Tsessebe	600													0		0
Impala (M)	75	525	525	525	525	525	525	525	525	525	525	525	525	15,750	0	15,750
Impala (F)	50	300	300	300	300	300	300	300	300	300	300	300	300	9,000	0	9,000
Impala (cull)	0													0		0
Klipspringer	200													0		0
Steenbok	75													0		0
Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	2,250		2,250
Lion (M)	2,500													0	10,000	10,000
Lion (F)	1,500													0		0
Leopard	2,000													0	8,000	8,000
Wildcat	50													0		0
Serval	75													0		0
Genet	50													0		0
Civet	75													0		0
Hyaena	100													900		900
Jackal	25													0		0
Bat-eared Fox	75													0		0
Porcupine	25													0		0
Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	1,200		1,200
Crocodile	1,000													0		0
Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	600		600
Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	360		360
Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	360		360
Sandgrouse	1													0		0
Duck	0													0		0
SINGLE TROPIES:																
Elephant (M)	7,500														30,000	
Elephant (F)	2,500														0	
Zebra	600			600			600								2,400	
Hippopotamus	1,500														6,000	
Warthog	100			100		100	100						100		1,000	
Buffalo (M)	1,000														0	
Nyala	1,200					1,200									4,800	
Bushbuck (M)	300					300									1,200	
Kudu (M)	400														0	
Waterbuck (M)	700														3,500	
Impala (M)	75														0	
Impala (F)	50														0	
Lion (M)	2,500						2,500								10,000	
Leopard	2,000						2,000								8,000	
TROPHY VALUE BAG		3,059	2,959	3,159	2,959	3,059	2,959	3,059	3,059	3,059	2,959	3,059	2,959	83,570		
AUCTION VALUE	*BAG*	*12,000*	*11,000*	*13,500*	*12,500*	*17,500*	*16,500*	*16,000*	*17,000*	*18,000*	*19,500*	*19,000*	*19,000*	*528,500*		
VALUE TROPIES		0	0	700	0	1,600	5,200	0	0	0	0	0	100		66,900	
AUCTION VALUE	*TROPHIES*	*3,000*	*0*	*1,950*	*0*	*2,625*	*19,850*	*0*	*0*	*0*	*0*	*0*	*175*		*209,200*	
TOTAL TROPHY VALUE		3,059	2,959	3,859	2,959	4,659	8,159	3,059	3,059	3,059	2,959	3,059	3,059			159,470
AUCTION VALUE	*TOTAL*	*15,000*	*11,000*	*15,450*	*12,500*	*20,125*	*36,350*	*16,000*	*17,000*	*18,000*	*19,500*	*19,000*	*19,175*			*737,700*
	FOREIGN				12,500		36,350	16,000	17,000	18,000			19,175			513,400
	LOCAL	15,000	11,000	15,450		20,125					19,500	19,000				224,300

DATA SOURCE

Appendix 8 Zimbabwe Government trophy fees for local hunters and foreign clients: 1991; and Species Index Code for species on quota

	TROPHY FEES		SPECIES INDEX CODE	
	1991 GOVERNMENT TROPHY FEE Zimbabwe $		Based on relative value of species for foreign sport hunter	
SPECIES	LOCAL Hunters	FOREIGN Clients	INDEX CODE Child, B	INDEX CODE Martin
Elephant (M)	7,500	7,500	1	1
Elephant (F)	2,000	2,500	1	1
Elephant (F tl)	1,000	1,000	1	1
Hippopotamus	800	1,500	4	1
Giraffe	800	1,000	4	1
Buffalo (M)	600	1,000	1	1
Buffalo (F)	450	500	1	1
Buffalo (NT)	450	500	1	1
Lion (M)	1,500	2,500	1	1
Lion (F)	1,000	1,500	1	1
Leopard	1,000	2,000	1	1
Crocodile	500	1,000	4	1
Zebra	450	600	2	2
Nyala	500	1,200	2	2
Kudu (M)	300	400	2	2
Kudu (F)	200	250	2	2
Eland (M)	500	900	2	2
Eland (F)	400	500	2	2
Waterbuck (M)	350	700	2	2
Waterbuck (F)	200	350	2	2
Sable (M)	800	1,200	2	2
Sable (F)	400	600	2	2
Wildebeest	200	400	2	2
Tsessebe	300	600	2	2
Bushpig	75	100	4	3
Warthog	75	100	3	3
Bushbuck (M)	150	300	2	3
Reedbuck	100	300	2	3
Impala (M)	60	75	3	3
Impala (F)	40	50	3	3
Impala (cull)	40	0	3	3
Duiker	25	75	3	4
Klipspringer	100	200	3	4
Steenbok	25	75	3	4
Grysbok	25	75	3	4
Wildcat	25	50	5	5
Serval	50	75	5	5
Genet	25	50	5	5
Civet	50	75	5	5
Hyaena	50	100	5	5
Jackal	25	25	5	5
Bat-eared Fox	50	75	5	5
Porcupine	25	25	5	5
Baboon	10	10	5	5
Guinea Fowl	5	5	5	5
Francolin	3	3	5	5
Pigeon/Dove	1	1	5	5
Duck	0	0	5	5
Sandgrouse	1	1	5	5

Code Key:	IX.CODE Child, B	IX.CODE Martin
1 =	Big Game	Premium Species
2 =	Big Plains Game	Large Ungulates
3 =	Small Plains Game	Medium Ungulates
4 =	Big other	Small Ungulates
5 =	Other	Other (predators, birds)

Sources:
Trophy Fees: DNPWLM: Loose Sheet. Schedule of Hunting Fees for 1990-1991 Annex I.
Indices: Child, B. (1988): p. 331. adapted from: Zimbabwe Government (1991). Wildlife Quotas - communal Lands, 1st Draft [by Martin, R.] Unpub- lished typewritten manuscript.

Appendix 9 Index value of quota allocation for Zimbabwe hunting areas, valued Government trophy fee for foreign hunters: 1991[1]

Appendix 9.1 Index Value: Charara Safari Area

CHARARA SAFARI AREA — INDEX VALUE OF ALLOCATED HUNTING QUOTAS

Citizen Hunting Area (includes Makuti Totals)

YEAR: 1991

TROPHY FEE TY: FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from: 1.5	1.5	9.5	9.5	17.5	17.5	25.5	25.5	2.6	2.6	10.6	10.6	18.6	18.6	26.6	26.6	4.7	4.7	12.7
	DATE to		7.5	7.5	15.5	15.5	23.5	23.5	31.5	31.5	8.6	8.6	16.6	16.6	24.6	24.6	2.7	2.7	10.7	10.7	18.7
	DRAW NO		4	5	9	10	14	15	19	20	24	25	29	30	34	35	39	40	44	45	49
	HUNT NO.		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
1	Elephant (M)	7500								7500									7500		
1	Elephant (F)	2500																			
1	Elephant (F tl)	1000																			
2	Zebra	600																			
1	Hippopotamus	1500																			
3	Bushpig	100																			
3	Warthog	100		100				100			100			100				100			100
1	Giraffe	1000																			
1	Buffalo (M)	1000	1000		1000		1000		1000			1000		1000		1000		1000			1000
1	Buffalo (F)	500		500		500		500			500		500		500		500			500	
1	Buffalo (NT)	500																			
2	Nyala	1200																			
3	Bushbuck (M)	300																			
2	Kudu (M)	400																			
2	Kudu (F)	250																			
2	Eland (M)	900											900								
2	Eland (F)	500																			
4	Duiker	75	75		75			75				75		75							
3	Reedbuck	300																			
2	Waterbuck (M)	700																			
2	Waterbuck (F)	350																			
2	Sable (M)	1200																			
2	Sable (F)	600																			
2	Wildebeest	400																			
2	Tsessebe	600																			
3	Impala (M)	75	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
3	Impala (F)	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
3	Impala (cull)	0																			
4	Klipspringer	200																			
4	Steenbok	75																			
4	Grysbok	75																			
1	Lion (M)	2500																			
1	Lion (F)	1500																			
1	Leopard	2000																			
5	Wildcat	50																			
5	Serval	75																			
5	Genet	50																			
5	Civet	75																			
5	Hyaena	100																			
5	Jackal	25																			
5	Bat-eared Fox	75																			
5	Porcupine	25																			
5	Baboon	10		10		10		10		10		10		10		10		10		10	
1	Crocodile	1000																			
5	Guinea Fowl	5	15	15	15	15	15	15	15	20	20	20	20	15	15	15	15	15	25	25	25
5	Francolin	3	9	9	9	9	9	9	9	12	12	12	12	9	9	9	9	9	15	15	15
5	Pigeon/Dove	1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8
5	Sandgrouse	1																			
5	Duck	0																			
	INDEX VALUES: TOTAL		1 356	891	1 356	791	1 281	966	1 281	7 799	889	1 374	1 683	1 466	781	1 291	781	1 391	7 798	808	1 398

CODE 1	1000
CODE 2	0
CODE 3	250
CODE 4	75
CODE 5	31

[1] See Appendix 8, page A77.

CHARARA SAFARI AREA

YEAR: 1991
TROPHY FEE TY FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE																			
	DATE from:		12.7	20.7	20.7	28.7	28.7	5.8	5.8	13.8	13.8	21.8	21.8	29.8	29.8	6.9	6.9	14.9	14.9	22.9	22.9
	DATE to:		18.7	26.7	26.7	3.8	3.8	11.8	11.8	19.8	19.8	27.8	27.8	4.9	4.9	12.9	12.9	20.9	20.9	28.9	28.9
	DRAW NO.		50	54	55	59	60	64	65	69	70	74	75	79	80	84	85	89	90	94	95
	HUNT NO.		C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38
1	Elephant (M)	7500						7500													
1	Elephant (F)	2500																			
1	Elephant (F tl)	1000																			
2	Zebra	600																			
1	Hippopotamus	1500																			
3	Bushpig	100																			
3	Warthog	100				100				100				100			100			100	
1	Giraffe	1000																			
1	Buffalo (M)	1000		1000		1000			1000		1000		1000		1000						
1	Buffalo (F)	500	500		500		500			500		500		500		500					
1	Buffalo (NT)	500																			
2	Nyala	1200																			
3	Bushbuck (M)	300													300	300	300	300	300	300	300
2	Kudu (M)	400																			
2	Kudu (F)	250																			
2	Eland (M)	900																			
2	Eland (F)	500																			
4	Duiker	75																			
3	Reedbuck	300																			
2	Waterbuck (M)	700																			
2	Waterbuck (F)	350																			
2	Sable (M)	1200																			
2	Sable (F)	600																			
2	Wildebeest	400																			
2	Tsessebe	600																			
3	Impala (M)	75	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	75	75	75
3	Impala (F)	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	50	50	50
3	Impala (cull)	0																			
4	Klipspringer	200																			
4	Steenbok	75																			
4	Grysbok	75													75		75		75		75
1	Lion (M)	2500															2500			2500	
1	Lion (F)	1500																			
1	Leopard	2000																2000			2000
5	Wildcat	50																			
5	Serval	75																			
5	Genet	50																			
5	Civet	75																			
5	Hyaena	100																			
5	Jackal	25																			
5	Bat-eared Fox	75																			
5	Porcupine	25																			
5	Baboon	10	10		10		10		10		10		10		10		10		10		10
1	Crocodile	1000																			
5	Guinea Fowl	5	25	25	25	20	25	20	25	20	25	25	25	25	20	25	15	15	15	15	15
5	Francolin	3	15	15	15	12	15	12	15	12	15	15	15	15	12	15	9	9	9	9	9
5	Pigeon/Dove	1	8	8	8	8	8	8	8	8	8	8	8	9	9	9	7	7	7	7	7
5	Sandgrouse	1																			
5	Duck	0																			
	INDEX VALUES:	TOTAL	806	1,298	808	1,390	808	7,790	1,308	890	1,308	798	1,308	899	1,676	1,099	1,266	2,581	541	3,056	2,541
		CODE 1																			
		CODE 2																			
		CODE 3																			
		CODE 4																			
		CODE 5																			

	CHARARA SAFARI AREA						
	YEAR:	1991					
	TROPHY FEE TY	FOREIGN					
SPECIES INDEX CODE Martin	DATE from: / DATE to: / DRAW NO. / HUNT NO. / SPECIES	TROPHY FEE	30.9 6.10 99 C39	30.9 6.10 100 C40	1991 CHARARA TOTAL INDEX VALUE	1991 MAKUTI TOTAL INDEX VALUE	1991 CHARARA & MAKUTI TOTAL INDEX VALUE
1	Elephant (M)	7500			22,500	22,500	45,000
1	Elephant (F)	2500			0	0	0
1	Elephant (F ti)	1000			0	0	0
2	Zebra	600			0	0	0
1	Hippopotamus	1500			0	0	0
3	Bushpig	100			0	100	100
3	Warthog	100		100	1,200	1,800	3,000
1	Giraffe	1000			0	0	0
1	Buffalo (M)	1000			15,000	23,000	38,000
1	Buffalo (F)	500			7,500	11,500	19,000
1	Buffalo (NT)	500			0	0	0
2	Nyala	1200			0	0	0
3	Bushbuck (M)	300	300	300	2,700	0	2,700
2	Kudu (M)	400			0	6,000	6,000
2	Kudu (F)	250			0	0	0
2	Eland (M)	900			900	0	900
2	Eland (F)	500			0	0	0
4	Duiker	75			375	3,000	3,375
3	Reedbuck	300			0	0	0
2	Waterbuck (M)	700			0	3,500	3,500
2	Waterbuck (F)	350			0	0	0
2	Sable (M)	1200			0	3,600	3,600
2	Sable (F)	600			0	0	0
2	Wildebeest	400			0	0	0
2	Tsessebe	600			0	0	0
3	Impala (M)	75	75	75	5,625	0	5,625
3	Impala (F)	50	50	50	3,750	0	3,750
3	Impala (cull)	0			0	0	0
4	Klipspringer	200			0	1,800	1,800
4	Steenbok	75			0	0	0
4	Grysbok	75		75	375	3,000	3,375
1	Lion (M)	2500			5,000	7,500	12,500
1	Lion (F)	1500			0	0	0
1	Leopard	2000		2000	6,000	10,000	16,000
5	Wildcat	50			0	0	0
5	Serval	75			0	0	0
5	Genet	50			0	0	0
5	Civet	75			0	150	150
5	Hyaena	100			0	500	500
5	Jackal	25			0	0	0
5	Bat-eared Fox	75			0	0	0
5	Porcupine	25			0	50	50
5	Baboon	10		10	200	390	590
1	Crocodile	1000			0	0	0
5	Guinea Fowl	5	15	15	770	1,085	1,855
5	Francolin	3	9	9	462	651	1,113
5	Pigeon/Dove	1	7	7	300	434	734
5	Sandgrouse	1			0	0	0
5	Duck	0			0	0	0
	INDEX VALUES: TOTAL		456	2,641	73,657	100,560	173,217
	CODE 1				56,000	74,500	130,500
	CODE 2				900	13,100	14,000
	CODE 3				13,275	1,900	15,175
	CODE 4				750	7,800	8,550
	CODE 5				1,732	3,260	4,992

Appendix 9.2 Index value: Makuti section (Hurungwe Safari Area)

HURUNGWE SAFARI AREA — INDEX VALUE OF ALLOCATED HUNTING QUOTAS
MAKUTI SECTION — *Citizen Hunting Area*
YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from:	1.5	1.5	1.5	9.5	9.5	9.5	17.5	17.5	17.5	25.5	25.5	25.5	2.6	2.6	2.6	10.6	10.6	10.6	18.6
			DATE to:	7.5	7.5	7.5	15.5	15.5	15.5	23.5	23.5	23.5	31.5	31.5	31.5	8.6	8.6	8.6	16.6	16.6	16.6	24.6
			DRAW NO.	1	2	3	6	7	8	11	12	13	16	17	18	21	22	23	36	27	28	31
			HUNT NO.	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19
1	Elephant (M)	7500																				
1	Elephant (F)	2500																				
1	Elephant (F tl)	1000																				
2	Zebra	600																				
1	Hippopotamus	1500																				
3	Bushpig	100																				
3	Warthog	100	100					100				100								100		
1	Giraffe	1000																				
1	Buffalo (M)	1000	1,000		1,000			1,000		1,000		1,000		1,000		1,000		1,000		1,000		1,000
1	Buffalo (F)	500		500		500			500		500		500		500		500		500		500	
1	Buffalo (NT)	500																				
2	Nyala	1200																				
3	Bushbuck (M)	300																				
2	Kudu (M)	400																				
2	Kudu (F)	250																				
2	Eland (M)	900																				
2	Eland (F)	500																				
4	Duiker	75		75		75		75		75		75		75		75		75		75		
3	Reedbuck	300																				
2	Waterbuck (M)	700																				
2	Waterbuck (F)	350																				
2	Sable (M)	1200																				
2	Sable (F)	600																				
2	Wildebeest	400																				
2	Tsessebe	600																				
3	Impala (M)	75																				
3	Impala (F)	50																				
3	Impala (cull)	0																				
4	Klipspringer	200																				
4	Steenbok	75																				
4	Grysbok	75																				
1	Lion (M)	2500																				
1	Lion (F)	1500																				
1	Leopard	2000																				
5	Wildcat	50																				
5	Serval	75																				
5	Genet	50																				
5	Civet	75																				
5	Hyaena	100																100				
5	Jackal	25																				
5	Bat-eared Fox	75																				
5	Porcupine	25																				
5	Baboon	10		10		10		10		10		10		10		10		10		10		
1	Crocodile	1000																				
5	Guinea Fowl	5	15	15	20	15	15	20	15	15	15	15	15	15	15	15	15	15	15	15	15	15
5	Francolin	3	9	9	12	9	9	12	9	9	9	9	9	9	9	9	9	9	9	9	9	9
5	Pigeon/Dove	1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
5	Sandgrouse	1																				
5	Duck	0																				
	INDEX VALUE:	TOTAL	1,131	616	1,039	616	1,131	824	1,031	616	1,131	616	1,031	616	1,031	616	1,131	616	1,131	616	1,031	
		CODE 1	1,000																			
		CODE 2	0																			
		CODE 3	100																			
		CODE 4	0																			
		CODE 5	31																			

HURUNGWE SAFARI AREA
MAKUTI SECTION
YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin			DATE from:	18.6	18.6	26.6	26.6	26.6	4.7	4.7	4.7	12.7	12.7	12.7	20.7	20.7	20.7	28.7	28.7	28.7	5.8	5.8
			DATE to:	24.6	24.6	2.7	2.7	2.7	10.7	10.7	10.7	18.7	18.7	18.7	26.7	26.7	26.7	3.8	3.8	3.8	11.8	11.8
			DRAW NO.	32	33	36	37	38	41	42	43	46	47	48	51	52	53	56	57	58	61	62
			HUNT NO.	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36	M37	M38
		SPECIES	TROPHY FEE																			
1		Elephant (M)	7500						7,500													
1		Elephant (F)	2500																			
1		Elephant (F tt)	1000																			
2		Zebra	600																			
1		Hippopotamus	1500																			
3		Bushpig	100																			
3		Warthog	100				100					100			100			100			100	
1		Giraffe	1000																			
1		Buffalo (M)	1000		1,000		1,000			1,000		1,000		1,000		1,000		1,000		1,000		1,000
1		Buffalo (F)	500	500		500		500			500		500		500		500		500		500	
1		Buffalo (NT)	500																			
2		Nyala	1200																			
3		Bushbuck (M)	300																			
2		Kudu (M)	400																			
2		Kudu (F)	250																			
2		Eland (M)	900																			
2		Eland (F)	500																			
4		Duiker	75	75		75		75		75			75			75	75		75			75
3		Reedbuck	300																			
2		Waterbuck (M)	700																			
2		Waterbuck (F)	350																			
2		Sable (M)	1200																			
2		Sable (F)	600																			
2		Wildebeest	400																			
2		Tsessebe	600																			
3		Impala (M)	75																			
3		Impala (F)	50																			
3		Impala (cull)	0																			
4		Klipspringer	200																			
4		Steenbok	75																			
4		Grysbok	75		75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
1		Lion (M)	2500																			
1		Lion (F)	1500																			
1		Leopard	2000																			
5		Wildcat	50																			
5		Serval	75																			
5		Genet	50																			
5		Civet	75																			
5		Hyaena	100		100						100							100				
5		Jackal	25																			
5		Bat-eared Fox	75																			
5		Porcupine	25																			
5		Baboon	10	10		10				10		10		10		10		10		10		10
1		Crocodile	1000																			
5		Guinea Fowl	5	15	15	15			20	25	25	25	20	25	20	20	25	25	20	25	25	20
5		Francolin	3	9	9	9			12	15	15	15	12	15	12	12	15	15	12	15	15	12
5		Pigeon/Dove	1	7	7	7			7	8	8	8	8	8	8	8	8	9	8	8	8	8
5		Sandgrouse	1																			
5		Duck	0																			
		INDEX VALUE:	TOTAL	616	1206	691	1175	650	7614	1209	723	1233	690	1163	719	1200	698	1434	690	1191	725	1200
			CODE 1																			
			CODE 2																			
			CODE 3																			
			CODE 4																			
			CODE 5																			

HURUNGWE SAFARI AREA
MAKUTI SECTION
YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from: 5.8 / DATE to: 11.8	13.8 / 19.8	13.8 / 19.8	13.8 / 19.8	21.8 / 27.8	21.8 / 27.8	21.8 / 27.8	29.8 / 4.9	29.8 / 4.9	29.8 / 4.9	6.9 / 12.9	6.9 / 12.9	6.9 / 12.9	14.9 / 20.9	14.9 / 20.9	14.9 / 20.9	22.9 / 28.9	22.9 / 28.9	22.9 / 28.9
	DRAW NO.		63	66	67	68	71	72	73	76	77	78	81	82	83	86	87	88	91	92	93
	HUNT NO.		M39	M40	M41	M42	M43	M44	M45	M46	M47	M48	M49	M50	M51	M52	M53	M54	M55	M56	M57
1	Elephant (M)	7500			7,500							7,500									
1	Elephant (F)	2500																			
1	Elephant (F tl)	1000																			
2	Zebra	600																			
1	Hippopotamus	1500																			
3	Bushpig	100																			100
3	Warthog	100				100		100			100		100		100		100			100	
1	Giraffe	1000																			
1	Buffalo (M)	1000		1,000		1,000		1,000		1,000											
1	Buffalo (F)	500	500				500		500		500		500								
1	Buffalo (NT)	500																			
2	Nyala	1200																			
3	Bushbuck (M)	300																			
2	Kudu (M)	400					400		400		400		400	400	400	400	400	400	400	400	400
2	Kudu (F)	250																			
2	Eland (M)	900																			
2	Eland (F)	500																			
4	Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
3	Reedbuck	300																			
2	Waterbuck (M)	700																		700	700
2	Waterbuck (F)	350																			
2	Sable (M)	1200														1,200		1,200			1,200
2	Sable (F)	600																			
2	Wildebeest	400																			
2	Tsessebe	600																			
3	Impala (M)	75																			
3	Impala (F)	50																			
3	Impala (cull)	0																			
4	Klipspringer	200				200		200		200		200		200		200		200		200	
4	Steenbok	75																			
4	Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
1	Lion (M)	2500												2,500					2,500		
1	Lion (F)	1500																			
1	Leopard	2000													2,000		2,000			2,000	
5	Wildcat	50																			
5	Serval	75																			
5	Genet	50																			
5	Civet	75																75			
5	Hyaena	100	100																		
5	Jackal	25																			
5	Bat-eared Fox	75																			
5	Porcupine	25				25						25									
5	Baboon	10		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1	Crocodile	1000																			
5	Guinea Fowl	5	25	25	25	20	25	25	20	25	25	20	25	15	15	15	15	15	15	15	15
5	Francolin	3	15	15	15	12	15	15	12	15	15	12	15	9	9	9	9	9	9	9	9
5	Pigeon/Dove	1	8	8	8	8	8	8	8	8	9	9	9	7	7	7	7	7	7	7	7
5	Sandgrouse	1																			
5	Duck	0																			
	INDEX VALUE: TOTAL		798	1,208	7,708	1,525	1,108	1,508	1,100	1,408	1,208	7,908	1,208	3,291	2,891	1,991	2,691	2,066	3,091	3,591	2,991
	CODE 1																				
	CODE 2																				
	CODE 3																				
	CODE 4																				
	CODE 5																				

HURUNGWE SAFARI AREA
MAKUTI SECTION
YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin	DATE from: / DATE to: / DRAW NO. / HUNT NO. / SPECIES	TROPHY FEE	30.9 6.10 96 M58	30.9 6.10 97 M59	30.9 6.10 98 M60	1991 MAKUTI TOTAL INDEX VALUE
1	Elephant (M)	7500				22,500
1	Elephant (F)	2500				0
1	Elephant (F tf)	1000				0
2	Zebra	600				0
1	Hippopotamus	1500				0
3	Bushpig	100				100
3	Warthog	100		100	100	1,800
1	Giraffe	1000				0
1	Buffalo (M)	1000				23,000
1	Buffalo (F)	500				11,500
1	Buffalo (NT)	500				0
2	Nyala	1200				0
3	Bushbuck (M)	300				0
2	Kudu (M)	400	400	400	400	6,000
2	Kudu (F)	250				0
2	Eland (M)	900				0
2	Eland (F)	500				0
4	Duiker	75	75	75	75	3,000
3	Reedbuck	300				0
2	Waterbuck (M)	700	700	700	700	3,500
2	Waterbuck (F)	350				0
2	Sable (M)	1200				3,600
2	Sable (F)	600				0
2	Wildebeest	400				0
2	Tsessebe	600				0
3	Impala (M)	75				0
3	Impala (F)	50				0
3	Impala (cull)	0				0
4	Klipspringer	200	200			1,800
4	Steenbok	75				0
4	Grysbok	75	75	75	75	3,000
1	Lion (M)	2500			2,500	7,500
1	Lion (F)	1500				0
1	Leopard	2000	2,000	2,000		10,000
5	Wildcat	50				0
5	Serval	75				0
5	Genet	50				0
5	Civet	75			75	150
5	Hyaena	100				500
5	Jackal	25				0
5	Bat-eared Fox	75				0
5	Porcupine	25				50
5	Baboon	10	10	10	10	300
1	Crocodile	1000				0
5	Guinea Fowl	5	15	15	15	1,085
5	Francolin	3	9	9	9	651
5	Pigeon/Dove	1	7	7	7	434
5	Sandgrouse	1				0
5	Duck	0				0
	INDEX VALUE: TOTAL		3,491	3,391	3,938	100,560
	CODE 1					74,500
	CODE 2					13,100
	CODE 3					1,900
	CODE 4					7,800
	CODE 5					3,260

Appendix 9.3 Index value: Tuli Safari Area

TULI SAFARI AREA — INDEX VALUE OF ALLOCATED HUNTS
Matabeleland Hunter's Association

YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from:	27.4	27.4	11.5	11.5	25.5	25.5	8.6	8.6	22.6	22.6	6.7	6.7	20.7	20.7	3.8	3.8
			DATE to:	7.5	7.5	21.5	21.5	4.6	4.6	18.6	18.6	2.7	2.7	16.7	16.7	30.7	30.7	13.8	13.8
			HUNT NO	1 N	2 S	3 N	4 S	5 N	6 S	7 N	8 S	9 N	10 S	11 N	12 S	13 N	14 S	15 N	16 S
1	Elephant (M)	7500		7,500		7,500													
1	Elephant (F)	2500																	
1	Elephant (F tl)	1000																	
2	Zebra	600							600		600		600		600		600		600
1	Hippopotamus	1500																	
3	Bushpig	100																	
3	Warthog	100	100		100														
1	Giraffe	1000																	
1	Buffalo (M)	1000																	
1	Buffalo (F)	500																	
1	Buffalo (NT)	500																	
2	Nyala	1200																	
3	Bushbuck (M)	300		300		300		300											
2	Kudu (M)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
2	Kudu (F)	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
2	Eland (M)	900	900	900	900	900	900	900	900		900		900		900		900		900
2	Eland (F)	500								500		500		500		500		500	
4	Duiker	75		75		75		75		75		75		75		75		75	
3	Reedbuck	300																	
2	Waterbuck (M)	700																	
2	Waterbuck (F)	350																	
2	Sable (M)	1200																	
2	Sable (F)	600																	
2	Wildebeest	400								400		400		400		400		400	
2	Tsessebe	600																	
3	Impala (M)	75	1,500	1,950	1,500	1,950	1,500	1,950	1,500	1,950	1,500	1,950	1,500	1,950	1,500	1,950	1,500	1,950	1,500	1,950
3	Impala (F)	50	1,000	1,300	1,000	1,300	1,000	1,300	1,000	1,300	1,000	1,300	1,000	1,300	1,000	1,300	1,000	1,300	1,000	1,300
3	Impala (cull)	0																	
4	Klipspringer	200																	
4	Steenbok	75		75		75		75		75		75		75		75		75	
4	Grysbok	75																	
1	Lion (M)	2500																	
1	Lion (F)	1500																	
1	Leopard	2000		2,000			2,000		2,000					2,000			2,000		
5	Wildcat	50																	
5	Serval	75																	
5	Genet	50																	
5	Civet	75																	
5	Hyaena	100	100		100		100												
5	Jackal	25							25		25		25		25				
5	Bat-eared Fox	75																	
5	Porcupine	25																	
5	Baboon	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
1	Crocodile	1000																	
5	Guinea Fowl	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
5	Francolin	3	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15
5	Pigeon/Dove	1	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5
5	Sandgrouse	1	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5
5	Duck	0																	
	INDEX VALUE	TOTAL	11,830	7,305	11,830	5,305	6,230	5,905	6,555	5,205	4,555	5,205	4,555	7,205	4,555	5,205	6,530	5,205	
		CODE 1	7,500																
		CODE 2	1,550																
		CODE 3	2,600																
		CODE 4	0																
		CODE 5	180																

TULI SAFARI AREA

YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from: / DATE to: / HUNT NO	17.8 27.8 17 N	17.8 27.8 18 S	31.8 10.9 19 N	31.8 10.9 20 S	14.9 24.9 21 N	14.9 24.9 22 S	28.9 8.10 23 N	28.9 8.10 24 S	12.10 22.10 25 N	12.10 22.10 26 S	1991 TULI TOTAL ALLOCATED QUOTA VALUE
1	Elephant (M)	7500												15,000
1	Elephant (F)	2500												0
1	Elephant (F tl)	1000												0
2	Zebra	600		600		600		600		600				6,000
1	Hippopotamus	1500												0
3	Bushpig	100												0
3	Warthog	100												200
1	Giraffe	1000												0
1	Buffalo (M)	1000												0
1	Buffalo (F)	500												0
1	Buffalo (NT)	500												0
2	Nyala	1200												0
3	Bushbuck (M)	300												900
2	Kudu (M)	400	400	400	400	400	400	400	400		400			9,600
2	Kudu (F)	250	250	250	250	250	250	250	250		250			6,000
2	Eland (M)	900	900		900		900		900		900			14,400
2	Eland (F)	500		500		500		500						4,000
4	Duiker	75												600
3	Reedbuck	300												0
2	Waterbuck (M)	700												0
2	Waterbuck (F)	350												0
2	Sable (M)	1200												0
2	Sable (F)	600												0
2	Wildebeest	400	400		400		400		400		400			4,000
2	Tsessebe	600												0
3	Impala (M)	75	1,500	1,950	1,500	1,950	1,500	1,950	1,500	1,950	1,500			42,900
3	Impala (F)	50	1,000	1,300	1,000	1,300	1,000	1,300	1,000	1,300	1,000			28,600
3	Impala (cull)	0												0
4	Klipspringer	200												0
4	Steenbok	75		75		75		75		75				900
4	Grysbok	75												0
1	Lion (M)	2500												0
1	Lion (F)	1500												0
1	Leopard	2000												10,000
5	Wildcat	50												0
5	Serval	75												0
5	Genet	50												0
5	Civet	75												0
5	Hyaena	100												300
5	Jackal	25												100
5	Bat-eared Fox	75												0
5	Porcupine	25												0
5	Baboon	10	20	20	20	20	20	20	20	20	20			500
1	Crocodile	1000												0
5	Guinea Fowl	5	10	10	10	10	10	10	10	10	10			250
5	Francolin	3	30	15	30	15	30	15	30	15	30	15		585
5	Pigeon/Dove	1	10	5	10	5	10	5	10	5	10	5		195
5	Sandgrouse	1	10	5	10	5	10	5	10	5	10	5		195
5	Duck	0												0
	INDEX VALUE	TOTAL	4,530	5,130	4,530	5,130	4,530	5,130	4,530	3,980	4,530	25		145,225
		CODE 1												25,000
		CODE 2												44,000
		CODE 3												72,600
		CODE 4												1,500
		CODE 5												2,125

Appendix 9.4 Index value: Doma Safari Area

	DOMA SAFARI AREA		INDEX VALUE OF ALLOCATED HUNTS *Lomagundi Hunter's Association*										
	YEAR	1991											
	TROPHY FEE TYPE	FOREIGN											
SPECIES INDEX CODE Martin	DATE from: / DATE to: / HUNT NO. / SPECIES	TROPHY FEE	1.5 12.5 1	16.5 27.5 2	31.5 11.6 3	15.6 26.6 4	30.6 11.7 5	15.7 26.7 6	30.7 10.8 7	14.8 25.8 8	29.8 9.9 9	13.9 24.9 10	1991 DOMA TOTAL INDEX VALUE
1	Elephant (M)	7500	7,500	7,500									15,000
1	Elephant (F)	2500			2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	20,000
1	Elephant (F tl)	1000											0
2	Zebra	600		600		600		600					1,800
1	Hippopotamus	1500											0
3	Bushpig	100	200	200	100	100	100	100	100	100	100	100	1,200
3	Warthog	100	200	200	200	200	200	200	200	200	200	200	2,000
1	Giraffe	1000											0
1	Buffalo (M)	1000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	10,000
1	Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	5,000
1	Buffalo (NT)	500											0
2	Nyala	1200											0
3	Bushbuck (M)	300	300		300		300		300		300		1,500
2	Kudu (M)	400	400	400		400		400		400		400	2,400
2	Kudu (F)	250											0
2	Eland (M)	900		900		900		900		900			3,600
2	Eland (F)	500			500		500		500		500		2,000
4	Duiker	75	75	75	75	75	75	75	75	75	75	75	750
3	Reedbuck	300											0
2	Waterbuck (M)	700											0
2	Waterbuck (F)	350											0
2	Sable (M)	1200			1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	9,600
2	Sable (F)	600											0
2	Wildebeest	400											0
2	Tsessebe	600											0
3	Impala (M)	75											0
3	Impala (F)	50											0
3	Impala (cull)	0											0
4	Klipspringer	200											0
4	Steenbok	75											0
4	Grysbok	75	75	75	75	75	75	75	75	75	75	75	750
1	Lion (M)	2500											0
1	Lion (F)	1500											0
1	Leopard	2000			2,000		2,000		2,000				6,000
5	Wildcat	50											0
5	Serval	75											0
5	Genet	50											0
5	Civet	75											0
5	Hyaena	100											0
5	Jackal	25											0
5	Bat-eared Fox	75											0
5	Porcupine	25											0
5	Baboon	10	20	20	20	20	20	20	20	20	20	20	200
1	Crocodile	1000											0
5	Guinea Fowl	5	50	50	50	50	50	50	50	50	50	50	500
5	Francolin	3	30	30	30	30	30	30	30	30	30	30	300
5	Pigeon/Dove	1	20	20	20	20	20	20	20	20	20	20	200
5	Sandgrouse	1											0
5	Duck	0											0
	INDEX VALUE: TOTAL		10,370	11,570	8,570	7,670	8,570	7,670	8,570	7,070	6,570	6,170	82,800
	CODE 1		9,000										56,000
	CODE 2		400										19,400
	CODE 3		700										4,700
	CODE 4		150										1,500
	CODE 5		120										1,200

Appendix 9.5 Index value: Rifa section (Hurungwe Safari Area)

HURUNGWE SAFARI AREA — INDEX VALUE OF QUOTA ALLOCATION
RIFA SECTION — *Mashonaland Hunter's Association*
YEAR: 1991
TROPHY FEE TY: FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	27.4 7.5 1 A	27.4 7.5 2 B	27.4 7.5 3 C	11.5 21.5 4 A	11.5 21.5 5 B	11.5 21.5 6 C	25.5 4.6 7 A	25.5 4.6 8 B	25.5 4.6 9 C	8.6 18.6 10 A	8.6 18.6 11 B	8.6 18.6 12 C	22.6 2.7 13 A	22.6 2.7 14 B	22.6 2.7 15 C	6.7 16.7 16 A
1	Elephant (M)	7,500								7,500			7,500			7,500		
1	Elephant (F)	2,500																
1	Elephant (F tl)	1,000																
2	Zebra	600					600										600	
1	Hippopotamus	1,500				1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
3	Bushpig	100																
3	Warthog	100	100	100	100	100	100	100	100		100	100		100	100		100	100
1	Giraffe	1,000																
1	Buffalo (M)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		1,000	1,000		1,000	1,000		1,000	1,000
1	Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
1	Buffalo (NT)	500																
2	Nyala	1,200																
3	Bushbuck (M)	300		300						300				300	300			
2	Kudu (M)	400				400		400		400		400			400		400	
2	Kudu (F)	250	250				250				250		250			250		
2	Eland (M)	900										900						
2	Eland (F)	500																
4	Duiker	75																
3	Reedbuck	300																
2	Waterbuck (M)	700					700							700				
2	Waterbuck (F)	350																
2	Sable (M)	1,200																
2	Sable (F)	600																
2	Wildebeest	400																
2	Tsessebe	600																
3	Impala (M)	75	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
3	Impala (F)	50	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
3	Impala (cull)	0																
4	Klipspringer	200																
4	Steenbok	75																
4	Grysbok	75	75	75	75	75	75											
1	Lion (M)	2,500							2,500					2,500				2,500
1	Lion (F)	1,500									1,500				1,500			
1	Leopard	2,000						2,000				2,000					2,000	
5	Wildcat	50																
5	Serval	75																
5	Genet	50																
5	Civet	75																
5	Hyaena	100			100			100			100			100			100	
5	Jackal	25								25								
5	Bat-eared Fox	75																
5	Porcupine	25																
5	Baboon	10	20	20	20	20	20	60	20	20	20	60	20	20	20	60	20	
1	Crocodile	1,000																
5	Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	15
5	Francolin	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
5	Pigeon/Dove	1	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3
5	Sandgrouse	1																
5	Duck	0																
	INDEX VALUE	TOTAL	3,478	3,528	3,328	5,127	6,277	7,192	7,152	11,777	6,502	7,992	11,302	8,252	6,852	11,302	7,792	7,147
		CODE 1	1,500															
		CODE 2	250															
		CODE 3	1,600															
		CODE 4	75															
		CODE 5	53															

HURUNGWE SAFARI AREA
RIFA SECTION
YEAR: 1991
TROPHY FEE TY FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from:	6.7	6.7	20.7	20.7	20.7	3.8	3.8	3.8	17.8	17.8	17.8	31.8	31.8	31.8	14.9	14.9
			DATE to:	16.7	16.7	30.7	30.7	30.7	13.8	13.8	13.8	27.8	27.8	27.8	10.9	10.9	10.9	24.9	24.9
			HUNT NO.	17 B	18 C	19 A	20 B	21 C	22 A	23 B	24 C	25 A	26 B	27 C	28 A	29 B	30 C	31 A	32 B
1	Elephant (M)	7,500		7,500			7,500												
1	Elephant (F)	2,500																	
1	Elephant (F tl)	1,000																	
2	Zebra	600																	
1	Hippopotamus	1,500	1,500	1,500		1,500			1,500			1,500			1,500				1,500
3	Bushpig	100																	
3	Warthog	100		100	100		100	100	100	100	100	100	100	100	100	100	100	100	100
1	Giraffe	1,000																	
1	Buffalo (M)	1,000		1,000	1,000		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
1	Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
1	Buffalo (NT)	500																	
2	Nyala	1,200																	
3	Bushbuck (M)	300	300				300	300					300				300		300
2	Kudu (M)	400		400			400	400		400				400				400	
2	Kudu (F)	250	250		250	250			250		250				250				
2	Eland (M)	900																	
2	Eland (F)	500																	
4	Duiker	75																	
3	Reedbuck	300																	
2	Waterbuck (M)	700					700				700					700			
2	Waterbuck (F)	350																	
2	Sable (M)	1,200																	
2	Sable (F)	600																	
2	Wildebeest	400																	
2	Tsessebe	600																	
3	Impala (M)	75	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
3	Impala (F)	50	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
3	Impala (cull)	0																	
4	Klipspringer	200																	
4	Steenbok	75																	
4	Grysbok	75																	
1	Lion (M)	2,500			2,500														
1	Lion (F)	1,500		1,500						1,500									
1	Leopard	2,000											2,000						
5	Wildcat	50																	
5	Serval	75																	
5	Genet	50																	
5	Civet	75																	
5	Hyaena	100		100			100			100				100			100		
5	Jackal	25																	
5	Bat-eared Fox	75																	
5	Porcupine	25																	
5	Baboon	10	20	20	20	20	20	20	20	20	20	20	60	20	20	20	20	20	20
1	Crocodile	1,000																	
5	Guinea Fowl	5	15	15	15	15	15	15	15	15	15	15	15	15	15	15	10	10	10
5	Francolin	3	9	9	9	9	9	9	9	9	9	9	9	9	6	6	6	6	6
5	Pigeon/Dove	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5	Sandgrouse	1																	
5	Duck	0																	
	INDEX VALUE	TOTAL		11,597	6,647	5,897	11,297	4,647	3,847	6,397	3,647	4,097	6,987	3,647	3,394	5,344	3,539	3,539	4,939
		CODE 1																	
		CODE 2																	
		CODE 3																	
		CODE 4																	
		CODE 5																	

HURUNGWE SAFARI AREA
RIFA SECTION
YEAR: 1991
TROPHY FEE TY FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from:	14.9	28.9	28.9	28.9	12.10	12.10	12.10	1991 RIFA TOTAL INDEX VALUE
			DATE to:	24.9	8.10	8.10	8.10	22.10	22.10	22.10	
			HUNT NO	33 C	34 A	35 B	36 C	37 A	38 B	39 C	
1	Elephant (M)	7,500									37,500
1	Elephant (F)	2,500									0
1	Elephant (F tl)	1,000									0
2	Zebra	600									1,200
1	Hippopotamus	1,500									30,000
3	Bushpig	100									0
3	Warthog	100	100	100							2,900
1	Giraffe	1,000									0
1	Buffalo (M)	1,000	2,000	2,000	2,000	1,000	1,000	1,000	1,000		37,000
1	Buffalo (F)	500	500	500	500	500	500				18,500
1	Buffalo (NT)	500									0
2	Nyala	1,200									0
3	Bushbuck (M)	300									3,000
2	Kudu (M)	400									4,800
2	Kudu (F)	250									2,750
2	Eland (M)	900									900
2	Eland (F)	500									0
4	Duiker	75									0
3	Reedbuck	300									0
2	Waterbuck (M)	700	700								4,200
2	Waterbuck (F)	350									0
2	Sable (M)	1,200									0
2	Sable (F)	600									0
2	Wildebeest	400									0
2	Tsessebe	600									0
3	Impala (M)	75	900	900	900	900	750	750	750		34,650
3	Impala (F)	50	600	600	600	600	500	500	500		23,100
3	Impala (cull)	0									0
4	Klipspringer	200									0
4	Steenbok	75									0
4	Grysbok	75									375
1	Lion (M)	2,500									10,000
1	Lion (F)	1,500									6,000
1	Leopard	2,000									8,000
5	Wildcat	50									0
5	Serval	75									0
5	Genet	50									0
5	Civet	75									0
5	Hyaena	100	100			100					1,200
5	Jackal	25									25
5	Bat-eared Fox	75									0
5	Porcupine	25									0
5	Baboon	10	20	20	20	20	10	10	10		910
1	Crocodile	1,000									0
5	Guinea Fowl	5	10	10	10	10	10	10	10		610
5	Francolin	3	6	6	6	6	3	3	3		306
5	Pigeon/Dove	1	3	3	3	3	3	3	3		120
5	Sandgrouse	1									0
5	Duck	0									0
	INDEX VALUE	TOTAL	4,939	4,139	4,039	3,139	2,776	2,276	2,276		228,046
		CODE 1									147,000
		CODE 2									13,850
		CODE 3									63,650
		CODE 4									375
		CODE 5									3,171

Appendix 9.6 Index value: Dandawa impala hunts

HURUNGWE SAFARI AREA — INDEX VALUE OF QUOTA
NYAKASANGA SECTION — *Dandawa Impala Hunts*
YEAR 1991
TROPHY FEE TYPE FOREIGN

SPECIES INDEX CODE Martin	DATE from:	1.5	1.5	1.5	1.5	1.5	1.5	1.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	3.6	3.6	3.6	3.6	3.6	3.6	1991 DANDAWA
	DATE to	8.5	8.5	8.5	8.5	8.5	8.5	8.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	10.6	10.6	10.6	10.6	10.6	10.6	TOTAL
	HUNT NO	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	INDEX VALUE
	SPECIES	TROPHY FE																													
3	Impala (M)	75	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	9,000
3	Impala (F)	50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	3,000
3	Impala (cull)	0	0																												0
	INDEX VALUE:	TOTAL:	400																												12,000

Appendix 9.7 Index value: Zambezi valley hunts

Appendix 9.7.1 Index value: Nyakasanga section (Hurungwe Safari Area): Hunts and individual trophies

HURUNGWE SAFARI AREA — INDEX VALUE OF AUCTIONED QUOTA
NYAKASANGA SECTION — *Zambezi Valley Auction Hunts*
YEAR: 1991
TROPHY FEE TY FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	1 5 13.1	18.5 30.1	4 6 17 6	21 6 4.7	8 7 21.7	25.7 7.8	11.8 24.8	28.8 10.9	14.9 27.9	1 5 14.5	18.5 31.5	4.6 17.6	21.6 4.7	8.7 21.7	25.7 7.8	11.8 24.8
	DATE from																	
	DATE to																	
	BUYER: Foreign/Local		F	F	F	F	F	F	F	F	L	F	F	F	F	F	L	F
	HUNT NO.		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16
	CAMP		A	A	A	A	A	A	A	A	A	C	B	B	B	B	B	B
1	Elephant (M)	7500																
1	Elephant (F)	2500																
1	Elephant (F tl)	1000																
2	Zebra	600																
1	Hippopotamus	1500																
3	Bushpig	100																
3	Warthog	100	100	100	100	100	100	100	100	100	100							
1	Giraffe	1000																
1	Buffalo (M)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1	Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
1	Buffalo (NT)	500																
2	Nyala	1200																
3	Bushbuck (M)	300																
2	Kudu (M)	400	400	400	400	400	400	400	400	400	400	400						
2	Kudu (F)	250																
2	Eland (M)	900																
2	Eland (F)	500																
4	Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
3	Reedbuck	300																
2	Waterbuck (M)	700																
2	Waterbuck (F)	350																
2	Sable (M)	1200																
2	Sable (F)	600																
2	Wildebeest	400																
2	Tsessebe	600																
3	Impala (M)	75	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
3	Impala (F)	50	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
3	Impala (cull)	0																
4	Klipspringer	200																
4	Steenbok	75																
4	Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
1	Lion (M)	2500																
1	Lion (F)	1500																
1	Leopard	2000																
5	Wildcat	50																
5	Serval	75																
5	Genet	50																
5	Civet	75																
5	Hyaena	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
5	Jackal	25																
5	Bat-eared Fox	75																
5	Porcupine	25																
5	Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
1	Crocodile	1000																
5	Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
5	Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
5	Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
5	Sandgrouse	1																
5	Duck	0																
	SINGLE TROPIES																	
1	Elephant (M)	7500		7500		7500	7500					7500						
1	Elephant (F)	2500																
1	Leopard	2000		2000					2000		2000							
1	Lion (M)	2500									2500				2500		2500	
1	Buffalo (M)	1000			1000													
2	Waterbuck (M)	700											700					
2	Nyala	1200																
1	Hippopotamus	1500			1500				1500									
3	Warthog	100												100				
3	Bushbuck (M)	300		300					300		300				300		300	
2	Kudu (M)	400																
3	Impala (M)	75																
3	Impala (F)	50	50	50				50	50									
2	Zebra	600					600			600	600			600	600			
	F-INDEX VALUE: TOTAL		3,234	13,034	5,684	10,684	11,284	3,234	7,034	3,784		10,584	3,384	3,384	6,084	2,684		2,684
	CODE 1		1,500	11,000	4,000	9,000	9,000	1,500	5,000	1,500		9,000	1,500	1,500	4,000	1,500		1,500
	CODE 2		400	400	400	400	1,000	400	400	1,000		400	700	600	600	0		0
	CODE 3		1,000	1,300	950	950	950	1,000	1,300	950		850	850	950	1,150	850		850
	CODE 4		150	150	150	150	150	150	150	150		150	150	150	150	150		150
	CODE 5		184	184	184	184	184	184	184	184		184	184	184	184	184		184
	L-INDEX VALUE: TOTAL										8,584						5,484	
	CODE 1										6,000						4,000	
	CODE 2										1,000						0	
	CODE 3										1,250						1,150	
	CODE 4										150						150	
	CODE 5										184						184	
	INDEX VALUE: GRAND TOT		3,234	13,034	5,684	10,684	11,284	3,234	7,034	3,784	8,584	10,584	3,384	3,384	6,084	2,684	5,484	2,684
	CODE 1		1,500	11,000	4,000	9,000	9,000	1,500	5,000	1,500	6,000	9,000	1,500	1,500	4,000	1,500	4,000	1,500
	CODE 2		400	400	400	400	1,000	400	400	1,000	1,000	400	700	600	600	0	0	0
	CODE 3		1,000	1,300	950	950	950	1,000	1,300	950	1,250	850	850	950	1,150	850	1,150	850
	CODE 4		150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
	CODE 5		184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184

HURUNGWE SAFARI AREA
NYAKASANGA SECTION
YEAR: 1991
TROPHY FEE TY FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from:	DATE to:	BUYER: Foreign/Local	HUNT NO.	CAMP	N17 B	N18 B	N19 D	N20 D	N21 D	N22 D	N23 D	N24 D	N25 D	N26 D	N27 D	N28 D	N29 D	N30 D	N31 E	N32 E
			28.8	10.9	L																		
			14.9	27.9	L																		
			1.5	10.5	F																		
			14.5	23.5	L																		
			27.5	5.6	L																		
			9.6	18.6	F																		
			22.6	1.7	F																		
			5.7	14.7	F																		
			18.7	27.7	F																		
			31.7	9.8	F																		
			13.8	22.8	F																		
			26.8	4.9	F																		
			8.9	17.9	F																		
			21.9	30.9	F																		
			1.5	10.5	F																		
			14.5	23.5	F																		
1	Elephant (M)	7500																					
1	Elephant (F)	2500																					
1	Elephant (F tl)	1000																					
2	Zebra	600																					
1	Hippopotamus	1500																					
3	Bushpig	100																					
3	Warthog	100																					
1	Giraffe	1000																					
1	Buffalo (M)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1	Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500		
1	Buffalo (NT)	500																					
2	Nyala	1200																					
3	Bushbuck (M)	300																					
2	Kudu (M)	400																					
2	Kudu (F)	250																					
2	Eland (M)	900																					
2	Eland (F)	500																					
4	Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
3	Reedbuck	300																					
2	Waterbuck (M)	700																					
2	Waterbuck (F)	350																					
2	Sable (M)	1200																					
2	Sable (F)	600																					
2	Wildebeest	400																					
2	Tsessebe	600																					
3	Impala (M)	75	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
3	Impala (F)	50	400	400	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
3	Impala (cull)	0																					
4	Klipspringer	200																					
4	Steenbok	75																					
4	Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
1	Lion (M)	2500																					
1	Lion (F)	1500																					
1	Leopard	2000																					
5	Wildcat	50																					
5	Serval	75																					
5	Genet	50																					
5	Civet	75																					
5	Hyaena	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
5	Jackal	25																					
5	Bat-eared Fox	75																					
5	Porcupine	25																					
5	Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
1	Crocodile	1000																					
5	Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
5	Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
5	Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
5	Sandgrouse	1																					
5	Duck	0																					
	SINGLE TROPIES																						
1	Elephant (M)	7500			7500	7500					7500									7500	7500		
1	Elephant (F)	2500																					
1	Leopard	2000						2000															
1	Lion (M)	2500																	2500			2500	
1	Buffalo (M)	1000								1000													
2	Waterbuck (M)	700															700						
2	Nyala	1200																					
1	Hippopotamus	1500								1500													
3	Warthog	100						100		100												100	
3	Bushbuck (M)	300																					
2	Kudu (M)	400					400																
3	Impala (M)	75	75																				
3	Impala (F)	50																					
2	Zebra	600																	600				

F-INDEX VALUE:	TOTAL			10,134			4,734	2,634	5,234	10,134	2,634	2,634	3,334	5,734	10,134	9,634	4,734
	CODE 1			9,000			3,500	1,500	4,000	9,000	1,500	1,500	1,500	4,000	9,000	8,500	3,500
	CODE 2			0			0	0	0	0	0	0	700	600	0	0	0
	CODE 3			800			900	800	900	800	800	800	800	800	800	800	900
	CODE 4			150			150	150	150	150	150	150	150	150	150	150	150
	CODE 5			184			184	184	184	184	184	184	184	184	184	184	184
L-INDEX VALUE:	TOTAL	2,759	2,684		10,134	3,034											
	CODE 1	1,500	1,500		9,000	1,500											
	CODE 2	0	0		0	400											
	CODE 3	925	850		800	800											
	CODE 4	150	150		150	150											
	CODE 5	184	184		184	184											
INDEX VALUE:	GRAND TOT	2,759	2,684	10,134	10,134	3,034	4,734	2,634	5,234	10,134	2,634	2,634	3,334	5,734	10,134	9,634	4,734
	CODE 1	1,500	1,500	9,000	9,000	1,500	3,500	1,500	4,000	9,000	1,500	1,500	1,500	4,000	9,000	8,500	3,500
	CODE 2	0	0	0	0	400	0	0	0	0	0	0	700	600	0	0	0
	CODE 3	925	850	800	800	800	900	800	900	800	800	800	800	800	800	800	900
	CODE 4	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
	CODE 5	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184

HURUNGWE SAFARI AREA
NYAKASANGA SECTION
YEAR: 1991
TROPHY FEE TY FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from:	27.5	9.6	22.6	5.7	18.7	31.7	13.8	26.8	8.9	21.9	1991 NYAKASANGA SECTION INDEX VALUE HUNTS	1991 NYAKASANGA SECTION INDEX VALUE TROPHIES	1991 NYAKASANGA SECTION INDEX VALUE TOTAL
			DATE to:	5.6	18.6	1.7	14.7	27.7	9.8	22.8	4.9	17.9	30.9			
			BUYER: Foreign/Local	F	L	L	F	L	F	F	F	F	F			
			HUNT NO	N33	N34	N35	N36	N37	N38	N39	N40	N41	N42			
			CAMP	F	E	E	E	E	E	F	E	E	E			
1	Elephant (M)	7500												0	75,000	75,000
1	Elephant (F)	2500												0	0	0
1	Elephant (F tl)	1000												0		0
2	Zebra	600												0	6,000	6,000
1	Hippopotamus	1500												0	7,500	7,500
3	Bushpig	100												0		0
3	Warthog	100	100							100				1,100	500	1,600
1	Giraffe	1000												0		0
1	Buffalo (M)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		42,000	4,000	46,000
1	Buffalo (F)	500												15,000		15,000
1	Buffalo (NT)	500												0		0
2	Nyala	1200												0	0	0
3	Bushbuck (M)	300												0	1,800	1,800
2	Kudu (M)	400												4,000	400	4,400
2	Kudu (F)	250												0		0
2	Eland (M)	900												0		0
2	Eland (F)	500												0		0
4	Duiker	75	75	75	75	75	75	75	75	75	75	75		3,150		3,150
3	Reedbuck	300												0		0
2	Waterbuck (M)	700												0	1,400	1,400
2	Waterbuck (F)	350												0		0
2	Sable (M)	1200												0		0
2	Sable (F)	600												0		0
2	Wildebeest	400												0		0
2	Tsessebe	600												0		0
3	Impala (M)	75	450	450	450	450	450	450	450	450	450	450	450	18,900	225	19,125
3	Impala (F)	50	350	350	350	350	350	350	350	350	350	350	350	15,600	200	15,800
3	Impala (cull)	0												0		0
4	Klipspringer	200												0		0
4	Steenbok	75												0		0
4	Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	3,150		3,150
1	Lion (M)	2500												0	12,500	12,500
1	Lion (F)	1500												0		0
1	Leopard	2000												0	10,000	10,000
5	Wildcat	50												0		0
5	Serval	75												0		0
5	Genet	50												0		0
5	Civet	75												0		0
5	Hyaena	100	100	100	100	100	100	100	100	100	100	100		4,200		4,200
5	Jackal	25												0		0
5	Bat-eared Fox	75												0		0
5	Porcupine	25												0		0
5	Baboon	10	40	40	40	40	40	40	40	40	40	40	40	1,680		1,680
1	Crocodile	1000												0		0
5	Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	840		840
5	Francolin	3	12	12	12	12	12	12	12	12	12	12	12	504		504
5	Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	504		504
5	Sandgrouse	1												0		0
5	Duck	0												0		0
	SINGLE TROPIES															
1	Elephant (M)	7500					7500								75,000	75,000
1	Elephant (F)	2500													0	0
1	Leopard	2000			2000										10,000	10,000
1	Lion (M)	2500													12,500	12,500
1	Buffalo (M)	1000			1000			1000							4,000	4,000
2	Waterbuck (M)	700													1,400	1,400
2	Nyala	1200													0	0
1	Hippopotamus	1500				1500		1500							7,500	7,500
3	Warthog	100											100		500	500
3	Bushbuck (M)	300		300											1,800	1,800
2	Kudu (M)	400													400	400
3	Impala (M)	75			75						75				225	225
3	Impala (F)	50													200	200
2	Zebra	600		600		600		600			600				6,000	6,000
	F-INDEX VALUE	TOTAL	2,234			4,234		5,234	2,234	2,809	2,134	2,234		179,597		
		CODE 1	1,000			2,500		3,500	1,000	1,000	1,000	1,000		129,000		
		CODE 2	0			600		600	0	600	0	0		9,800		
		CODE 3	900			800		800	900	875	800	900		29,776		
		CODE 4	150			150		150	150	150	150	150		4,960		
		CODE 5	184			184		184	184	184	184	184		6,072		
	L-INDEX VALUE	TOTAL		3,034	5,209		9,634								50,566	
		CODE 1		1,000	4,000		8,500								37,000	
		CODE 2		600	0		0								2,000	
		CODE 3		1,100	875		800								8,650	
		CODE 4		150	150		150								1,360	
		CODE 5		184	184		184								1,556	
	INDEX VALUE:	GRAND TOT	2,234	3,034	5,209	4,234	9,634	5,234	2,234	2,809	2,134	2,234				230,153
		CODE 1	1,000	1,000	4,000	2,500	8,500	3,500	1,000	1,000	1,000	1,000				166,000
		CODE 2	0	600	0	600	0	600	0	600	0	0				11,800
		CODE 3	900	1,100	875	800	800	800	900	875	800	900				38,325
		CODE 4	150	150	150	150	150	150	150	150	150	150				6,300
		CODE 5	184	184	184	184	184	184	184	184	184	184				7,728

Appendix 9.7.2 Index value: Sapi Safari Area: Hunts and individual trophies

SAPI SAFARI AREA: INDEX VALUE OF ALLOCATED HUNTING QUOTAS
Zambezi Valley Auction Hunts

YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin	SPECIES	TROPHY FEE	DATE from:	1.5	18.5	4.6	21.6	8.7	25.7	11.8	28.8	14.9	1.5	18.5	4.6	21.6	8.7	25.7	11.8	28.8	14.9
			DATE to:	14.5	31.5	17.6	4.7	21.7	7.8	24.8	10.9	27.9	14.5	31.5	17.6	4.7	21.7	7.8	24.8	10.9	27.9
			BUYER (Foreign/Local):	F	F	F	F	F	F	F	L	L	F	L	F	L	L	F	F	L	F
			HUNT NO.	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18
			CAMP	G	G	G	G	G	G	G	G	G	H	H	H	H	H	H	H	H	H
1	Elephant (M)	7500																			
1	Elephant (F)	2500																			
1	Elephant (F tl)	1000																			
2	Zebra	600																			
1	Hippopotamus	1500																			
3	Bushpig	100																			
3	Warthog	100			100				100		100										
1	Giraffe	1000																			
1	Buffalo (M)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1	Buffalo (F)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
1	Buffalo (NT)	500																			
2	Nyala	1200																			
3	Bushbuck (M)	300																			
2	Kudu (M)	400																			
2	Kudu (F)	250																			
2	Eland (M)	900																			
2	Eland (F)	500																			
4	Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
3	Reedbuck	300																			
2	Waterbuck (M)	700																			
2	Waterbuck (F)	350																			
2	Sable (M)	1200																			
2	Sable (F)	600																			
2	Wildebeest	400																			
2	Tsessebe	600																			
3	Impala (M)	75	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525	525
3	Impala (F)	50	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
3	Impala (cull)	0																			
4	Klipspringer	200																			
4	Steenbok	75																			
4	Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
1	Lion (M)	2500																			
1	Lion (F)	1500																			
1	Leopard	2000																			
5	Wildcat	50																			
5	Serval	75																			
5	Genet	50																			
5	Civet	75																			
5	Hyaena	100											100	100	100	100	100	100	100	100	100
5	Jackal	25																			
5	Bat-eared Fox	75																			
5	Porcupine	25																			
5	Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
1	Crocodile	1000																			
5	Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
5	Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
5	Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
5	Sandgrouse	1																			
5	Duck	0																			
	SINGLE TROPIES																				
1	Elephant (M)	7500			7500				7500						7500						7500
1	Elephant (F)	2500																			
1	Zebra	600	600											600							
1	Hippopotamus	1500	1500											1500	1500				1500		
1	Warthog	100		100							100			100	100	100					100
2	Buffalo (M)	1000																			
2	Nyala	1200											1200	1200		1200					
1	Bushbuck (M)	300												300		300					300
3	Kudu (M)	400																			
3	Waterbuck (M)	700	700				700		700					700							700
2	Impala (M)	75																			
3	Impala (F)	50																			
3	Lion (M)	2500											2500		2500			2500			
2	Leopard	2000	2000	2000									2000								
	F-INDEX VALUE	TOTAL	7,359	4,659	10,159	2,559	3,259	2,559	10,859			8,359		14,259			5,159	4,159		11,259	
		CODE 1	3,600	1,600	9,000	1,500	1,500	1,500	9,000			1,500		10,600			1,500	3,000		9,400	
		CODE 2	2,000	2,000	0	0	0	0	0			3,200		0			0	0		0	
		CODE 3	1,525	825	925	825	1,525	825	1,625			3,325		3,325			3,325	825		1,525	
		CODE 4	150	150	150	150	150	150	150			150		150			150	150		150	
		CODE 5	84	84	84	84	84	84	84			184		184			184	184		184	
	L-INDEX VALUE	TOTAL								2,659	2,659		7,059			4,259	2,659			2,659	
		CODE 1								1,600	1,500		4,000			1,900	1,500			1,500	
		CODE 2								0	0		1,200			1,200	0			0	
		CODE 3								825	925		1,525			825	825			825	
		CODE 4								150	150		150			150	150			150	
		CODE 5								84	84		184			184	184			184	
	INDEX VALUE:	GRAND TOTA	7,359	4,659	10,159	2,559	3,259	2,559	10,859	2,659	2,659	8,359	7,059	14,259	4,259	2,659	5,159	4,159	2,659	11,259	
		CODE 1	3,600	1,600	9,000	1,500	1,500	1,500	9,000	1,600	1,500	1,500	4,000	10,600	1,900	1,500	1,500	3,000	1,500	9,400	
		CODE 2	2,000	2,000	0	0	0	0	0	0	0	3,200	1,200	0	1,200	0	0	0	0	0	
		CODE 3	1,525	825	925	825	1,525	825	1,625	825	925	3,325	1,525	3,325	825	825	3,325	825	825	1,525	
		CODE 4	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	
		CODE 5	84	84	84	84	84	84	84	84	84	184	184	184	184	184	184	184	184	184	

SAPI SAFARI AREA:

YEAR: 1991
TROPHY FEE TYPE: FOREIGN

SPECIES INDEX CODE Martin			DATE from:		1.5	14.5	27.5	9.6	22.6	5.7	18.7	31.7	13.8	26.8	8.9	21.9	1991 SAPI INDEX VALUE HUNT	1991 SAPI INDEX VALUE TROPHY	1991 SAPI INDEX VALUE TOTAL
			DATE to:		10.5	23.5	5.6	18.6	1.7	14.7	27.7	9.8	22.8	4.9	17.9	30.9			
			BUYER (Foreign/Local):		L	L	L	F	L	F	F	F	F	L	L	F			
			HUNT NO.		S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30			
			CAMP		CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R	CH-R			
		SPECIES	TROPHY FEE																
1		Elephant (M)	7500														0		0
1		Elephant (F)	2500														0		0
1		Elephant (F tl)	1000														0		0
2		Zebra	600														0		0
1		Hippopotamus	1500														0		0
3		Bushpig	100														0		0
3		Warthog	100				100					100					500		500
1		Giraffe	1000														0		0
1		Buffalo (M)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	30,000		30,000
1		Buffalo (F)	500	1000	500	1000	500	1000	500	1000	500	1000	500	1000	500	1000	18,000		18,000
1		Buffalo (NT)	500														0		0
2		Nyala	1200														0		0
3		Bushbuck (M)	300														0		0
2		Kudu (M)	400		400		400			400		400		400		400	2,400		2,400
2		Kudu (F)	250														0		0
2		Eland (M)	900														0		0
2		Eland (F)	500														0		0
4		Duiker	75	75	75	75	75	75	75	75	75	75	75	75	75	75	2,250		2,250
3		Reedbuck	300														0		0
2		Waterbuck (M)	700														0		0
2		Waterbuck (F)	350														0		0
2		Sable (M)	1200														0		0
2		Sable (F)	600														0		0
2		Wildebeest	400														0		0
2		Tsessebe	600														0		0
3		Impala (M)	75	525	525	525	525	525	525	525	525	525	525	525	525	525	15,750		15,750
3		Impala (F)	50	300	300	300	300	300	300	300	300	300	300	300	300	300	9,000		9,000
3		Impala (cull)	0														0		0
4		Klipspringer	200														0		0
4		Steenbok	75														0		0
4		Grysbok	75	75	75	75	75	75	75	75	75	75	75	75	75	75	2,250		2,250
1		Lion (M)	2500														0		0
1		Lion (F)	1500														0		0
1		Leopard	2000														0		0
5		Wildcat	50														0		0
5		Serval	75														0		0
5		Genet	50														0		0
5		Civet	75														0		0
5		Hyaena	100														900		900
5		Jackal	25														0		0
5		Bat-eared Fox	75														0		0
5		Porcupine	25														0		0
5		Baboon	10	40	40	40	40	40	40	40	40	40	40	40	40	40	1,200		1,200
1		Crocodile	1000														0		0
5		Guinea Fowl	5	20	20	20	20	20	20	20	20	20	20	20	20	20	600		600
5		Francolin	3	12	12	12	12	12	12	12	12	12	12	12	12	12	360		360
5		Pigeon/Dove	1	12	12	12	12	12	12	12	12	12	12	12	12	12	360		360
5		Sandgrouse	1														0		0
5		Duck	0														0		0
		SINGLE TROPIES																	
1		Elephant (M)	7500															30,000	
1		Elephant (F)	2500															0	
1		Zebra	600			600			600									2,400	
1		Hippopotamus	1500															6,000	
1		Warthog	100			100		100	100							100		1,000	
2		Buffalo (M)	1000															0	
2		Nyala	1200					1200										4,800	
1		Bushbuck (M)	300					300										1,200	
3		Kudu (M)	400															0	
3		Waterbuck (M)	700															3,500	
2		Impala (M)	75															0	
3		Impala (F)	50															0	
3		Lion (M)	2500							2500								10,000	
2		Leopard	2000							2000								8,000	
		F-INDEX VALUE	TOTAL					2,959		8,159	3,059	3,059	3,059			3,059	107,962		
			CODE 1					1,500		2,200	2,000	1,500	2,000			1,600	84,500		
			CODE 2					400		2,400	0	400	0			400	10,800		
			CODE 3					825		3,325	825	925	825			825	27,960		
			CODE 4					150		150	150	150	150			150	2,700		
			CODE 5					84		84	84	84	84			84	2,012		
		L-INDEX VALUE	TOTAL	3,059	2,959	3,859		4,659						2,959	3,059			42,508	
			CODE 1	2,000	1,500	2,700		2,400						1,500	2,000			24,100	
			CODE 2	0	400	0		1,200						400	0			4,400	
			CODE 3	825	825	925		825						825	825			10,800	
			CODE 4	150	150	150		150						150	150			1,800	
			CODE 5	84	84	84		84						84	84			1,408	
		INDEX VALUE	GRAND TOTA	3,059	2,959	3,859	2,959	4,659	8,159	3,059	3,059	3,059	2,959	3,059	3,059				150,470
			CODE 1	2,000	1,500	2,700	1,500	2,400	2,200	2,000	1,500	2,000	1,500	2,000	1,600				88,600
			CODE 2	0	400	0	400	1,200	2,400	0	400	0	400	0	400				15,200
			CODE 3	825	825	925	825	825	3,325	825	925	825	825	825	825				38,760
			CODE 4	150	150	150	150	150	150	150	150	150	150	150	150				4,500
			CODE 5	84	84	84	84	84	84	84	84	84	84	84	84				3,420

Appendix 10 Calculation of hunter days for licensing system alternatives

Hunting area	No. Hunts per season	No. Hunters per Hunt	Total Hunters planned	No. Days per Hunt	Total Hunter days planned
Charara	40	2	80	6	480
Makuti	60	2	120	6	720
Tuli	26	4	104	11	1'144
Doma	10	4	40	12	480
Rifa	39	4	156	11	1'716
Dandawa	30	2	60	8	480
Nyakasanga	18	2	36	14	504
	24	2	48	10	480
Total Nyakasanga	42		84		984
Sapi	18	2	36	14	504
	12	2	24	10	240
Total Sapi	30		60		744
C/M Safari Operator	5	2	10	21	210
	5	2	10	15	150
	10	2	20	5	100
Total Safari Operator	20		40		460

Source: DNPWLM licensing office, Harare.

Appendix 11 Calculation of visitor days for licensing system alternatives

Hunting Area	No. Hunters per hunting season	No. Visitors per Hunter	No. Visitors per season	No. Hunt days spent	Total Visitor Days
Charara	80	1.0	80	3	240
Makuti	120	1.0	120	3	360
Tuli	104	3.0	312	5.5	1'716
Doma	40	3.0	120	6	720
Rifa	156	3.6	562	5.5	3'089
Dandawa	60	1.0	60	4	240
Nyakasanga	36	2.8	100	7	700
	48	2.8	134	5	672
Total Nyakasanga	84		235		1'372
Sapi	36	3.0	108	7	756
	24	3.0	72	5	360
Total Sapi	60		90		1'116
C/M Safari Operator	10	1.0	10	10.5	105
	10	1.0	10	7.5	75
	20	1.0	20	7.5	50
Total Safari Operator	40		40		230

Source: DNPWLM licensing office, Harare.

Appendix 12 Calculation of visitor:hunter ratios for selected licensing systems

Hunting area	No. Visitors per season			Average visitors 1988-1990	No. Hunters per season	Average visitors per Hunter
	1988	1989	1990			
Makuti	71	46	160	92	100	1.0
Rifa	496	715	489	567	156	3.6
Nyakasanga	483	484	240	402	144	2.8
Sapi	195	262	293	250	84	3.0
Assumptions made for:						
Charara						1.0
Doma						3.0
Tuli						3.0
Dandawa						1.0
C/M Safari Operator						1.0

Source: Zimbabwe Government (1988, 1989a, and 1990a).

Appendix 13 Calculation of pupil days for ZHA school education facilities

Education Facility (ZHA branch)	No. Education Camps per year	No. Pupils per Camp	No. Education Days per Camp	No. Pupil Education Days per year
Doma hunting area (Lomagundi branch)	10	25	6	1'500
Rifa hunting area (Mashonaland branch)	9	30	6	1'620

Source: Rifa: Grobbelaar, Mashonaland licensing office, Harare; Doma: Thomas, Lomagundi licensing office, Mhangura.

Appendix 14 Calculation of hunting revenue for DNPWLM lottery system in Charara/Makuti

in Z$	Charara	Makuti	Charara/Makuti
Revenue from Hunts	56'482	72'085	128'567
Revenue from Tickets	17'224	25'836	43'060
Hunting Revenue	73'706	97'921	171'627

Source: DNPWLM ticket register' Licensing office, Harare.

Appendix 15 Examples of South African venison hunting quotas and values: 1992

Appendix 15.1 Venison hunts: Natal Parks Board: 1992

SOUTH AFRICAN VENISON and TROPHY HUNTING
Allocation and Value of Quotas
NATAL PARKS BOARD: MKUZI AND SPIOENKOP GAME RESERVES
YEAR: 1991
Value in Rands Exchange rate: 1 ZRand = 1.8413 ZS

SPECIES	LOCAL HUNT TROPHY FEE	LICENCE FEE	7 x MEAT HUNTS 5 DAY HUNT QUOTA NOS	VALUE	LICENCE FEE	2 x TROPHY HUNT 5 DAY HUNT QUOTA NOS	VALUE	LICENCE FEE	1 x TROPHY HUNT 5 DAY HUNT QUOTA	VALUE	LICENCE FEE	2 x MIXED HUNTS 5 DAY HUNT QUOTA	VALUE	LICENCE FEE	2 x MIXED HUNTS 5 DAY HUNT QUOTA	VALUE	LICENCE FEE
Nyala (M)	1600	15		0	0	2	3,200	30	2	3,200	30	1	1,600	15	1	1,600	15
Bushpig/Warthog (M/F)	120	6	1	120	6	2	240	12	2	240	12	1	120	6	1	120	6
Common Duiker	100	6	1	100	6		0	0		0	0	1	100	6	1	100	6
Common Reedbuck (M)	480	6		0	0	1	480	6	1	480	6		0	0	1	480	6
Impala (F)	130	6	2	260	12		0	0		0	0	2	260	12	2	260	12
Impala (M)	150	6		0	0	2	300	12	2	300	12		0	0		0	0
Nyala (F)	1400	15	4	5,600	60		0	0		0	0	2	2,800	30	2	2,800	30
Zebra (M/F)	1400	10		0	0	1	1,400	10		0	0		0	0		0	0
Blue Wildebeest BM)	1400	10		0	0		0	0	1	1,400	10		0	0		0	0
Red Duiker	200	20		0	0		0	0		0	0	1	200	20		0	0
SPECIES Nos. / VALUE Rands			4	6,080		5	5,620		5	5,620		6	5,080		6	5,360	
Licence Fee Total					84			70			70			89			75
TOTAL HUNT VALUE Rands					6,164			5,690			5,690			5,169			5,435
TOTAL HUNT VALUE ZS					11,350			10,477			10,477			9,518			10,007

Notes: All female (F) animal species are of venison hunting quality. All male (M) animal species are of trophy hunting quality.
All prices inclusive V.A.T.
Maximum of 4 Hunters per Hunt

Source: Gary Davies, Natal Parks Board PO Box 662, 3200 Pietermaritzburg, South Africa.
Exchange rate per 31.12.91, from: Reserve Bank of Zimbabwe (1991)

Appendix 15.2 Venison hunts: Ciskei Safaris: 1992

SOUTH AFRICAN VENISON and TROPHY HUNTING
Allocation and Value of Quotas
CISKEI SAFARIS (PTY) LTD
YEAR: 1992
Values in Rands Exchange Rate: 1ZRand = 1.8413 Z$

SPECIES	TROPHY FEE	TSOLWANA 1 DAY HUNT		TSOLWANA 2 DAY HUNT		TSOLWANA 3 DAY HUNT		TSOLWANA 5 DAY TROPHY HUNT		TSOLWANA 5 DAY VENISON HUNT	
		QUOTA No.	VALUE	QUOTA No.	VALUE	QUOTA No.	VALUE	QUOTA (M) No.	VALUE (M)	QUOTA (F) No.	VALUE (F)
Black Wildebeest (F)	475		0		0	1	475		0	1	475
Black Wildebeest (M)	510		0		0		0	1	510		0
Blesbuck (F)	255		0		0		0		0	1	255
Blesbuck (M)	275		0		0		0	1	275		0
Fallow Deer (F)	230		0		0		0		0	1	230
Fallow Deer (M)	275		0		0		0	1	275		0
Impala (F)	230		0		0		0		0	1	230
Impala (M)	250		0		0		0	1	250		0
Kudu (F)	610		0		0		0		0	1	610
Kudu (M)	950		0		0		0	1	950		0
Mountain Reedbuck (F)	110		0	1	110	2	220	2	220	2	220
Mountain Reedbuck (M)	140		0		0	1	140	1	140	1	140
Red Hartebeest (F)	500		0		0		0		0	1	500
Red Hartebeest (M)	610		0		0		0	1	610		0
Springbuck (F)	90	2	180	3	270	3	270	3	270	3	270
Springbuck (M)	125		0	1	125	1	125	1	125	1	125
SPECIES Nos. | VALUE Rands		1	180	3	505	5	1,230	10	3,625	10	3,055
HUNTER DAYS @ R125.– per day			125		250		375		625		625
TOTAL HUNT VALUE in Rands			305		755		1,605		4,250		3,680
TOTAL HUNT VALUE in Z$			562		1,390		2,955		7,828		6,776

NOTES: All species of female (F) animals are of venison hunting quality. All species of male (M) animals are of trophy hunting quality.
All prices inclusive V.A.T.
A maximum of 4 hunters permitted per hunting bag and hunt.

DATA SOURCE: Ian Wilmot, Ciskei Safaris (Pty) Ltd, PO Box 1424, Queenstown 5320, South Africa.
Exchange rate per 31.12.91 from: Reserve Bank of Zimbabwe (1991).

Appendix 16 Example of safari operator marketing of Charara/Makuti quota for safari hunting

CHARARA/MAKUTI — ALLOCATION and VALUATION of HUNTING QUOTAS if MARKETED BY SAFARI OPERATOR
Foreign Client Safari Hunting (Example)
YEAR: 1991
Values in US$ — Exchange rate: 1 US$ = 3.0731 Z$

13 Cats

TOTALS OF CLIENT	SPECIES	Draw Card Elephant	Bushpig	Warthog	Draw Card Buffalo	Draw Card Buffalo	Bushbuck	Kudu	Eland	Duiker	Waterbuck	Sable	Impala	Impala	Klipspring	Grysbok	Draw Car Lion	Draw Car Leopard
	Sex (Trophy or Non-Trophy)	male			male	female	male	male	male		male	male	male	female	male		male	
	1991 QUOTA Nos	6	3	30	38	38	9	15	1	45	5	3	75	75	9	45	5	8
	TROPHY FEES CHARGED TO CLIENT: U	7500	50	50	1000	100	200	500		25	500		125	50	50	60	3000	2000
D-VALUE US	D-RATE H-DAY N Type of Hunt sold																	
94,500	900 105 5 21-day Elephant Hunts @	1	2	2	2	2	1	1		2	1		2			1		1
	TOTAL Nos	5	10	10	10	10	5	5	0	10	5	0	10	0	0	5	0	5
67,300	TOTAL Trophy Fees	37,500	500	500	10,000	1,000	1,000	2,500	0	250	2,500	0	1,250	0	0	300	0	10,000
161,800	REMAINING QUOTA	1	-7	20	28	28	4	10	1	35	0	3	65	75	9	40	5	3
	incomplete species		7												7			
	NEW QUOTA	1	0	20	28	28	4	10	1	35	0	3	65	75	16	40	5	3
25,000	500 50 10 5-day Buffalo Hunts @			1	1	1		1		1			1	1	1	1		
	TOTAL Nos	0	0	10	10	10	0	10	0	10	0	0	10	10	10	10	0	0
19,600	TOTAL Trophy Fees	0	0	500	10,000	1,000	0	5,000	0	250	0	0	1,250	500	500	600	0	0
44,600	REMAINING QUOTA	1	0	10	18	18	4	0	1	25	0	3	55	65	6	30	5	3
	incomplete species																	
	NEW QUOTA	1	0	10	18	18	4	0	1	25	0	3	55	65	6	30	5	3
52,500	700 75 5 15-Cat Hunts @			1	1	1	1			1			1	1			1	
	TOTAL Nos	0	0	5	5	5	5	0	0	5	0	0	5	5	0	0	5	0
22,750	TOTAL Trophy Fees	0	0	250	5,000	500	1,000	0	0	125	0	0	625	250	0	0	15,000	0
75,250	REMAINING QUOTA	1	0	5	13	13	-1	0	1	20	0	3	50	60	6	30	0	3
	incomplete species						1								1			
	NEW QUOTA	1	0	5	13	13	0	0	1	20	0	3	50	60	7	30	0	3
	Total allocated QUOTA Nos	5	3	25	25	25	9	15	0	25	5	0	25	15	2	15	5	5

281,850 ***TOTAL HUNT VALUE in US$***
866,350 ***TOTAL HUNT VALUE in Z$*** Exchange rate: 3.07 Z$/1 US $ (per 31.5.91)
1,427,984 ***TOTAL HUNT VALUE in Z$*** Exchange rate: 5.07 Z$/1 US $ (per 18.2.92)

Data Source: Exchange rates from: Reserve Bank of Zimbabwe (1991).
Hunt allocations based on personal communication by Mr J Seymour-Smith from 23.5.91, Harare, Zimbabwe
Notes: Total Quota Nos are different to the C/M Total Authorized Quotas for Bushpig, Sable, Guinea Fowl, Francolin, and Pigeon/Dove because the former are the Authorized quotas, the latter are the allocated quotas.

Appendix 17 Maps used

at Scale of 1:1'000'000 *(Land Classification)*	Zimbabwe		1st Edition 1979
at Scale of 1:250'000 *(Topographical)*	Mana Pools	SD-35-16	3rd Edition 1983
	Kariba	SE-35-4	3rd Edition 1983
at Scale of 1:50'000 *(Topographical)*	Nyamuomba Island	1628 B4	2nd Edition 1977
	Kariba	1628 D2	2nd Edition 1978
	Sanyati Gorge	1628 D4	2nd Edition 1977
	Makuti	1629 A3	2nd Edition 1977
	Vuti	1629 A4	2nd Edition 1978
	Nzoe	1629 C1	2nd Edition 1978
	Chatigera	1629 C2	2nd Edition 1978
	Kalukumula	1629 C3	2nd Edition 1978

Appendix 18 Estimated costs of 10-day hunt in Rifa for Citizen Hunters

a) Transport: At least one 4-wheel drive vehicle and one heavy duty truck. Distance from Harare to Rifa is 350km one-way.

Truck costed at Z$4/km for a 700km return trip =	Z$ 3'500
4-Wheel drive costed at Z$2/km for a 700km return trip =	Z$ 1'400
In the hunting area itself, 300km costed at Z$2/km =	Z$ 600
Total Transport Costs	Z$ 5'500

b) Camping Equipment: If basics are hired from a company (Rooney's), the expected cost is Z$500 for the period. In addition, hunters need to borrow mobile water pumps, a deep freeze or fridge and lighting equipment.

c) Food and Drink: An average of 3 hunters plus 6 guests costed at Z$40 per person/day for the 10-day period = Z$ 3'600

Labourers for camp duties are costed at Z$20 per person/day	Z$ 800
Total Food and Drink Cost	Z$ 4'400

d) Ammunition and Weapons: Hunters will normally own their own weapons which cost significantly more to purchase, than hiring them from the ZHA. On average the required weapons are worth: Heavy calibre rifle Z$ 8'000; Medium calibre rifle Z$ 6'000; Shotgun Z$ 4000. Their ammunition is also expensive: Heavy calibre ammunition Z$30/round; Medium calibre ammunition Z$ 10/round and Shotgun ammunition Z$5/round.

Costs for ammunition and weapon hire are included here as minimum recurrent costs that could be expected:

Hire of rifle (0.375 calibre) for 10-day period =	Z$ 250
20 round of ammunition	Z$ 400
Total Ammunition and Weapon Hire Costs	Z$ 650

e) Total (Minimum) Hunting-Trip Costs: Total estimated costs [totals of points a) to d)] for a 10-day hunting trip are: Z$ 11'050

Source: Charles Grobbelaar, Zimbabwe Hunters' Association, Harare, whose help is gratefully acknowledged.

Appendix 19 Probability and time waited (draw sequence) for winning in a lottery[1]

"The higher the ticket holding of a person, the more likely he will, on average, be drawn earlier on in the procedure than the person holding fewer tickets."

The following is true:
The average amount of time waited for by an individual who has a high probability of being selected is very much less than the average amount of time waited for by an individual with a low probability for success.

There exists a relationship between the time waited (draw sequence) and the draw probability:
The average amount of draws that a person would wait for (time) if all other persons were to get more than one hunt each - representing the longest time the person waits - is described by the formula for the mean of a geometric distribution (Underhill, 1987: 219-221):

$$\text{Time} = \frac{rq}{p}$$

where:
r = the number of draws that a person has to win;
q = (1 - p), or the remaining probability;
p = the probability of winning.

Because, for the DNPWLM lottery system hunters are only allowed to win one hunt each, r = 1 for our example, and the general formula becomes:

$$\text{Time} = \frac{q}{p}$$

Therefore, the time waited by each person to win a single hunt **decreases** in comparison to the above general formula.

Example of a likely event occurring:
An applicant with 99% (99 tickets) probability of winning a hunt in the Charara/Makuti study area has to wait (1 - 0.99)/0.99 amount of time, or 0.01/0.99 which equals 0.01 units (a small number divided by a large number), or **a very short time indeed. Conclusion:** A person with a large probability of winning barely waits at all until he wins a hunt.

Counter example:
An applicant with 9% (1 ticket) probability of winning a hunt in the Charara/Makuti study area has to wait
(1 - 0.09)/0.09 amount of time, or 0.91/0.09 which equals 10.1 units (a large number divided by a small number), or **a very long amount of time indeed. Conclusion:** A person with a small probability of winning will wait an extremely long time until he wins a hunt.

Example of an unlikely event occurring:
Were there to be a person with a small probability (eg. 9%) of winning a hunt being drawn at the first draw (a very unlikely event to occur), then the next draw would favour the major ticket holder slightly better than all other ticket holders remaining to be drawn. **General conclusion for relationship between draw sequence and draw probability:** All persons with large probabilities of winning a hunt will, on average, be drawn earlier than persons who have smaller probabilities of winning.

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[1] The invaluable help of Prof. T. Dunne in clarifying this statistical relationship is gratefully acknowledged.

Appendix 20 Study area: Map of Charara/Makuti hunting areas in Zimbabwe (Foldout)