TREND OF TROPHY HUNTING IN TANZANIA: CASE STUDY OF SIX SPECIES IN SELOUS GAME RESERVE

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN WILDLIFE MANAGEMENT OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA

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ABSTRACT

Selous Game Reserve (SGR) is the most important destination for trophy hunting in Tanzania. Assessment of the trend of trophy hunting and its role in conservation was conducted for a 10-year period (2001-2010) using buffalo, elephant, greater kudu, impala, leopard and lion. The main objective was to assess ecological sustainability of trophy hunting and its role in wildlife conservation in Tanzania. Data were collected from secondary sources, including SGR trophy hunting database, trophy hunting sheets, Sectors' annual reports and previous research records. Furthermore, a questionnaire survey to Sector Wardens and observations were used. SPSS and R-computer programs were used in analysis. Pearson correlation test was used to test correlation between parameters recorded. Trends of trophy qualities were tested using One Way ANOVA. Furthermore, a post hoc pair-wise test was employed to test which years' records were different, if any. Results reveal that, at least 10 842 animals from the six study species were hunted during that period. Buffalo was the most hunted species followed by impala, together contributing 80% of hunts. Furthermore, buffalo was the most important for revenue (40.33%) followed by elephant (21.95%) and leopard (16.07%) though allocated quotas were not fully utilized. Animal populations have been decreasing. Though there were positive correlations between parameters for impala, buffalo and greater kudu, trophy quality for some species were decreasing. Perceptions from this study highlight that, despite the benefits from trophy hunting Sector Wardens doubted if quotas were sustainable, given the current conservation challenges. Poaching was the most mentioned challenge, amplified by encroachment and institutional failure to enforce the laws. The conclusion is that trophy hunting is important for revenue generation and conservation and recommends that it should be based on realistic quotas. Furthermore, the wildlife law and its regulations

should be enforced, staff supervising the hunting be provided with quotas and empowered to enforce the law to prevent mal-practices.

DECLARATION

I, Francisca Jacob Malembeka, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

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The above declaration is confirmed

_____ _____

Prof. A.N. Songorwa Date
(Supervisor)

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DEDICATION

To almighty God, the creator of the universe and all creatures, who grants me immense joy to work in His wonderful creation – the wildlife rich-areas of Tanzania. To my parents, relatives, friends and mentors who taught me to appreciate nature and also, to all the 'Bwananyamas' who tirelessly risk their lives to ensure Tanzanian wildlife is utilized sustainably.

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LIST OF ACRONYMS AND SYMBOLS

ANOVA	Analysis Of Variance
BTC	Belgian Technical Cooperation
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Flora and Fauna
DGO(s)	District Game Officer(s)
FR(s)	Forest Reserve(s)
GR(s)	Game Reserve(s)
MEADP	Ministry of Economic Affairs and Development Planning
MF	Ministry of Finance
MNRT	Ministry of Natural Resources and Tourism
MPEA	Ministry of Planning and Economic Affairs
MPEE	Ministry of Planning and Economic and Empowerment
NP(s)	National Park(s)
OA(s)	Open Area(s)
OUTRRAIN	Quality Conservation through Integrated Education, Outreach and
PA(s)	Protected Area(s)
PH(s)	Professional Hunter(s)
PM(s)	Project Manager(s)
SCI	Safari Club International
SCP	Selous Conservation Programme
SGR	Selous Game Reserve
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture

TAWIRI	Tanzania Wildlife Research Institute
TNRF	Tanzania Natural Resource Forum
TZ	Tanzania
URT	United Republic of Tanzania
USD	United States (of America) Dollar
WMA(s)	Wildlife Management Area(s)
i. e.	That is
%	Percent
^{o}C	Degree Celsius

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Tanzania is among the few African countries with remarkable arrays of wildlife species. This wildlife is important for the lives of all Tanzanians as a source of not only food and medicine (Patkin, 1995) but also income (through various activities, including photographic tourism and trophy hunting) (TNRF, 2008). The Convention on Biological Diversity (CBD) identifies and encourages conservation efforts of each member country to ensure effective management systems by achieving a balance between the three CBD's core objectives: conservation, sustainable use and equitable benefit sharing. In particular, CBD stresses that local communities should have access to genetic resources from the biodiversity and also that there should be fair and equitable sharing of benefits from the biodiversity around them (CBD, 2006).

Tanzania practices trophy hunting as one form of wildlife utilization (MNRT, 2003; MNRT, 2007). This refers to a form of hunting, which is pleasurable to the hunter and which is done for leisure. It is also known as tourist- or sport hunting (Loveridge *et al.*, 2007a). In Tanzania, trophy hunting means hunting of animals within a given hunting block for leisure or for obtaining trophies thereof and includes sport fishing (MNRT, 2010).

Being a form of wildlife utilization, trophy hunting serves as one of the tools for conservation as it is argued by various authors that hunting is one of the key things in ensuring mammal survival (Caro *et al.*, 1999; Loveridge *et al*., 2007b). However, it has been observed that some species are liked more by hunters compared to others. For

instance, on average, 1.5 buffaloes (*Syncerus caffer caffer)* were hunted by each trophy hunter who visited SGR from 1996 to 2001. Buffalo, lion *(Panthera leo)* and leopard (*Panthera pardus*) make the top three preferred species, which have a significant contribution to revenue accruing from trophy hunting (Baldus and Caudwell, 2005). Studies conducted from 1996 to 2001 have revealed that, these three key species generated 42.0% of the trophy fees for the Wildlife Division. Buffalo was the most important species, contributing 13.3% of the revenue for the Tanzanian Wildlife Division (Baldus and Caudwell, 2005). In the long run this can threaten their existence, given the fact that some species are especially vulnerable to over-exploitation, in large part due to their life histories, relative demand by trophy hunters and economic potential. It is critical that they be managed conservatively in order to ensure their continued existence (Whitman, 2002). For example, the infanticide by male lions, which take over control of prides, has been witnessed to disturb the population size (Whitman, 2004; Loveridge *et al.*, 2007b; Songorwa and du Toit, 2007). Therefore, as much as the lions are important for revenue generation, their long-term existence is questionable along with their role in the ecosystem due to interferences in their social groups.

1.2 Problem Statement and Justification

In Tanzania, trophy hunting is based on a quota system. Quotas are said to be based on scientific data of the animal populations' trends and reproduction rates (MNRT, 2010). However, it has been found that, quite often the setting of hunting quotas does not base on scientific data as expected; rather it is done administratively (Caro *et al.,* 1998). If so, the current way of setting quotas might result in adverse impacts on hunted populations in the long run, as it has been already revealed by various studies that populations of large mammals in western Tanzania have been declining due to setting quotas far beyond the recovery rates (Caro *et al.,* 1999; Caro, 2008). According to Salum (2005), the present

hunting pressure on species through trophy hunting is exacerbated by the sizes of the hunting blocks, which have been subdivided subsequently over time. The number of blocks used for trophy hunting in SGR increased from 22 in 1988 to 45 in 1998 and since 2002 the number of blocks used for trophy hunting is 43 (Pers. observation). The resizing of hunting blocks has led to the number of animals hunted to increase. Whitman (2002) argues that, the desire to maximize benefits from trophy hunting, which are gained through increasing the number of animals hunted, affects even the harem species because the number becomes too high to allow regeneration. Likewise for carnivores the quota is associated with the length of the safari package.

Despite the fact that SGR is one of the most researched game reserves in Tanzania, little has been done with regard to trophy hunting (Baldus and Caudwell, 2005; Caro, 2008; Salum, 2005; Songorwa and du Toit, 2007; Brink, 2010). Studies by Songorwa and du Toit (2007) and Caro (2008) in particular, indicate a decline in population sizes. Two of the study species (leopard and elephant (*Loxodonta africana)*) are listed as endangered and lion may be endangered if unregulated trade continues (CITES, 2000). Impala (*Aepyceros melampus*), greater kudu (*Tragelaphus strepsiceros*) and buffalo fall under lower risk but conservation-dependant for sustainability (Macdonald and Norris, 2005).

Little information is available about current trends and sustainability of the trophy hunting industry and the animal populations' dynamics. Therefore, there is a need to examine the trophy hunting industry in terms of long-term sustainability, given that some target species are vulnerable to over-exploitation and, therefore, it is critical that they be managed conservatively in order to ensure their continued existence. The current study focused on sub-ungulates, ungulates and carnivores (elephant, impala, buffalo, greater kudu, lion and leopard) because these are the groups for which information regarding selective harvesting

is mostly available. The presence of some of them, e.g. elephant, leopard and lion, attracts conservation attention and decision making. Impala was chosen in order to compare if smaller herbivores are also affected by trophy hunting. The results from this study could be useful and hence be applicable to other areas in Tanzania where trophy hunting is conducted.

1.3 Objectives

1.3.1 Main objectives

The main objective of this study was to assess the ecological sustainability of trophy hunting and its role in wildlife conservation in Tanzania.

1.3.2 Specific objectives

Specific objectives included to:

(i) To enumerate numbers of each study species that were hunted from their respective set quotas over a period of 10 years (2001-2010) (how much of the quotas were utilized);

(ii) Establish trends of quality of trophies from study species;

(iii) Establish the nature and trends of threats on study species for a period of 10 years (2001-2010) besides trophy hunting; and

(iv) To calculate the revenue generated annually from trophy hunting of study species for a period of 10 years (2001-2010).

Through this study the researcher intended to answer the following research questions:

(i) To what extent were the study species' quotas utilized during the 10 year period?

(ii) If not all of the quotas were utilized, what were the reasons?

(iii) What had the population status/trends of the study species for the past ten years been?

(iv) What were the trophy sizes from the animals hunted in the period of 10 years?

(v) Was there a significant change in trophy size from the animals hunted in the 10-year period?

(vi) What were the main challenges wildlife conservation was facing in SGR?

(vii) What were the most liked species by poachers?

(viii) Were some of the liked species the study species?

(ix) How had trophy hunting contributed to conservation in SGR?

(x) How much money accrued from trophy hunting of the study species over the 10-year period?

(xi) What could Tanzania learn from this case study?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Animal Species in SGR

Due to the existing variety of land forms, habitats, large size and remoteness, SGR has a great species richness of large and small mammals (57 species) compared to other areas of miombo woodland (MNRT, 2005). Elephant, buffalo and common waterbuck (*Kobus ellipsiprymnus*) predominate in the valleys, and sable antelope (*Hippotragus niger*) and greater kudu on the hills. Lechtein's hartebeest (*Alcelaphus buselaphus lichteinsteinii*) are plentiful, but impala and Nyassa wildebeest (*Connochaetes taurinus*) are confined to short grass ridges near major rivers. Maasai giraffes (*Giraffa camelopardalis*) are common in the Rufiji river basin (MNRT, 2005).

Spotted hyenas (*Crocuta crocuta*), leopards and lions are the most common carnivores in SGR (Creel and Creel 1993 in Salum, (2005)). Black-backed jackals (*Canis mesomelas*) are mainly in north-west Selous and side-striped jackals (*Canis adustus*) (Maleko, 2011 pers. comm.) are rare, sightings being limited to boundary areas in close proximity to human settlements. Wild dogs (*Lycaon pictus*) are not common but there is a substantial population and possibly the biggest anywhere in Africa (Creel and Creel 1993 in Salum (2005)). Cheetahs (*Acinonyx jubatus*) are rare and generally found in the north-eastern short-grassed and open woodlands. Large concentrations of crocodiles (*Crocodylus niloticus*) are found in the Rufiji river downstream from Stieglers's Gorge and in the nearby lakes whose population in the Rufiji, Ulanga, Kilombero and Ruaha rivers is indicated to be stable. Also, 450 bird species have been recorded in the reserve (MNRT, 2005).

2.2 Challenges Faced by Wildlife Conservation in Tanzania

According to TNRF (2008), Tanzania has the largest mammal populations left in any country on earth (MNRT, 2003). Furthermore, the country is not only home to many mammal species, but also harbours a number of other wildlife species, which are either endemic or globally endangered and threatened (MNRT, 2007; Packer *et al*., 2009). For example, SGR has been reported to harbour the biggest lion population in the world (Packer *et al*., 2011) and is important for elephant conservation (MNRT, 2003). Despite the fact that a large portion of mainland Tanzania (340 213.68 km²) (MNRT, 2007) equivalent to 36.09% has been set aside for wildlife conservation, these populations face a number of challenges, including loss of habitats, human-wildlife conflicts, mining in protected areas (PAs) and unsustainable hunting practises.

2.2.1 Loss of wildlife habitats as a result of human activities

It has been identified in Tanzania, like elsewhere in the world that, the main challenge wildlife conservation is facing is loss of habitats due to increase of human activities (MNRT, 2007; TAWIRI, 2012; Adams, 2012). The best available scientific data suggest that the country has shown strong commitment to wildlife and biodiversity conservation, setting aside 33.6% of its land as PAs closed to human settlements (MNRT, 2007). However, it has been shown that, these parks and reserves are often insufficient for conserving wildlife in any given area. Many species need resources during certain times of the year, which are found outside the protected areas (TNRF, 2008). Also, much wildlife lives outside the PAs at all times. Therefore, human population pressure is a challenge to conservation as sometimes conservation interferes with humans' economic interests leading to human-wildlife conflicts (Dickman, 2010).

2.2.2 Human-wildlife conflicts

Findings have highlighted the increase of permanent settlements of about eight percent of iron corrugated sheets, increase in permanent as well as temporary huts close to PAs (TAWIRI, 2012). In line with this, livestock keeping has been noted to increase let alone cultivation and dependency on PAs for raw materials like grass and wood (TAWIRI, 2012). These activities pose actual and/or potential human-wildlife conflicts. Livestock keeping, for example, not only attracts conflicts through depredation of livestock by carnivores (Dickman, 2010) but also sometimes carnivores get wounded or even die due to snares set by pastoralists who graze their livestock inside PAs. Since in the SGR lions are more in the north due to habitat type preferences (MNRT, 2003) they are more likely to suffer the conflict as the same part of the reserve and its surrounding areas are said to have more livestock (Twaibu, 2009) compared to the southern part, posing a challenge to lions' existence in the long run.

2.2.3 Unsustainable hunting practices

In a study conducted in western Tanzania a slight increase in rainfall was observed and no remarkable outbreak of diseases (Caro, 2008). However, there was a decline in some wildlife populations, including giraffes, hippopotamus (*Hippopotamus amphibius*), warthogs (*Phacochoerus aethiopicus*) and other mammals, which could have been caused by illegal hunting. Also, the study discovered that the decline was partly caused by trophy hunting for lions and greater kudu (in areas adjacent to his study site), which was probably unsustainable, hence led to the decline (Caro, 2008). Likewise was the case for resident hunting whose quotas were claimed to be too high in partially protected areas in Katavi ecosystem (Caro, 1998). Balme *et al.* (2010) argue that trophy hunting adds pressure on hunted species by adding rather than being a substitute. This is because even when an adaptive approach is used in setting quotas, normally other sources of mortalities, e.g.

through poaching, are not considered. Other unsustainable hunting practices include the use of baits, which - as an unintended effect - has been reported to habituate carnivores with easy hunts, causing human-wildlife conflicts to increase in off trophy hunting season (Twaibu, 2009).

2.3 Trophy Hunting in Tanzania

Trophy hunting is important as a way of earning revenue from wildlife in remote areas, which lack infrastructure, scenic attractions and dense wildlife populations that photographic tourists generally demand (Baldus and Cauldwell, 2005). This fact makes trophy hunting to remain the best wildlife use option particularly in lower potential wildlife tourism areas where it is found. Furthermore, it has been recognised as a major tool for conservation as it adds economic value not only to hunted species but also to the habitat. Through trophy hunting even species considered as vermin (interfering with human interests) can provide incentive for conservation as something without value is defenceless and may decline or even become extinct (Damm, 2011).

In Tanzania, trophy hunting takes place in hunting blocks (Fig. 1) based on quotas set by the Wildlife Division (URT, 2010). Some authors doubt if a truly scientific basis for setting hunting quotas can ever be developed in the complex multi-species ecosystems in Africa (Whitman, 2002; Packer *et al.,* 2009). Instead the cumulative experience of setting quotas over many years that relies on several verifiable indicators (population estimates, trophy quality, age, abundance and off-take levels) that allow for the confidence of setting future hunting quotas through an adaptive management approach has been suggested (Baldus and Cauldwell, 2005).

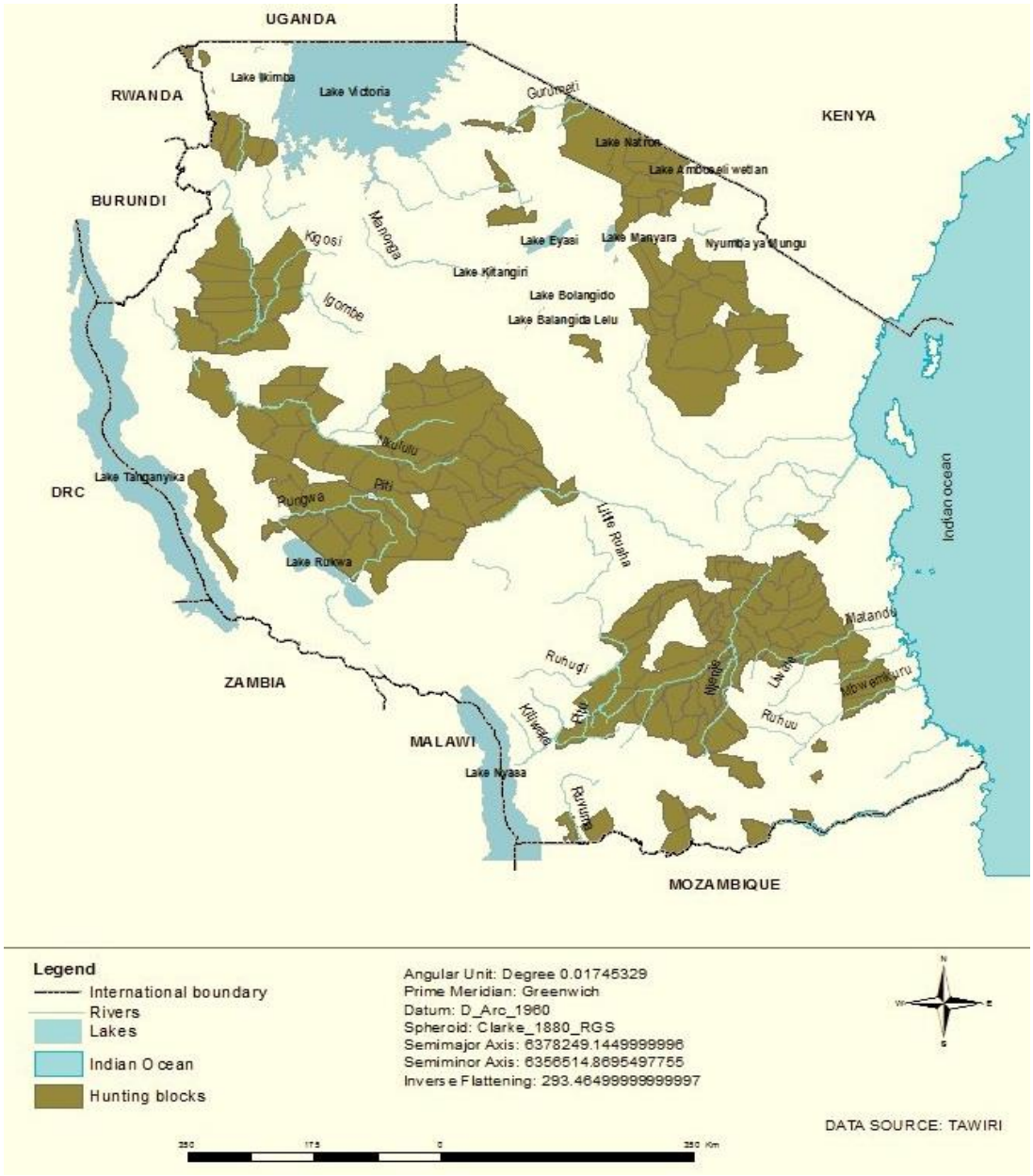

Figure 1: Map of Tanzania showing hunting blocks

***Source*: TAWIRI (2010)**

Currently the approach used by the Wildlife Division to allocate hunting quotas is to rely on the knowledge of game reserve managers commonly known as Project Managers (PMs) who suggest quotas for their respective Game Reserves (GR) and on District Game Officers (DGOs) who suggest quotas for Game Controlled Areas (GCAs) and Open Areas (OAs) (Baldus and Caudlwell, 2005; Pers. experience).

Also, in setting the quotas, past hunting records and recommendations of professional hunters and outfitters are taken into account. It is argued that, same quotas have been maintained despite the fact that some concessions have been subdivided into four thus posing a danger of exceeding the number of animals available (Baldus and Caudlwell, 2005; Salum, 2005). It has been recommended that such changes *i.e* subdivisions should be reflected in the set quotas too (Salum, 2005). Some studies have suggested, for example, that lion hunting should not exceed 1.0 animal/1 000 km^2 in the SGR whereas an upper limit of 0.5 animal/1 000 km^2 should be imposed for the rest of the country (Packer *et al.*, 2011). Likewise, an upper limit of 3.0 leopards/1 000 km^2 harvest is suggested for SGR and not exceeding 1.0 leopard/1 000 km^2 in the rest of Tanzania (Packer *et al.*, 2011). Also, a strict age minimum would help to ensure safe harvest levels (e.g. 6 years for lion and 7 years for leopard) despite uncertainties about local population sizes (Whitman *et al.*, 2004). Setting and sticking to sustainable quotas is better because stopping trophy hunting may reduce funds available for anti-poaching and the loss of viability and reduction in profitability would be much lower than if lion hunting was stopped altogether (Lindsey *et al*., 2012).

2.4 Regulations of Trophy Hunting in Tanzania

Previously in Tanzania trophy hunting commenced on 1 July and ended on 31 December each year. In recent years the regulation changed and the season was lengthened to 31 March (URT, 2010). Now it is back to 31 December. Some of the regulations stipulated in the new Regulations include; the control of hunting quota which, among other things, directs hunters not to exceed the hunting quotas issued and only to hunt within indicated hunting blocks (URT, 2010). Another thing is the regulation of time, location and of animals to hunt. No hunting of any animal during hours of darkness or the period between sunset and sunrise. Also, not to hunt the young or any animal or any female animal which

is pregnant or accompanied by its young (URT, 2010). All these are overseen by the Wildlife Division through the staff supervising trophy hunting.

2.5 Conservation Status and Priority of Study Species for Revenue Generation

Conservation agencies need to balance the activities that make species or ecosystems sustainable with activities that make the agencies themselves sustainable. Current status of species present in SGR range from lower risk to endangered status. For example, according to Macdonald and Norris (2005), three of the study species, i.e., impala, buffalo and greater kudu fall under lower risk, but are conservation-dependant with habitat loss as the major threat. This means that protection of these species and their habitats is important, if they are to survive. Also, in the results of her study involving impala, giraffe and buffalo in southern Tanzania, Malembeka (2010) observed this need of protection for their survival with higher threats in OAs and Forest Reserves (FRs) followed by WMAs and least in National Parks (NPs). Contrary to this, findings from the North-west Sector of SGR (Fig. 2) suggest that trophy hunting is the major factor for decline of species (Songorwa and du Toit, 2007). Lion and leopard fall in the CITES regulated list (CITES, 2000) and are ranked as vulnerable by IUCN (2009) while the African elephant is on IUCN's red list (IUCN, 2009).

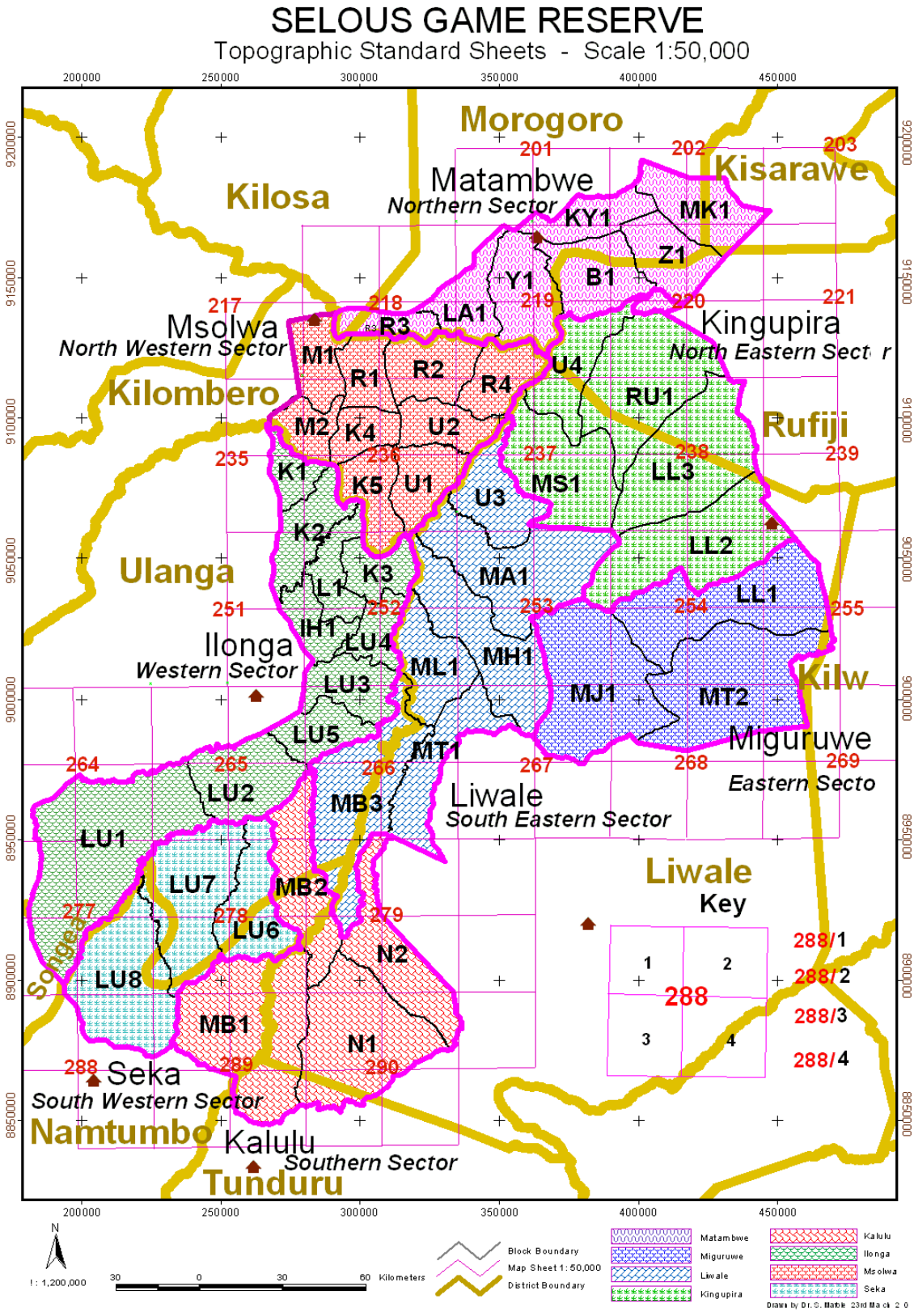

Figure 2: Map of Selous Game Reserve showing location and hunting blocks at the time of this study

***Source*: MNRT (2005)**

In a research conducted to know the preferred hunting destinations, Tanzania was ranked the best, the factors being the feel for wilderness, attractive scenery and large hunting areas (Lindsey *et al.*, 2012). It is known that SGR provides the biggest number of animals hunted in Tanzania, therefore, conforming to the above-mentioned attributes. This is due to the high demand for trophies, which focuses on short-term profit making by outfitters. Sometimes it has led to unscrupulous practices, which make sustainability of the industry questionable (Songorwa and Du Toit, 2007; Leader-Williams *et al.*, 2009; Lindsey *et al.*, 2012). It is thought that sometimes the regulations were somehow over passed. For example, the use of bait was banned in Tanzania unless the bait was on the hunting list. According to Kayera (in Whitman *et al.*, 2004) the use of baits for hunting lions and leopards was permitted by order of the Director of Wildlife although, in reality, baits were being widely used. For example, a professional hunter who has guided on average six lion hunts per year (72 in total) in SGR for 12 years said that; 'it is nonsense if people tell you they do not bait'. Furthermore, he said that, of the 72 lions he hunted, 66 were baited and only six were hunted without bait and that only buffalo and elephants were really hunted on fair chase and search, while hunting big cats (including leopards and lions) was boring (Brink, 2010). Currently the use bait has been legalised (URT, 2010).

Tanzania has been using various strategies to reduce demand for CITES-listed animals by increasing the number of days in a safari package. In order to hunt a lion, leopard or elephant, for example, a 21-day safari package is needed despite the number of days spent in search of those animals (MNRT, 2010). However, this very condition increases the number of other hunted animals (MNRT, 2010). Other strategies include setting the minimum requirement by the Wildlife Division. Just to mention a few, the minimum requirement for leopard trophies is that, the body length (excluding the tail) must be at least 1.3 meters. Furthermore, the use of nose colour criterion for lions can be applied to

determine maturity, although some researchers doubt the honesty of hunters since it is easy to use artificial colours to adjust ageing using the nose (Brink, 2010) and the capability of the game scouts to prevent this (Leader-Williams, 2009). Minimum trophy sizes are also applicable to elephants (Games and Severre, 2002 in Whitman *et al.*, 2004).

Recently the government of Tanzania has set minimum criteria to guide hunting of key species, which include restriction on hunting a lion under six years of age, not to hunt an elephant with tusks weighing below 18 kg per tusk or of length less than 160 cm and, for leopard, nose to tip of tail of at least 150 cm (URT, 2010).

Recent studies have indicated the effects caused by trophy hunting. For example, Songorwa and du Toit (2007) discovered that, with the exception of hippo, for which there was no clear pattern, there has been a decline in trophy quality in four of the big five species (lion, leopard, elephant and buffalo). Also, some outfitters admit that it is becoming increasingly difficult to get good trophies of lion and buffalo and also that trophy quality has declined over the past years (Whitman, 2002; Packer *et al*., 2011).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

The current study was carried out in SGR (Fig. 2), which is situated in south-eastern Tanzania between 7^0 20'S and 10^0 30'S. The northern side of SGR extends from 36^0 55' 50.6 E, 7^0 48' 18.7''S to 38^0 21'40''E, 7^0 21' 15.6''S while to the eastern side extends from 38^0 31'14.6''E, 7^0 27' 31.90''S, heading to geographical point 38^0 31' 14.6'' E, 7^0 27' 31.90''S, heading southwards to geographical point 38^0 38' 5.768'' E, 9^0 6' 53.88'' S, then narrowing in the direction of South-east from map point 37^0 36' 50.92'' E, 9^0 9' 28.07'' heading in the same direction to geographical point 37^0 28' 16.96'' E, 10^0 12' 0.0021''S. Southward direction SGR extends from 37^0 1' 43.68 E, 10^0 21' 25.36''5 to 36^0 5'11.518''E, 9^0 47' 35.21 S and western side extends from 36^0 15' 53.972''E along the west side of Ilonga – Msolwa to Matambwe to geographical position 37^0 53' 33.16'' E, 7^0 24' 57.712''S (MNRT, 2005).

SGR covers an estimated area of 47 000 km^2 (Rodgers, 1970 in Salum, 2005) comprising of the major part of the larger 'Selous ecosystem', which includes other protected areas such as Mikumi National Park, Udzungwa Mountains National Park, Kilombero Game Controlled Area and including areas of sparse settlement of Selous - Niassa Corridor and peripheral areas. The ecosystem covers a total area of 105 940 km^2 (Rodgers, 1970 in Salum, 2005). In the south, the rainfall is uni-modal while in the northern part it is bimodal (MNRT, 2003). In the unimodal area dry season lasts from late May to early November and the six-month wet season begins with torrential storms in late November. Annual rainfall ranges from about 750 mm in the east to 1 300 mm in the west. Average temperatures range from about 13^0 C to about 41^0 C with higher temperatures occurring in

the east. Mean monthly maximum temperatures at Kingupira station range from 30.7^0 C in June to 37.3^0 C in November while mean monthly minimum temperatures range from 17.9^0 C in June to 25.3^0 C in January (MNRT, 2005).

SGR possesses a very diverse flora with an estimated total of over 1 800 species (MNRT, 2005). Miombo woodlands cover some 75% of the reserve as well as most of the peripheral areas being dominated by genus *Brachystegia*. The *Acacia-Combretum* wooded grassland is found in the north of Ruaha river characterizing an open wooded grassland with flat-topped *Terminalia spinosa*. Along the Rufiji River the extensive swamps and lakes with their tall *Borassus aethiopum* palms cover some 250 km^2 (MNRT, 2005).

Administratively, SGR has eight sectors namely Northen Sector (Matambwe), North-eastern Sector (Kingupira), Eastern Sector (Miguruwe), South-eastern Sector (Liwale), Sourthern Sector (Kalulu), South-western Sector (Likuyu seka maganga), Western Sector (Ilonga) and North-western Sector (Msolwa) with sizes ranging from 1 738 km^2 for Matambwe to 9 345 km^2 for Kingupira (Appendix 1) each headed by a Sector Warden (Fig. 2). The head quarters of SGR are at Matambwe. For the sake of coordination and easy communication, SGR has another office in Dar es Salaam. The number of employees in SGR has been varying from time to time. During the study it was 336, which is said to be far below the international recommendation of 622 (wildlife staff only) and a total of 718, including support staff like drivers, secretaries, record managers, accountants and plants personnel. At the time of this study SGR had 47 hunting blocks whereby 43 were used for trophy hunting and responsible for generating 90.0% of income and the remaining four were used for photographic-tourism, generating about 10.0% of SGR's revenues (MNRT, 2003).

3.2 Data Collection

3.2.1 Study species

Ten years' data on the study species, i.e., buffalo, elephant, greater kudu, impala, leopard and lion were collected in this study as elaborated below.

3.2.2 Study design and sampling procedure

Two designs were used in this study; a cross-sectional study design (Casley and Kumar, 1988; de Vaus, 1993) and retrospective study design (de Vaus, 1993). Cross-sectional study design was used for primary data collection through questionnaire administration to SGR Sector Wardens. Questionnaire survey was administered to substantive sector wardens or their representatives. Data were collected only once as required by the study design for the in the entire period of investigation. Data obtained from the survey provided information on perceptions and attitudes on trophy hunting.

On the other hand, a retrospective study design was used for collecting secondary data, whichwere the main data for the study. Such data included set quotas, utilized quotas, wildlife census results, poaching data and other data on decimating factors to wildlife. The Wildlife Division (WD) sets hunting quotas for all game species prior to hunting season. Standard quotas for each block in SGR are shown in Table 1. For each game species there was a general minimum and maximum number allowed for hunting. For example, the allowed number for impala varied from 15 to 20 per block (Table 1). However, the actual quotas per block may not necessarily have been between 15 and 20. This is because hunting blocks fall under five different categories, category one being the best (TAWIRI, 2010). Therefore, wherever available quotas were collected at block level based on the actual quotas set (Appendices 2, 3 and 4).

Table 1: Quotas and prices for study species in SGR during the study period

Species	Allocated quota per block	Price per animal (in USD)	
		2001 to 2009/10	From 2010/11 todate
Buffalo	25-30[a]	First 600 [b], Second 720 [b], third 840[b]	1 900[c]
Elephant	No quotas[a]	4000[b]	15 000 (18-21.4kg)[c]
			20 000 (21.5kg and above) [c]
Impala	15-20[a]	240 [b]	390 [c]
Greater Kudu	4-8[a]	1 170[b]	2 200 [c]
Leopard	4-5[a]	2 000[b]	3 500 [c]
Lion	4-5[a]	2 000[b]	4 900 [c]

Sources: This study[a]; Baldus and Caudwell (2005) [b]; URT (2010)[c]

Trophy hunting data of the study species from 2001 to 2010 were used. Likewise the case was for poaching data obtained from annual reports and anti-poaching records.

In addition to that, other available reports/information about the study species' population trends were used. Such reports included census reports from TAWIRI, trophy hunting records from CITES office in Dar es Salaam and annual reports available at SGR sectors and those available at the Wildlife Division. In addition to that, other sources were used, including those provided by Prof. A.N. Songorwa at SUA (Appendices 2, 3 and 4). Wherever possible the data collected were recorded sector-wise.

3.2.3 Methods

3.2.3.1 Primary data collection

A structured questionnaire with both open and close-ended questions (Appendix 5) was administered to SGR Sector Wardens. The questions were designed to gather their views on trophy hunting, its contribution to conservation and whether there were other

challenges to study species besides trophy hunting. Because of sex biasness in employees in the Wildlife Division (MNRT, 2007) all eight respondents were males.

Also, one field trip with staff in Ilonga Sector was made on 19 January 2012, i.e., during trophy hunting season. This was done for the purpose of experiencing the search effort for suitable animals, observing how trophy measurements were taken, how records were kept and how they could be used in the study for computational analysis, i.e., whether to use body weight, body length, horn size or spoor diameter. Unfortunately, only one animal was shot that day (Plate 1).

Plate 1: A freshly shot Lichtenstein's hartebeest (*Alcelaphus lichtensteini*) in SGR (Photo by M. Manyenga)

3.2.3.2 Secondary data collection

Secondary data, which were the main data for this study, were collected from data sheets kept at each sector of SGR and at the Reserve's office in Dar es Salaam. From the data sheets the researcher obtained records of individual hunted animals. The data sheets were filled using scores as per Safari Club International's (SCI) standards (Fig. 3, 4, 5, 6 and 7) which rank the biggest tusks, horns, antlers, skulls and bodies of hunted animals. Each year hunters whose trophies score the best are awarded.

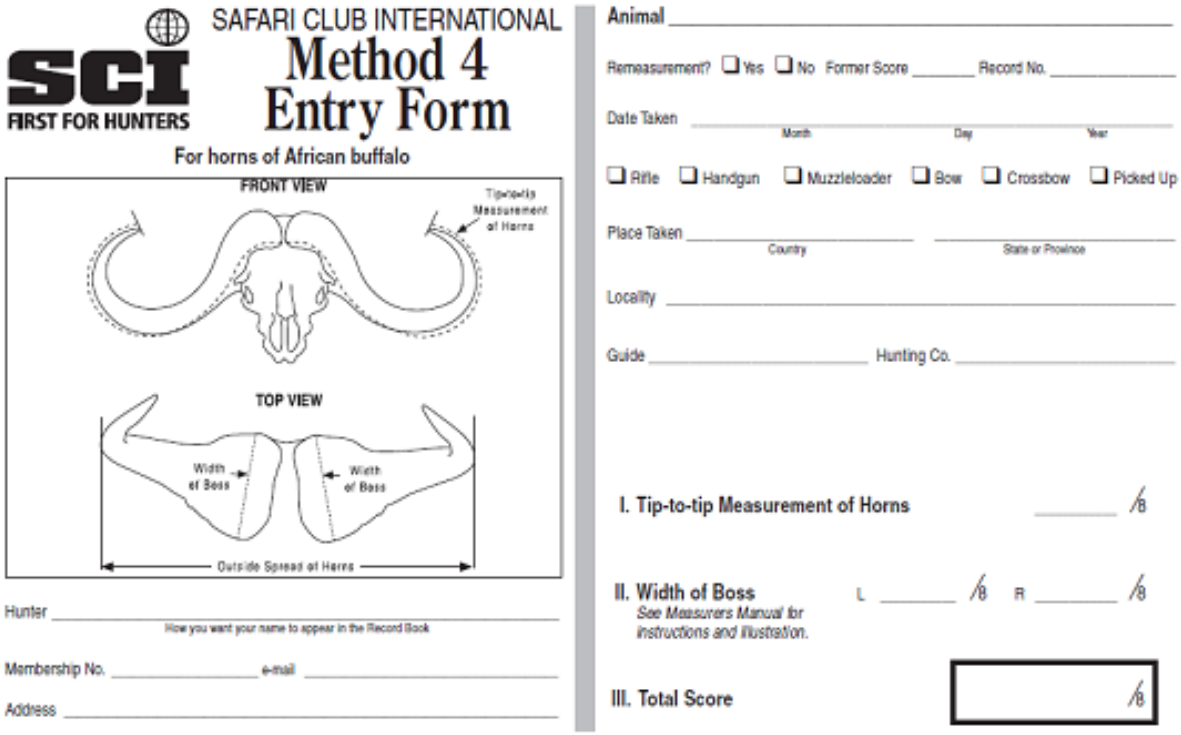

Figure 3: SCI's method for taking buffalo trophy measurements

***Source*: MNRT (2011)**

Normally a thread can be used then the length is converted into metric measurements as shown in Fig. 3 for tip-to-tip horn measurement. For boss width, top view is used (Fig.3). According to Jonker (2003), the fine buffalo trophy is the one with the smallest gap between left and right horns.

For elephants general measurements are recorded though most hunters are interested in ivory whose weights are measured as described in Fig. 4. Other measurements include length of the ivory and foot circumference (right front) which is recorded even if the hunted elephant is tusk-less.

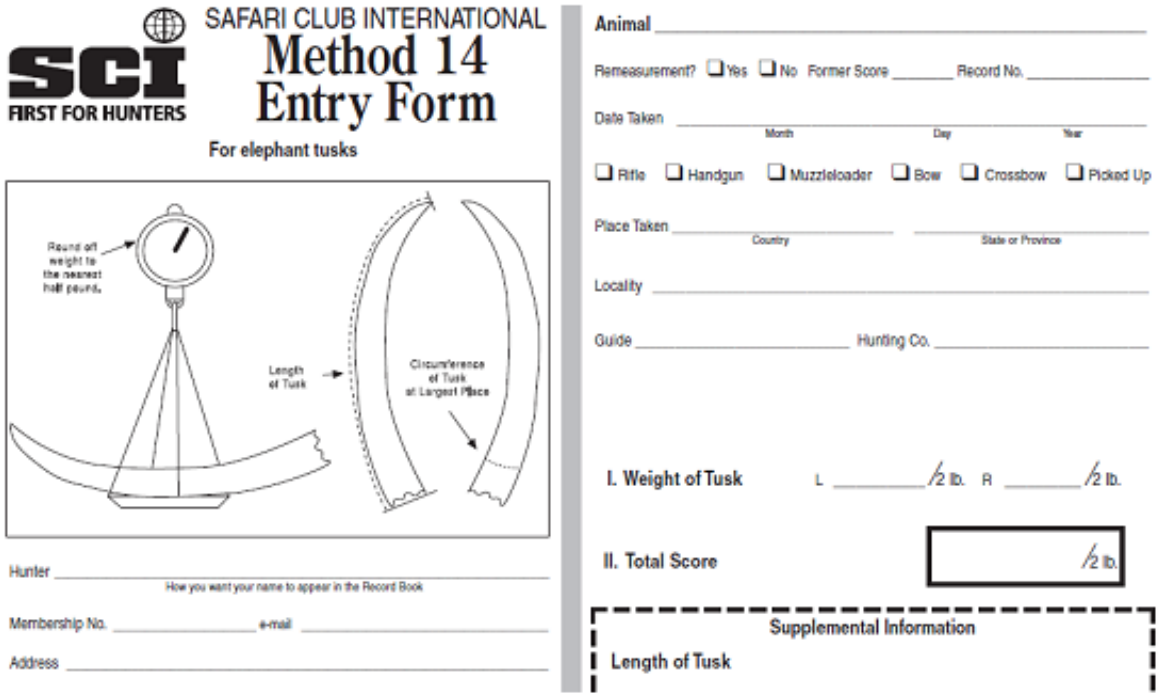

Figure 4: SCI's method for elephant hunting record

***Source*: MNRT (2011)**

For antelopes with simple horns like impala, bushbuck (*Tragelophus scriptus*) and dikdik (*Madoqua kirkii*) normally horn length and horn circumference at the base are recorded (Fig. 5).

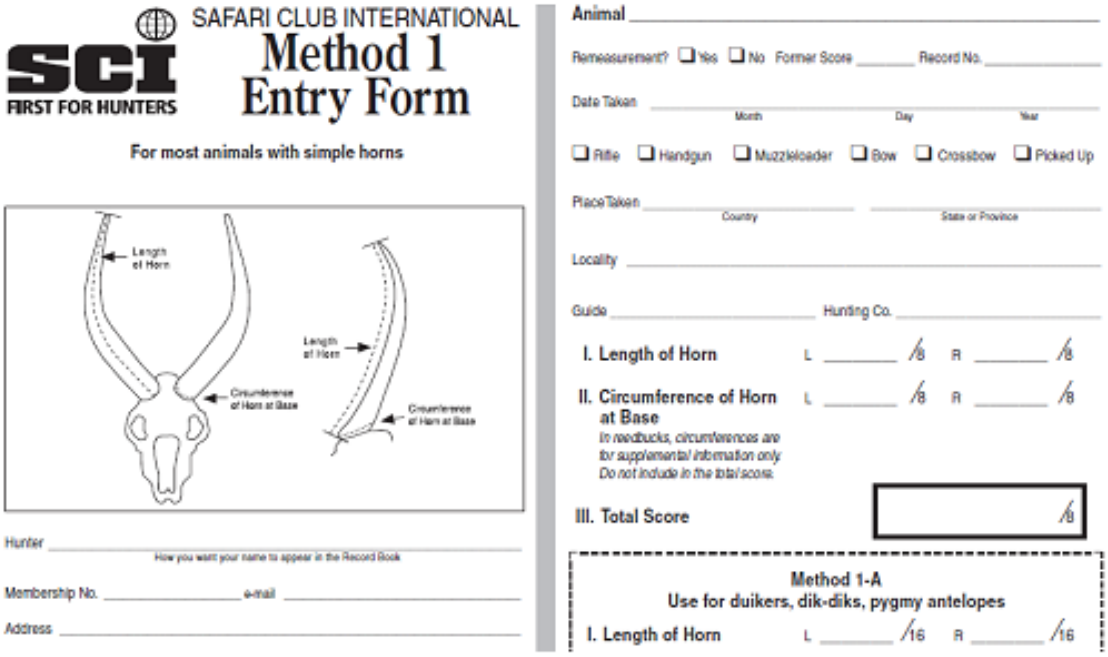

Figure 5: SCI's method for impala hunting record

***Source*: MNRT (2011)**

For greater kudu horn width is taken at the base but, unlike the antelopes with simple horns, spiral length is measured by rotating the measure around the horn spirals (Fig. 6).

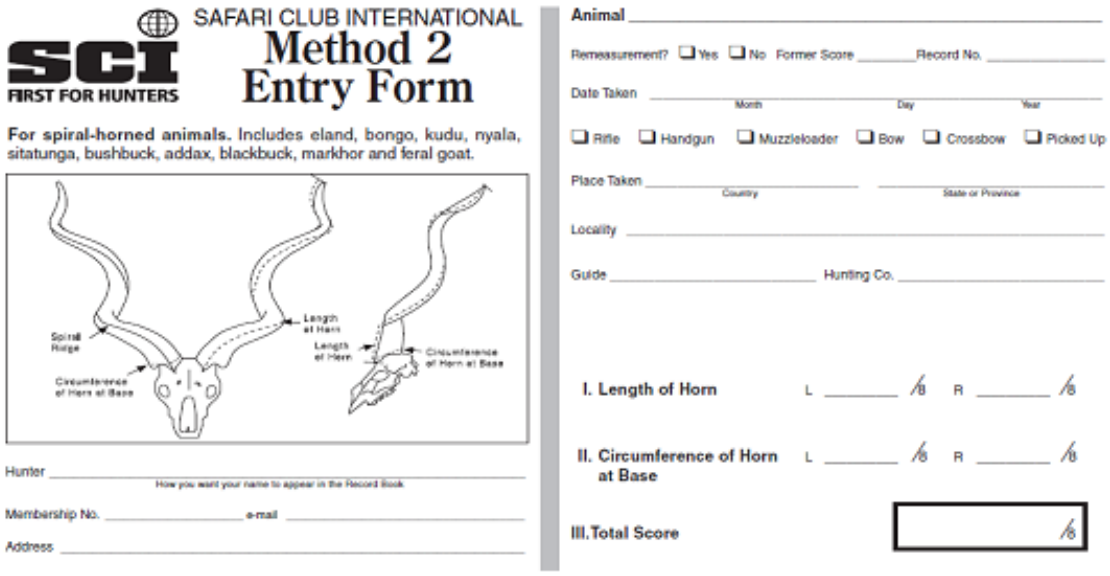

Figure 6: SCI's method for greater kudu hunting record

***Source*: MNRT (2011)**

For large carnivores including lion and leopard, important parameters include skull length and width (Fig. 7). Also, pad length and width are measured though during hunting nose color may be used to estimate age (for lions).

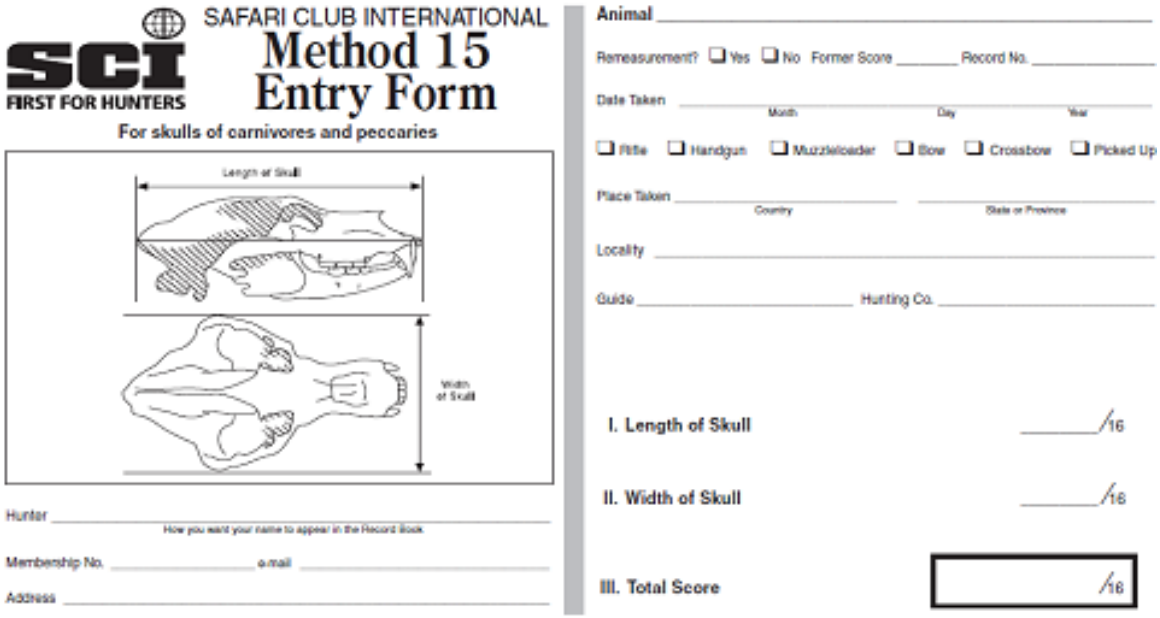

Figure 7: SCI's method for skull hunting record

***Source*: MNRT (2011)**

Furthermore, the data sheets containing trophy hunting records and trophy measurements are used by CITES to issue export permits. The numbers hunted were used to project the revenue generated and trophy measurements were used to determine trophy quality and trends.

3.2.4 Data analysis

Quantitative secondary data obtained were sorted, compiled into one spreadsheet and summarized using Excel computer program Version 1997-2003 to get them into a format suitable for descriptive statistical analysis (means, frequencies, graphs and bar charts). Pearson correlation test (r) was carried out using R-computer program to assess the

relationship for various trophy measurements. One Way ANOVA test was carried out using Statistical Package for Social Sciences (SPSS) program Version 19 to test if there were significant differences between annual means of trophy measurements. Where there were differences a Tukey's post hoc pair-wise comparison test was performed to show which year's annual means of parameters recorded were different.

3.3.5 Limitations to the study

The study encountered several problems, including missing data for some of the trophy measurements, which made it difficult to make comparisons between different measures. Also, some of the sheets were completely not filled while others were torn away. Another limitation was that some of the permits were issued by CITES Arusha office, which could lead to underestimated projections of the number and or revenues generated from trophy hunting. Delayed proposal approval by Senate resulted into delayed- release of research funds by BTC coupled with delayed research permit by Wildlife Division. This led to a mismatch of the data collection period with that of trophy hunting; hence the researcher could not meet and interview camp managers and/or professional hunters (PHs). Another limitation (a minor one) was that the database at the Wildlife Division was being handled by one person who had many other responsibilities, which necessitated the researcher to make many visits to Dar es Salaam without being able to access the data set. This was felt more due to small amount of research funds, but thanks to OUTRRAIN project for covering the extra expenses. Since SGR is important for elephant conservation (MNRT, 2005), much of the poaching data were mainly those of elephants. Lastly, the secrecy surrounding the trophy hunting business limited freedom in information sharing.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Perceptions About Trophy Hunting

All questionnaire respondents (N=8) believed that trophy hunting was good. About 50.0% of them thought it was important as a source of foreign currency and 33.0% believed it was useful as a population control measure and, to some degree, a source of employment and multiplier effects. According to MNRT (2003), hunting contributes about 90.0% of the reserve's revenue. It was banned for nine years (1973-1982) which adversely affected government finances since it worked on revolving fund fashion. The effects included decline in staff morale and infrastructure (MNRT, 2003), highlighting the importance of trophy hunting in conservation.

On the other hand it was thought that trophy hunting is causing selective pressure on hunted populations (75.0% of respondents) and is leading to behavioral change. For example, greater kudus were reported to have changed their feeding behavior by feeding at night. Also, they run away once they notice the presence of human beings. It was reported also that buffaloes and elephants have become more aggressive. Some of the Sector Wardens were not aware of the hunting quotas, even for their own administrative areas. They were skeptical if the quotas were properly set. Furthermore, 60.0% of the respondents blamed the secrecy surrounding trophy hunting and acknowledged their inability to enforce laws regulating the industry.

Like other game reserves in Tanzania, SGR's performance was affected by lack of vehicles and fuel for activities like monitoring trophy hunting. The Sector Wardens relied on the hunting camps' vehicles to pick and drop scouts supervising the hunting. Also, at all sectors it was mentioned that human resource was not enough since game scouts from

other sectors especially the new ones (who have a good command of English language) are sent to Matambwe for three months to supervise photo tourism in the four blocks. They, therefore, doubted the hunting industry's sustainability especially if it is not properly supervised.

4.2 Number of Animals Hunted

For the period between 2001 and 2010 at least 10 842 individual animals from the study species (Table 2) were hunted, an average of 1 084 a year.

Table 2: Animals of the study species hunted in SGR (2001 – 2010)

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
	Selous ecosystem								SGR		
Buffalo	773	643	788	801	857	490	616	399	189	191	5 747
Elephant	43	19	55	45	52	40	47	40	50	54	445
Impala	363	322	317	374	388	289	310	247	189	81	2 880
Greater Kudu	48	30	48	35	54	29	33	22	29	15	343
Leopard	89	71	94	82	120	102	101	72	72	38	841
Lion	83	81	78	65	64	50	51	62	35	17	586
Total	**1 399**	**1 166**	**1 380**	**1 402**	**1 535**	**1 000**	**1 158**	**842**	**564**	**396**	**10 842**

Note: Data from 2006 to 2010 may be incomplete due to missing of some hunting forms/reports

Four of the five study species (buffalo, leopard, greater kudu and lion) were the species most preferred by hunters visiting Africa (Lindsey *et al.*, 2012). The figures in Table 2 indicate that, among the study species, buffalo and impala are the most hunted in SGR contributing about 80% to the total number. Buffalo alone contributed over 53.0% followed by impala (27.0%). Leopard on the other hand contributed 8.0% while lion, greater kudu and elephant were the least-contributing species (5.0%, 4.0% and 3.0% respectively). According to an experienced game scout, buffalo (Plate 2) is considered the most challenging species to hunt, making a dream of most hunters hunting in SGR

(Kulunge, 2012 pers. communication). Findings suggest that the best buffalo trophies at the destination was the paramount reason for coming to hunt there (Lindsey *et al.*, 2012).

In 2009 and 2010, the Tanzanian government changed the law and regulations guiding trophy hunting (URT, 2009; URT, 2010). Earlier it was claimed that, despite the extensive and more natural hunting, game fees were cheaper in Tanzania compared to other countries. Therefore, more animals are shot in Tanzania, mainly in SGR since it is the most important destination for trophy hunting (Baldus and Caudwell, 2005). Sometimes buffaloes and impalas are hunted either for bait or for food in hunting camps so long as they are on the permits (Pers. observation, 2009) hence making their numbers on the list of hunted animals to be bigger than those of the other study species.

Plate 2: A hunter, observer and guides rejoicing after a successful buffalo hunt in SGR in 2008 (Photo by M. Kyando)

4.3 Utilization of Allocated Quotas

4.3.1 Perceptions about utilizing the allocated quotas from questionnaire survey

Regarding questions on underutilizing or overutilizing quotas (Table 1, Appendices 2, 3 and 4) none of the Sector Wardens knew about the actual quotas. One went further to state that, 'the quotas are for filling in forms and not for hunting'. Therefore, it was not easy for them to comment anything. Instead they recommended consultation with CITES office in Dar es Salaam.

However, with regard to the quotas the following suggestions were made. The first was to set quotas based on scientific data, making use of data collected by field personnel, including poaching data. Secondly, it was highly recommended that copies of the quotas be sent to the respective sectors in time so that they can be in a position to enforce the law properly. Also, it was proposed that fines to companies contravening the law, including overutilizing quotas, should be increased.

4.3.2 Results from secondary data

With regard to the indicative quotas set by Wildlife Division, results of this study indicate that the quotas of all study species have not been fully utilized except for buffalo in years 2004 and 2005 where they were over utilized (Table 3).

Table 3: Levels of quota utilized in SGR (2001- 2010)

Species	Quota	Buffalo	Elephant	Greater kudu	Impala	Leopard	Lion	Total
2001	AQ	828	50	130	488	130	167	1 843
	UQ	773	43	48	363	89	83	1 399
2002	AQ	850	50	127	494	133	164	1 868
	UQ	643	19	30	322	71	81	1 166
2003	AQ	888	100	127	478	154	159	1 906
	UQ	788	55	48	317	94	78	1 380
2004	AQ	686	100	78	357	91	105	1 417
	UQ	801	45	35	374	82	65	1 402
2005	AQ	743	100	105	439	152	133	1 672
	UQ	857	52	54	388	120	64	1 535
2006	AQ	1075	100	172	705	172	172	2 396
	UQ	490	40	29	289	102	50	1 000
2007	AQ	1075	200	172	645	172	172	2 336
	UQ	616	47	33	310	101	51	1 158
2008	AQ	1075	200	172	645	172	172	2 336
	UQ	399	40	22	247	72	62	842
2009	AQ	1075	200	172	645	172	172	2 336
	UQ	189	50	29	189	72	35	564
2010	AQ	1075	200	172	645	172	172	2 336
	UQ	191	54	15	81	38	17	396

Note: AQ= Allocated quota; UQ = Utilized Quota

It has been reported that populations of species which were most shot experienced sharp declines compared to those less short (Brink, 2010). For the period of the current study (2001-2010) the number of hunted animals peaked in 2005 (Table 3 and Fig. 8). The drop afterwards is thought to be associated with the economic recession in western countries in the second half of the last decade though some authors are of the opinion that negative publicity could be responsible (Brink, 2010) and others highlight the decline in trophy quality (Songorwa and du Toit, 2007).

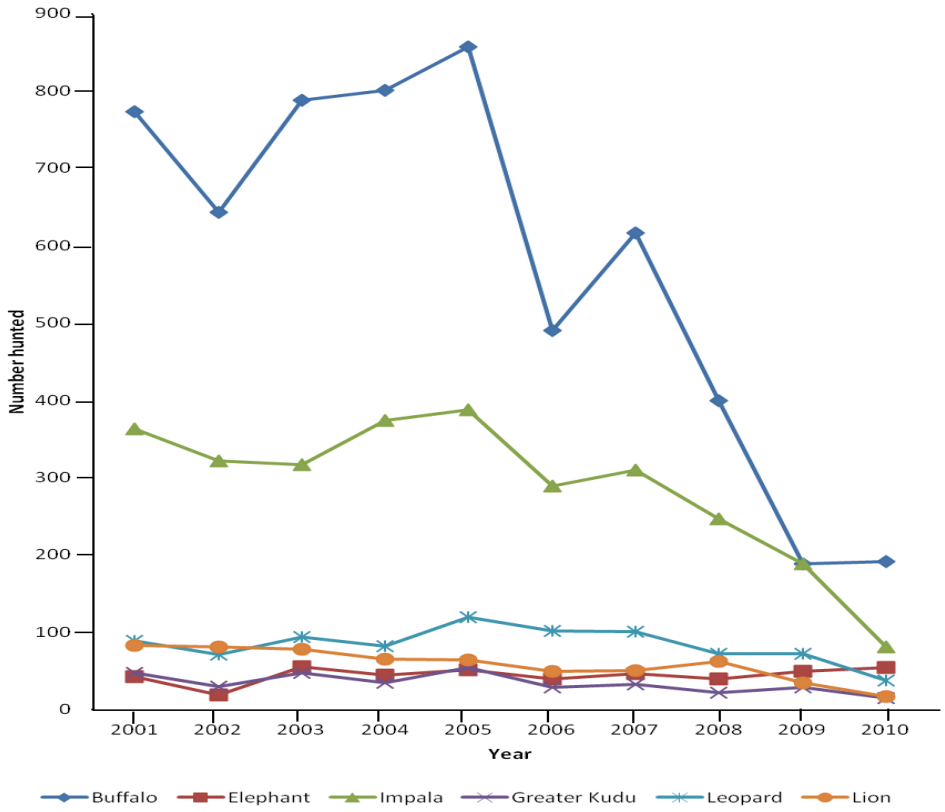

Figure 8: Trends of quota utilization in SGR (2001 – 2010)

Though buffalo was the most preferred species (Lindsey *et al*., 2006) and, on average, each hunter shot 1.5 (Baldus and Caudwell, 2005), its entire quota for SGR was not fully utilized except years 2004 and 2005 which were exceeded as shown in Table 4 and Fig. 9. The reason could be the unproportionate increase of the allocated quota (AQ) starting from year 2006 (Table 4).

Table 4: Buffalo population and hunting records in SGR (2001-2010)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Estimated population	-	280 701	-	-	-	113 463	-	-	41 493	-
Allocated Quota	828	850	888	686	743	1 075	1 075	1 075	1 075	1 075
Utilized Quota	773	643	788	801	857	490	616	399	189	191
% of quota utilized	93.36	75.65	88.74	116.76	115.34	45.58	57.30	37.12	17.58	17.77

Note: Set qoutas for some hunting blocks in 2002, 2003, 2004 and 2005 were missing (Appendix 2) for 2006-2010 minimum allowed quota was used i.e 25 buffaloes from each of the 43 hunting blocks

Results in Table 4 and Fig. 9 show that buffalo quotas were overutilized in 2004 and 2005. But, this might have been due to missing quotas for 14 blocks in 2004 and five blocks in 2005. Therefore, it is most likely that buffalo quota was used most in 2001 (93.4%) followed by 2003 (88.7%). On the other hand, based on the estimated data, the population of buffalo in SGR could be declining (Table 4). There was a drop of 71 970 buffaloes in four years (2006 - 2009) and a drop of 239 208 buffaloes in seven years (2002-2009).

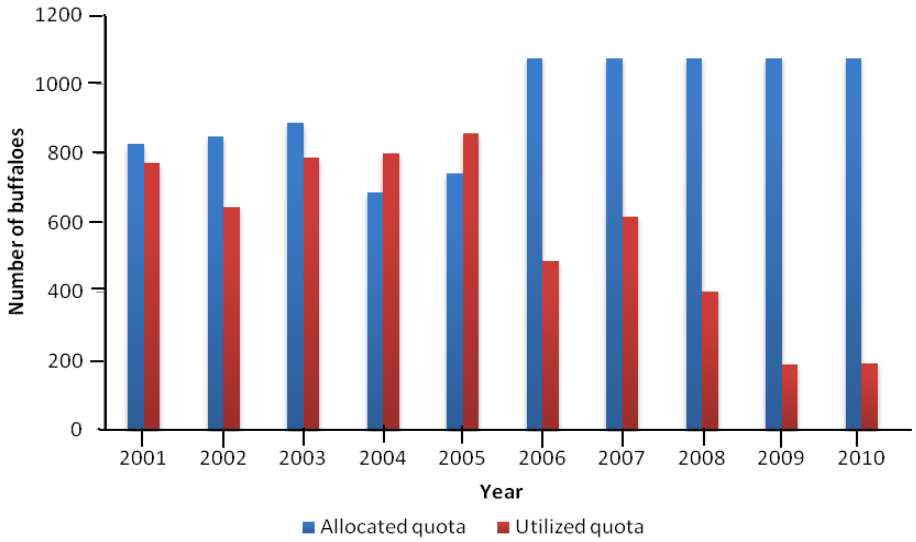

Figure 9: Allocated quotas and numbers of shot buffaloes (2001-2010)

SGR remains an important source of trophies exported from Tanzania. For example, though there are no annual quotas for elephants, the allowed number for export varied from 50 (in 2001 to 2002) and increased to 100 (from 2003 to 2006) and was increased to 200 from 2008 to 2010 (Hochi, R. pers. communication 2011). SGR alone has been contributing highly to the export by nearly half of the national offtake (Table 5), though its elephant population showed a decline throughout the study period.

Table 5: Elephant population and hunting records in SGR (2001-2010)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Estimated population (SGR)	-	75 781	-	-	-	70 000	-	-	38 848	-
Allowed # for export (TZ)	50	50	100	100	100	100	200	200	200	200
Animals hunted (SGR)	43	19	55	45	52	40	47	40	50	54

The minimum offtake recorded was 19 in 2002 though there has been no clear pattern in the offtake (Fig. 10).

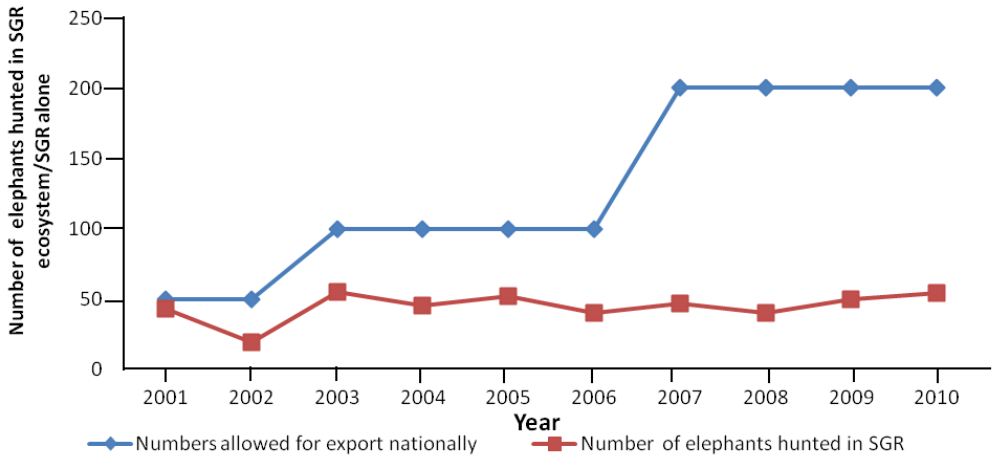

Figure 10: National export quota for elephant trophies vs the number hunted in Selous Ecosystem/SGR

For impala the number of shot individuals peaked in 2005 whereby 388 individual animals were shot utilizing 88.0% of the alocated quota (439), though quotas were over utilized in 2004 to 104.8% (Table 6 and Fig. 11).

Table 6: Impala population and hunting records in SGR (2001-2010)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Estimated population	-	54 130	-	-	-	25 543	-	-	46 613	-
Allocated Quota	488	494	478	357	439	654	645	645	645	645
Animals hunted	363	322	317	374	388	289	310	247	189	81
% of quota utilized	74.39	65.18	66.32	104.76	88.38	44.19	48.06	38.29	29.30	12.56

Note: Allocated qoutas for some hunting blocks in 2004 and 2005 were missing (Appendix 3) for 2006-2010 minimum allowed quota was used i.e 15 impalas*43 hunting blocks

Across the study period the allocated quota for impala was fully utilized only in 2004 (Fig. 11). Moreover, despite impala being available across SGR, their utilized quota dropped consecutively from 2008 to 2010 suggesting that perhaps there are no enough clients looking for impala trophies or that the demand for trophies from other species which indirectly affects the number of impalas hunted has dropped too. It could also suggest that there are no more good trophy impalas, which could mean population decline. However, the quota was unproportionately increased since the year 2006.

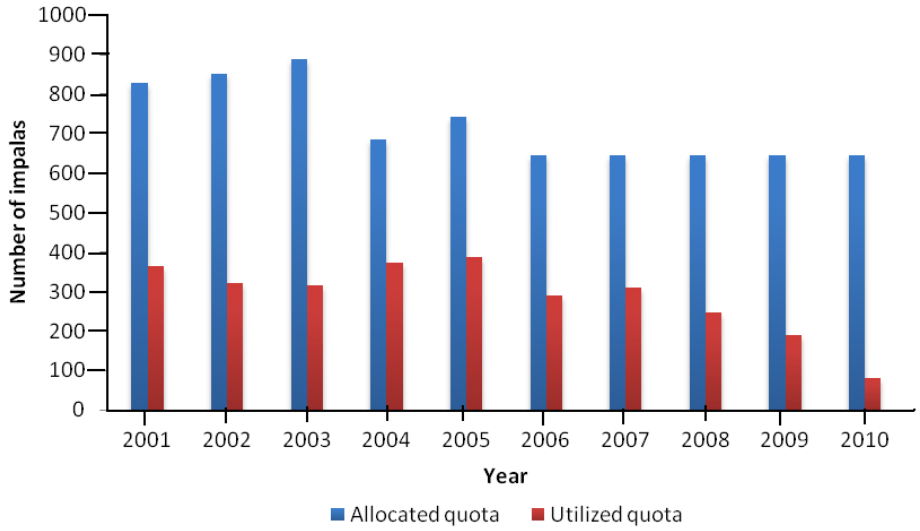

Figure 11: Allocated and utilized quotas for impala in SGR (2001-2010)

The trend in quota utilization for greater kudu (Table 7 and Fig. 9) had no sharp changes compared to buffalo and impala (Fig. 8, Fig 9 and Fig. 11). However, as observed in impala, the utilized quota peaked in 2005 whereby a total of 54 animals (51.4%) were hunted (the utilized quota could be less than 50.0% because set quotas for five blocks were not recorded). The same missing pattern was also observed in records for 2004 (Appendix 2) whose shot number might be more compared to those shot in 2005. Likewise for the poorly kept records for years from 2006 to 2010. The unproportionate increase of the allocated quota in 2005 could have also affected the trend.

Table 7: Greater kudu population and hunting data in SGR (2001-2010)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Estimated population	1 344	_	_	_	_	_	_	_	_	_
Allocated Quota	130	127	127	78	105	172	172	172	172	172
Animals hunted	48	30	48	35	54	29	33	22	29	15
% of quota utilized	36.92	23.62	37.80	44.87	51.43	16.86	19.19	12.79	16.86	8.72

Note: Allocated qoutas for some hunting blocks in 2003, 2004 and 2005 were missing (Appendix 3) for 2006-2010 minimum allowed quota was used i.e 4 greater kudu*43 hunting blocks

Though Lindsey *et al*. (2012) argue that greater kudu is among the top five preffered species by both experienced and inexperienced hunters in Eastern and Southern Africa, the number of hunted animals remained small across the study period (Fig. 12).

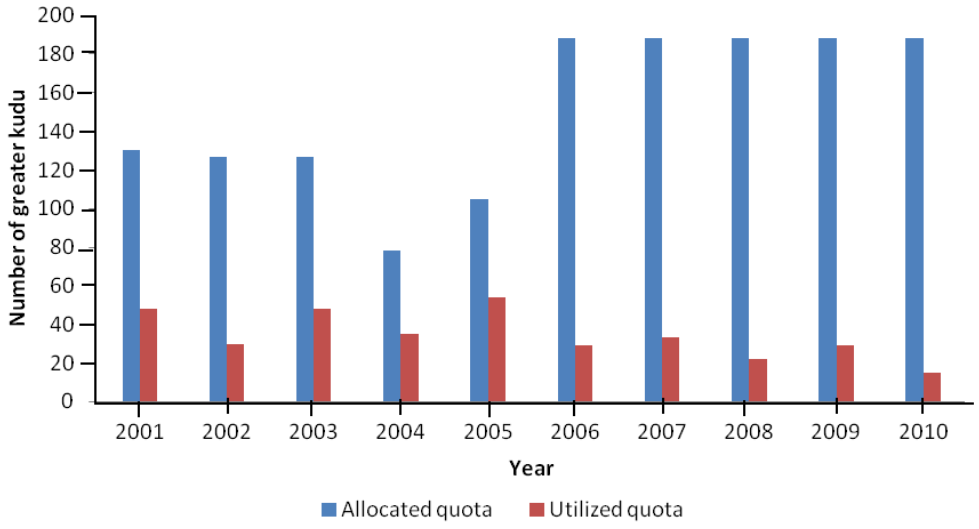

Figure 12: Allocated and utilized quotas for greater kudu in SGR (2001-2010)

Like in the other species in SGR, leopard quota has never been used up. For the entire study period, the utilized qouta was highest in 2004 with 90.1% of the allocated quota being utilized. Thereafter the number hunted (Table 8; Fig. 13) continued to fall. Even at global level hardly are leopard quotas fully utilized. For example, in 1999, CITES set a quota of 1 635 leopards to be hunted but only 878 were hunted (Macdonald and Norris, 2005). Brink (2010) argues that leopard quotas should be minimized to only two animals per block in SGR, which means only about 86 for the whole reserve.

Table 8: Leopard hunting records in SGR (2001-2010)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Estimated population	-	-	-	-	-	-	-	-	-	-
Allocated quota	130	133	154	91	152	172	172	172	172	172
Animals hunted	89	71	94	82	120	102	101	72	72	38
% of quota utilized	68.46	53.38	61.04	90.11	78.95	59.30	58.72	41.86	41.86	22.09

Note: Allocated qoutas for some hunting blocks in 2004 and 2005 were missing (Appendix 4) for 2006-2010 minimum allowed quota was used i.e 4 leoprads*43 hunting blocks

Like for the other species allowed quotas were never fully utilized (Fig 13). This calls for a review of how the quotas are set to make them more realistic.

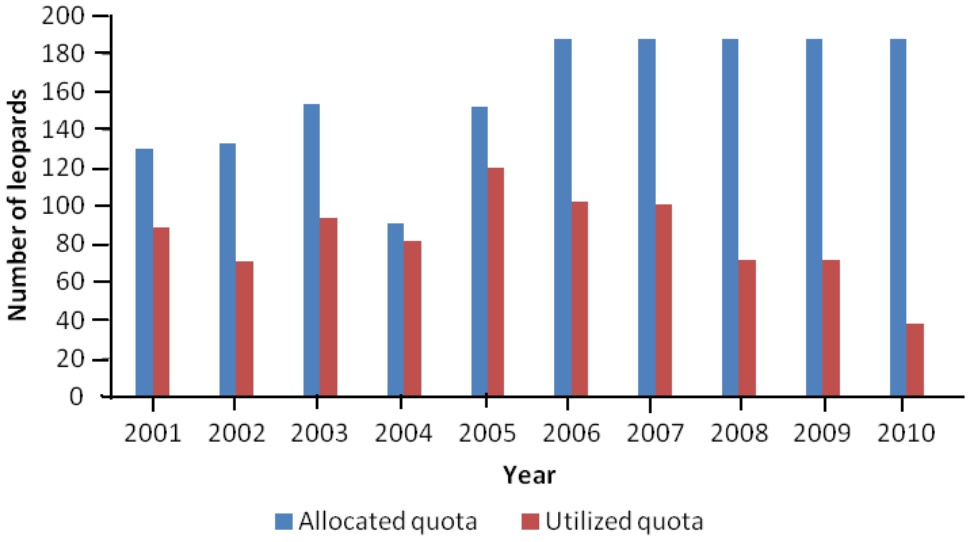

Figure 13: Allocated and utilized quotas for leopard in SGR (2001- 2010)

SGR is known to be one of the six lion strongholds and has the largest lion population in the world; the other three found in Tanzania are Serengeti (Serengeti National Park and Ngorongoro Conservation Area), Maasai steppe (Tarangire National Park, Lake Manyara National Park and adjacent areas), and Western Tanzania (Ruaha National Park, Katavi National Park and adjacent areas) (Packer *et al.*, 2011). However, only about half of the allocated annual quotas were used from 2001 to 2005 and the highest utilized quota was in 2004 by 61.9% (Table 9). Most of the lions are hunted in Northen Sector (Matambwe),

North-eastern Sector (Kingupira), Western Sector (Ilonga) and North-western Sector (Msolwa).

Table 9: Lion population and hunting records in SGR (2001-2010)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Estimated population	-	-	-	-	-	-	-	-	-	-
Allocated quota	167	164	159	105	133	172	172	140	172	172
Animals hunted	83	81	78	65	64	50	51	62	35	17
% of quota utilized	49.70	49.39	49.06	61.90	48.12	29.07	29.65	44.29	20.35	9.88

Note: Allocated qoutas for some hunting blocks in 2004 and 2005 were missing (Appendix 4) for 2006-2010 minimum allowed quota was used i.e 4 lions*43 hunting blocks

It has been suggested that, though it has never been fully utilized, the quota for lions (Table 9 and Fig. 14) should be reduced to one lion per block for the whole SGR (Brink, 2010; Packer *et al.*, 2011), which would mean around 43 lions per year. On average 58.6 animals were hunted per year during the study period. The suggested quota of one lion was based on the lions, which means harvesting less than 10% of the male population, which is thought to be sustainable.

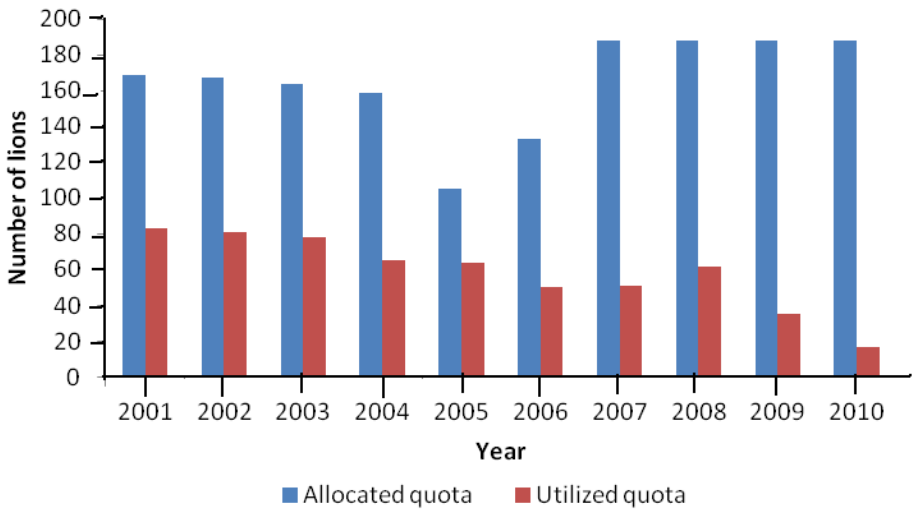

Figure 14: Allocated and utilized quotas for lions in SGR (2001-2010)

4.4 Importance of Each Species in Generating Revenue

Throughout the study period trophy hunting continued to be an important source of foreign currency through block fees, permit fees, game fees, conservation fees, trophy handling fees and observer fees (MNRT, 2005). All hunted animals of the six study species were sold based on the set fees (Table 1). However, the species differed not only in number of animals hunted (Table 2) but also in the amount of money they brought in (Table 10 and Fig. 15). The most important species in terms of revenue generation were buffalo, elephant and leopard, which together contributed 78.3% of the total game fees collected (buffalo alone contributing 40.3%, elephant 21.9%) and leopard 16.1%). Lion contributed 11.3% followed by impala and greater kudu, which contributed the least.

Table 10: Revenues (in USD) collected through game fees (2001-2010)

Year	Buffalo	Elephant	Impala	Greater kudu	Leopard	Lion	Total	% Contribution to total
2001	556 560	172 000	87 120	56 160	178 000	166 000	1 215 840	11.24
2002	462 960	76 000	77 280	35 100	142 000	162 000	955 340	8.83
2003	567 360	220 000	76 080	56 160	188 000	156 000	1 263 600	11.68
2004	576 720	180 000	89 760	40 950	164 000	130 000	1 181 430	10.92
2005	617 040	208 000	93 120	63 180	240 000	128 000	1 349 340	12.47
2006	352 800	160 000	69 360	33 930	204 000	100 000	920 090	8.51
2007	443 520	188 000	74 400	38 610	202 000	102 000	1 048 530	9.69
2008	287 280	160 000	59 280	25 740	144 000	124 000	800 300	7.40
2009	136 080	200 000	45 360	33 930	144 000	70 000	629 370	5.82
2010	362 900	810 000	31 590	33 000	133 000	83 300	1 453 790	13.44
Total	**4 363 220**	**2 374 000**	**703 350**	**416 760**	**1 739 000**	**1 221 300**	**10 817 630**	**100.00**

Previous studies (Baldus and Caudwell, 2005) report the top three species in terms of revenue generation as buffalo, lion and leopard. In the current study things were a bit different as elephant was found to be the second important (contributing 22.0% of the

revenue collected over the study period) and leopard was third (16.1%) (Table 10 and Fig. 15).

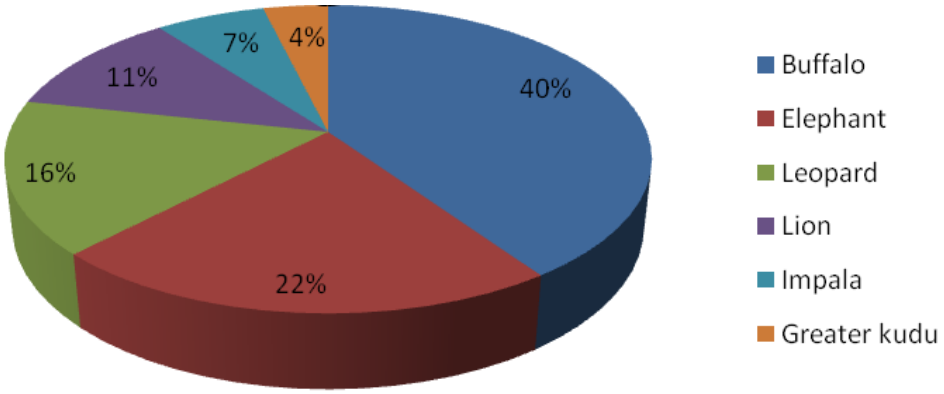

Figure 15: Contribution (in %) of study species to total revenues generated in SGR (2001-2010)

The changes in annual revenues accruing from greater kudu, impala and lions were not as abrupt as in buffalo (Fig 16). Changes in game fee structure (Table 1) have long been pointed out to be affecting the revenues generated and suggestions on changing marketing strategies have been given by various authors (Baldus and Caudwell, 2005; Leader-Williams, 2009). Recently the government of Tanzania changed the game fees for trophy hunting (URT, 2010; Table 1). These changes might have caused the increase in revenue collection notably in elephant and buffalo. For all species except buffalo and elephant revenue collection dropped (Fig. 16). According to Lindsey *et al.* (2006), elephant is not among the top five preferred species. Therefore, the big increase in revenue accrued from elephant hunting is thought to be caused by the increase in game fees in 2010 (Table 1).

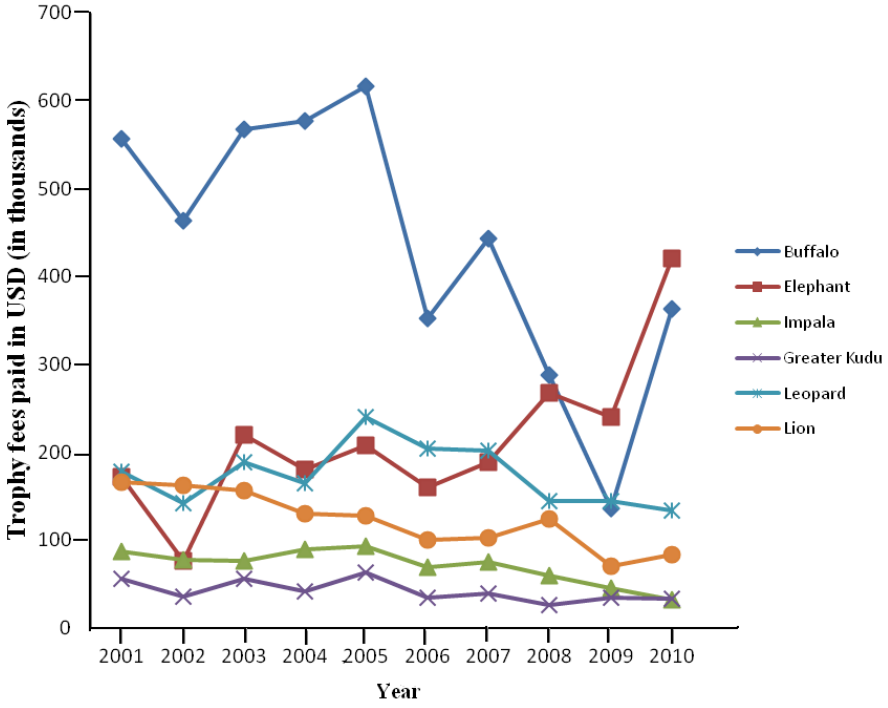

Figure 16: Revenues generated from game fees in SGR (2001-2010)

4.5 Trends in Trophy Quality (2001-2010)

SGR has been reported and acknowledged to have better records of trophy hunting compared to other game reserves due to long international cooperation (Brink, 2010). This study highlights the existing weakness in keeping records. For example out of 5747 buffaloes reported to have been hunted from 2001 to 2010 only 3 519 (61.2%) had been somehow recorded. Furthermore, only 3 211 (55.9%) were recorded in a way that could be used for meaningful analysis. Many record sheets had missing values or had values too far from reality. For example, boss width of 80 inches.

4.5.1 Correlations between various measurements of trophies

There are general patterns of relationships between different parameters in mammals. For example, the relationship between age and tusk weight in elephants (Douglas-Hamilton, 2003). In the current study various parameters were tested for relationships as shown in Table 11.

Table 11: Correlations between various measurements of trophies (2001-2010)

Species	Parameters compared		Pearson correlation (*r*)	Significance (P-value)
Buffalo	Horn (tip-to- tip)	Boss width	0.325	0.000
Elephant	Tusk weight	Tusk circumference	0.139	0.137
	Tusk length	Tusk weight	0.228	0.017
	Tusk length	Tusk circumference	0.322	0.001
Impala	Horn length	Horn circumference	0.121	0.000
Greater kudu	Horn length	Horn circumference	0.129	0.069
	Skull length	Skull width	0.314	0.000
Leopard	Pad length	Pad width	0.300	0.000
	Skull length	Skull width	0.372	0.000
Lion	Pad length	Pad width	0.530	0.000

Results from Pearson test highlight a positive relationship between parameters measured. However, only two of the study species, i.e. elephant and greater kudu, had strong relationships (p-value > 0.05). For the other four species (buffalo, impala, leopard and lion) relationships were not strong (p-values were < 0.05). One reason could be inaccuracies in taking and recording measurements. For example, it is doubtful, if a buffalo can have left boss width of 18 inches and right boss width of just six inches; or a lion with a pad length of eight inches and pad width of one and a half inches.

4.5.2 Trends in quality of buffalo trophies

Tip-to-tip horn measurements show the best trophy to have been gotten in 2002 with a mean of 70.15 ±8.74 inches. There was a significant difference when compared to means of 2001, 2004, 2005, 2006, 2007, 2008, 2009 and 2010 (Table 12). Furthermore, there was a consecutive decline in annual means for horn length from 2008 to 2010 (68.98 ± 8.48, 67.26 ±10.62 and 65.56 ±11.76 inches respectively). Boss width showed no significant difference except for the year 2002 with a mean of 14.05 ±1.43 inches for left boss and 14.04 ± 1.44 inches for the right boss. According to Songorwa and du Toit (2007), tip-to-

tip horn measurement may be longer but it is not what is desired by trophy hunters. Sometimes the horn length (tip-to-tip) in buffaloes is reduced as a result of stiff battles with other males for mates during estrus cycles (Macdonald and Norris, 2005) hence this may not be a good indicator of trophy quality.

Table 12: Annual means of buffalo trophy measurements (2001-2010)

Year	Tip-to-tip	Left boss width	Right boss width	Average boss width
2001	66.72^{c}	11.48^{bc}	11.51^{b}	11.46
2002	70.15^{a}	14.05^{a}	14.04^{a}	11.54
2003	69.26^{ab}	11.64^{c}	11.67^{b}	11.65
2004	68.38^{b}	11.61^{bc}	11.63^{b}	11.61
2005	66.72^{bc}	11.22^{bc}	11.23^{b}	11.22
2006	67.31^{c}	11.09^{bc}	11.10^{b}	11.09
2007	65.67^{cd}	11.69^{b}	11.50^{b}	11.60
2008	68.92^{bc}	11.45^{bc}	11.42^{b}	11.43
2009	67.26^{cd}	11.16^{bc}	11.20^{b}	11.18
2010	65.56^{c}	11.32^{bc}	11.31^{b}	11.31

Note: Means in the same column with different superscripts are significantly different at P=0.05; measurements were in inches

4.5.3 Trends in quality of elephant trophies

There was no clear pattern of trophy quality in elephants. A periodic increase and decline was observed, for example, in mean weight of tusks over the years (Table 13). Though generally there was a slight increase in annual means of tusk weight and circumference in 2010, the increases were not statistically significant. This might have resulted from the negative reports about trophy hunting in Tanzania (Baldus and Caudwell, 2005) including in newspapers (Brink, 2010). These might have forced hunters to look for better quality trophies elsewhere. Another possible reason is the coming into effect of the new Wildlife

Conservation Act in 2009 and regulations for trophy hunting in 2010, which increased not only game fees but also fines as well.

According to Baldus and Caudwell (2005), the criteria for Selous Conservation Programme (SCP) set in 1999 for weight of tusk was between 13.6 kg and 20 kg. An extra fee would be charged for tusks weighing more than 20 kg and on the other hand penalty would be charged for tusks weighing less than 13.6 kg. Results of the current study show that, across the study period, the lowest annual tusk weight was 15.92 kg for year 2003 and only annual means of 2010 met the upper limit level (20.42 kg). The overall mean of all recorded tusk weights (2001-2010) was 18.56 kg. This is not surprising because the criterion has been reduced from 20 kg to 18 kg, indicating difficulties in getting elephants with tusks weighing 20 kg, though the criterion on tusk length remained the same i.e 160 cm (URT, 2010). Significant difference in tusk length was observed whereby records of 2001 (79.28 kg) were the best followed by those of 2003 (71.96 kg).

Table 13: Annual means of elephant trophy measurements (2001-2010)

Year	Average tusk weight (kg)	Average tusk circum-ference (inches)	Average tusk length (inches)	Foot circum-ference right front (inches)
2001	17.00 [a]	14.85 [a]	79.28[a]	48.12 [a]
2002	18.02 [a]	14.81 [a]	66.54[b]	43.07 [a]
2003	15.92 [a]	14.56 [a]	71.96[ab]	44.79 [a]
2005	17.19 [a]	14.91 [a]	67.35 [b]	45.46 [a]
2006	18.29 [a]	15.14 [a]	67.65 [b]	46.95 [a]
2007	18.06 [a]	14.80 [a]	66.11 [b]	46.73 [a]
2008	18.74 [a]	15.55 [a]	66.47 [b]	45.79 [a]
2009	19.27 [a]	15.03 [a]	65.81 [b]	45.34 [a]
2010	20.42 [a]	15.68 [a]	66.04 [b]	44.37 [a]

Note: Means in the same column with different superscripts are significantly different at P=0.05

4.5.4 Trends in quality of greater kudu trophies

There was a weak positive correlation between average horn length and average horn circumference (correlation 0.129, p-value > 0.05). Furthermore, there was a significant difference between average annual means of horn circumference of 2008 (mean 10.57 ±3.60 inches) with the rest. (Table 14 Figure 17) while average horn length remained the same. These results suggest that the quality of greater kudu hunted was almost the same.

Table 14: Annual means of greater kudu trophy measurements (2001- 2010)

Year	Mean horn length left	Mean horn length right	Average horn length	Mean horn circumfe-rence left	Mean horn circumfe-rence right	Average horn circumfe Rence
2001	48.38[a]	48.26[a]	48.32[a]	9.76[a]	9.69[a]	9.73[a]
2002	46.48[a]	44.97[a]	45.88[a]	9.45[a]	9.55[a]	9.50[a]
2003	46.25[a]	46.41[a]	46.42[a]	9.75[a]	9.87[a]	9.59[a]
2005	45.70[a]	44.43[a]	45.07[a]	9.97[a]	9.94[a]	9.95[a]
2006	47.73[a]	47.24[a]	47.48[a]	9.81[a]	9.8[a]	9.81[a]
2007	48.01[a]	47.84[a]	47.92[a]	10.36[a]	10.28[a]	10.32[a]
2008	46.87[a]	46.43[a]	46.65[a]	10.57[a]	10.57[a]	10.57[b]
2009	44.43[a]	44.33[a]	44.38[a]	9.87[a]	9.92[a]	9.90[a]
2010	49.92[a]	49.93[a]	49.93[a]	9.68[a]	9.75[a]	9.72[a]

Note: Means in the same column with different superscripts are significantly different at P=0.05;

measurements were in inches

The mean annual horn length was shortest in 2009 (44.38±4) and longest in 2010 (49.93±1) (Fig. 17), although there was no statisticall significant difference in horn length across the study period. This indicates that animals of same horn sizes were hunted.

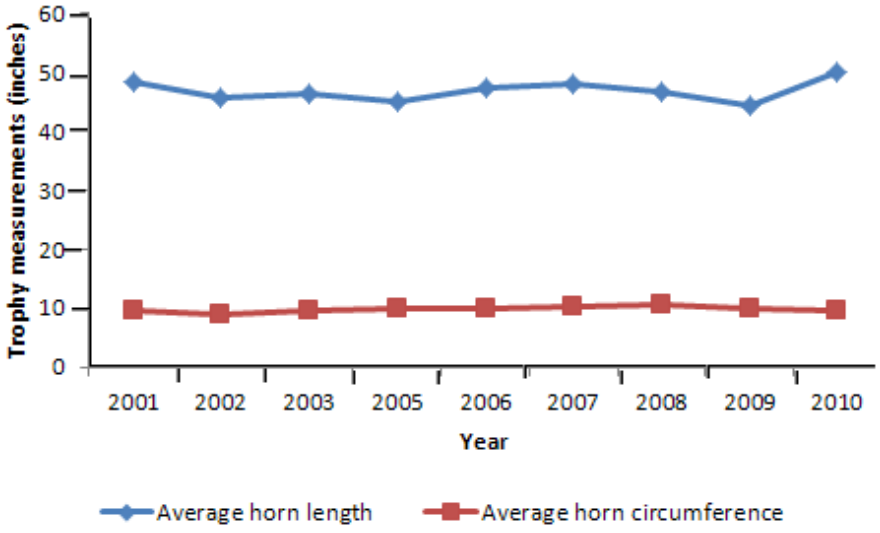

Figure 17: Trends of annual means of greater kudu trophies in SGR (2001- 2010)

4.5.5 Trends in quality of impala trophies

Results for the 2001 to 2010 period indicate a weak positive correlation between horn length and horn width in impala trophies recorded (correlation 0.12, p-value 0.01). There were no significant differences in the average parameters (p-value 0.97 for horn length and 0.71 for average horn circumference respectively) though there were minor differences in annual means (Table 15). This might have been contributed to by the fact that impalas are small (and at the lower level on the food chain). Being small in size they reproduce more and grow fast so they are many compared to other species.

Table 15: Annual means of impala trophy measurements (2001-2010)

Year	Mean horn length left	Mean horn length right	Average horn length	Mean horn circum-ference left	Mean horn circum-ference right	Average horn circum-ference
2001	22.69 [a]	22.09 [a]	22.01 [a]	5.28 [a]	5.24 [a]	5.01 [a]
2002	20.58 [a]	20.62 [a]	20.66 [a]	5.64 [a]	5.61 [a]	5.55 [a]
2003	21.00 [a]	21.04 [a]	21.13 [a]	5.63 [a]	5.50 [a]	5.38 [a]
2004	20.38 [a]	20.33 [a]	20.58 [a]	5.77 [a]	5.27 [a]	5.56 [a]
2005	21.76 [a]	42.85 [a]	21.83 [a]	7.63 [a]	7.60 [a]	5.99 [a]
2006	21.80 [a]	23.08 [a]	22.46 [a]	5.29 [a]	5.26 [a]	5.23 [a]
2007	21.65 [a]	21.48 [a]	21.50 [a]	5.30 [a]	5.37 [a]	5.26 [a]
2008	21.05 [a]	21.27 [a]	21.16 [a]	5.64 [a]	5.64 [a]	5.64 [a]
2009	21.43 [a]	22.03 [a]	21.13 [a]	5.27 [a]	5.30 [a]	5.16 [a]
2010	22.15 [a]	22.23 [a]	22.17 [a]	5.47 [a]	5.42 [a]	5.27 [a]

Note: Means in the same column with different superscripts are significantly different at P=0.05;

measurements were in inches

Unlike the effects of trophy hunting in leopards and lions, Packer *et al.* (2011) the results from this study suggest that hunting does not affect impala. Hedrick (2011) argues that selective hunting is not always the factor for decrease in trophy sizes as seen in big horn sheep in Arizona.

4.5.6 Trends in quality of leopard trophies

Results reveal that there was no clear pattern of leopard trophy sizes (skull width and skull length, and pad width and pad length) but a slight decline in mean skull length especially from 2008 to 2010 although the shortest skull length recorded were those of 2003 followed by those of 2005. The best leopard trophy measurements were those of 2001 (Table 16 and Fig. 18). The largest skulls were those of 2001 the mean of which was significantly different from the rest.

Table 16: Trend of leopard trophies (2001-2010)

Year	Mean skull Length	Mean skull Width	Mean pad length	Mean pad width
2001	12.70[a]	7.69[ab]	5.32[ab]	4.65[ab]
2002	10.53[b]	6.708[b]	5.19[ab]	4.00[b]
2003	8.73[d]	5.83[c]	4.53[b]	3.53[bc]
2005	8.93[d]	5.72[cd]	3.32[cd]	2.30[dc]
2006	10.44[c]	6.77[b]	4.45[b]	3.54[bc]
2007	9.95[cd]	6.73[b]	4.27[b]	3.24[c]
2008	10.34[c]	6.35[bc]	4.19[bc]	3.44[bc]
2009	9.67[cd]	6.42[bc]	4.04[bc]	3.15[c]
2010	9.33[d]	6.35[c]	4.53[b]	3.72[bc]

Note: Means in the same column with different superscripts are significantly different at P=0.05;

measurements were in inches

The trend of leopard trophy measurements across the study period indicates a decrease from 2001 to 2005 though measurements of 2004 were missing (Fig 18). Records show a slight increase in size of trophies in 2006, thereafter no clear pattern was observed.

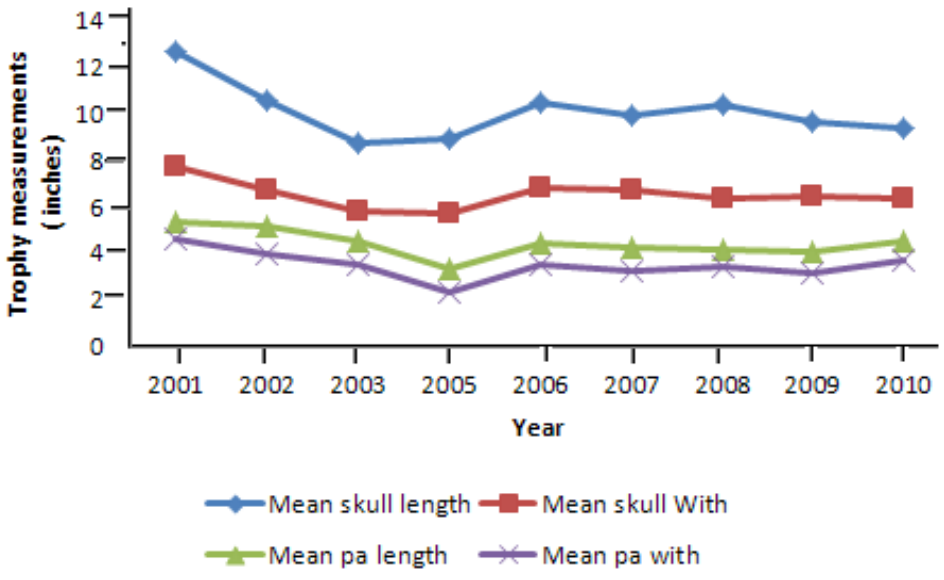

Figure 18: Trends of annual means of leopard trophies in SGR (2001- 2010)

One Sector Warden reported that hunting leopard is tricky due to the species secretive behavior though frequent encounters of tracks suggest leopard population to be stable in some sectors. However, there has been mentioned difficulties in hunting big cats in SGR without breaching the hunting regulations (for example hunting near water points, baiting and hunting at night with cabarets), suggesting that it is not easy to get leopards with desired trophy quality.

4.5.7 Trends in quality of lion trophies

Significant differences were observed among the measured lion trophies. For example, mean skull length for 2001 was significantly different from that of 2010 (Table 17). Likewise mean skull width for 2002 was different from that of 2010. The biggest mean pad length and width were those of 2010 (6.33±0.7 and 4.79±0.3 inches respectively (Table 17)). It is argued that trophy hunting in Tanzania affects lion populations negatively (Lindsey *et al.*, 2012).

Table 17: Trend of lion trophies (2001-2010)

Year	Mean skull Length	Mean skull Width	Mean pad length	Mean pad Width
2001	14.62^{ab}	8.76^{bcd}	5.28^{cd}	4.69^{bc}
2002	14.48^{ab}	9.58^{b}	5.77^{c}	4.31^{d}
2003	14.07^{b}	9.39^{bc}	5.81^{bc}	4.67^{d}
2005	14.242^{b}	8.62^{cd}	5.15^{cd}	4.37^{d}
2006	13.79^{cb}	9.16^{bc}	5.43^{cd}	4.35^{d}
2007	14.48^{ab}	9.63^{ab}	6.02^{b}	4.45^{cd}
2008	13.91^{bc}	9.96^{ab}	5.17^{c}	4.10^{d}
2009	14.82^{ab}	9.57^{ab}	5.40^{cd}	4.14^{d}
2010	12.85^{dc}	8.66^{cd}	6.33^{bc}	4.79^{b}

Note: Means in the same column with different superscript are significantly different at P=0.05;

measurements were in inches

Though there were significant differences in trophy measurements in some years (Table 17), no clear pattern of trophy quality was observed (Fig. 19). It is known that lions attain full body size at the age of two but, mane gains full growth between four and five years (Macdonald and Norris, 2005). Therefore, skull size may not be the perfect measure. Other features like behavior must be considered since lions' social organization is influenced by age. Sticking to solitary lions would help in avoiding hunting undersize and underage lions. It has been recommended that interventions should focus on reducing off-takes to sustainable levels, implementing age-based regulations and improving governance of trophy hunting. Such measures could ensure sustainability while retaining incentives for the conservation of lions and their habitat (Lindsey *et al.*, 2012). Other authors have gone further to suggest that, since baiting is almost unavoidable in lion hunting, hunters should use baits to carefully assess the lions to see if they meet the criteria before shooting (Baldus and Caudwell, 2005).

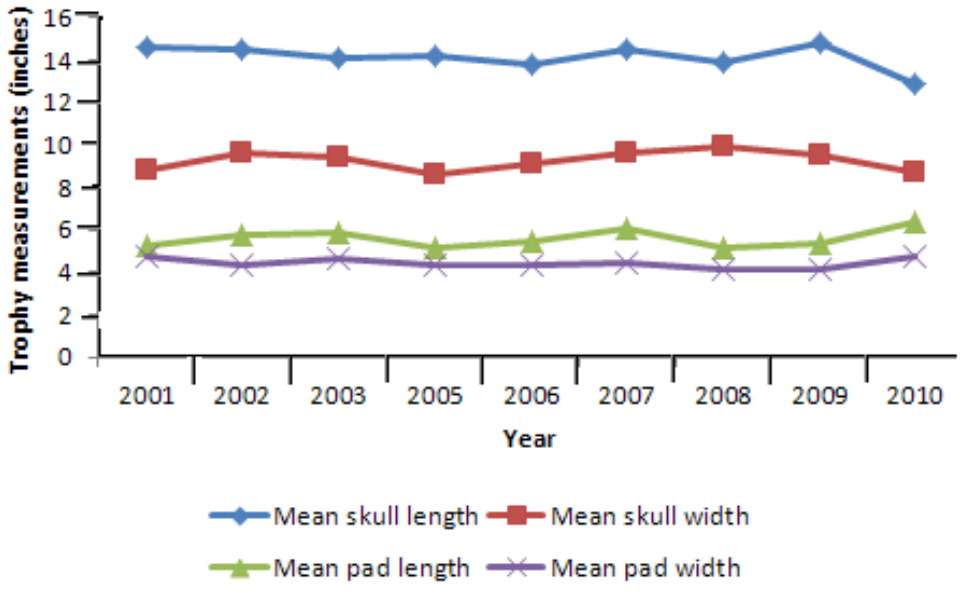

Figure 19: Trends of annual means of lion trophies in SGR (2001- 2010)

4.6 Sustainability of Trophy Hunting

Although most of the annual means of trophy measurements were not significantly different, the hunting practice may not have been sustainable. It requires a close look and remedy in order to ensure continuity of the hunted populations. Non-adherence to hunting regulations was reported by all questionnaire respondents. Furthermore, not all hunted animals were from the elaborated guidelines. For example, hunting of leopards whose females spend almost half of their lives accompanied by cubs and whose males are entirely solitary (Macdonald and Norris, 2005) and lions from prides (Table 18).

According to Brink (2010), some hunters in Tanzania were captured on camera and pictures posted on hunting companies' websites with lions aged two years, something which is against the hunting regulations. Also, Packer *et al*. (2011) found that, most lion trophies from Tanzania belonged to the sub-adult group. On the other hand, some authors have reported that, about 30.0% of documented leopard trophies from Tanzania were females (Packer *et al.,* 2009) indicating that laws and regulations governing trophy hunting were not fully followed. Recent trophy hunting studies have revealed that, if the industry is to be sustainable, consideration should be given to the economic part of it as well as the negative impacts it can cause on the hunted populations (Palazy *et al.,* 2012). Also, it has been recommended that interventions should focus on reducing off-takes to sustainable levels, implementing age-based regulations and improving governance of trophy hunting. Such measures could ensure sustainability while retaining incentives for the conservation of animals and their habitats (Lindsey *et al*., 2012).

Table 18: Social organizations from which the animals were short

Social organization	Buffalo	Elephant	Impala	Greater kudu	Leopard	Lion
Herd	522	3	44	11	-	-
Male group	719	33	170	19	7	20
Family/Pride	-	-	-	-	6	15
Mixed herd	-	10	45	8	-	-
Solitary	923	90	179	50	155	73
Not indicated	583	57	263	68	243	97
Total	2747	193	701	156	411	205

4.6 Nature and Trends of Threats to Study Species Besides Trophy Hunting

4.6.1 Main challenges facing wildlife conservation in SGR

According to SGR Sector Wardens, wildlife conservation is facing many challenges. The most reported challenges were inadequacy of funds (29.2%) and poaching (25.0%). Inadequacy of funds was said to affect anti-poaching efforts, monitoring of different activities like trophy hunting and purchase buying of field gear necessary for conservation activities and motivating game scouts. Though poaching ranked second to inadequacy of funds, it is the factor most affecting conservation efforts, considering the human population growth in adjacent villages (Table 19). In addition to that, dependency on natural resources for fuel (charcoal and firewood), poles and grasses for building by the adjacent community exert pressure on the PAs.

Table 19: Trends of human population in adjacent districts

District	Year 1967	1978	1988	2002	2012
Kilombero	-	133 013[b]	187 593[c]	321 611[c]	407 880[d]
Kilosa	193 810[a]	274 544[b]	346 526[c]	488 191[c]	438 175[d]
Morogo rural	291 110[a]	418 083[b]	225 857[c]	263 012[c]	286 248[d]
Ulanga/Mahenge	174 922[a]	113 510[b]	138 642[c]	193 280[c]	265 203[d]
Kisarawe	180 536[a]	153 450[b]	78 290[c]	95 323[c]	101 598[d]
Rufiji	121 024[a]	135 342[b]	153 938[c]	202 001[c]	217 274[d]
Liwale	-	39 406[b]	52 240[c]	75 128[c]	91 380[d]
Kilwa	97 957	113 872[b]	150 419[c]	171 057[c]	190 744[d]
Namtumbo	-	-	137 038[c]	175 051[c]	201 639[d]
Tunduru	97 555[a]	135 535[b]	170 320[c]	247 055[c]	298 279[d]
Songea	151 390[a]	229 876[b]	115 634[c]	156 930[c]	173 821[d]

***Source*:** MPEA (1969[a])., MPEA (1983[b])., MPEE (2006[c]) and MF (2013[d])

Shortage of human resource also affects wildlife conservation whereby the present number of employees is too small (around 336) to effectively protect the areas under their jurisdictions. The activities include patrols (including handling cases in courts). This is coupled with a poor road network which reduces patrol coverage. Other activities carried out by the same 336 staff are supervision of trophy hunting and photographic-tourism, handling human-wildlife conflicts, publicity activities, monitoring and administration.

A new and overlooked challenge is presence of minerals in the reserve, including uranium in Likuyu seka maganga area and gold in Ilonga area, which cause an influx of people into or around the reserve. According to a former Sector Warden of Likuyu seka maganga (Rajabu Amasi, 2011 pers. communication) uranium exploration began in 2007 and has been going on to-date. On average 80 people were present at the camp inside SGR. Normally only one game scout is stationed at the camp to ensure that conservation regulations are observed. This is a challenge because one person cannot effectively

monitor 80 people be it at the actual site of exploration or at the camp. Furthermore given the frequent traffic of vehicles and planes in and out, poaching may be accelerated and the activities may not be compatible with conservation, for example, use of heavy plants (Plate 3).

Plate 3: One of the heavy machines used in uranium exploration at Likuyu seka maganga in SGR (Photo by M. Juma)

Many authors have argued that, the biggest force behind extinction in current days is overhunting (Leader-Williams, 2009; Nyahongo, 2010; Holmern, 2010). It is not clear, however, which type of hunting (legal trophy hunting or poaching) is responsible for the claimed loss (Leader-Williams, 2009), though records available at Wildlife Division (from 2006 to 2010) indicate that poaching is responsible for more elephant deaths compared to trophy hunting, diseases, problem animal control and natural deaths combined (Appendix 6).

4.6.2 Population trends of study species (2001-2010)

It is obvious that, the above-mentioned challenges contribute to the decline or at least stagnation of populations. Records from wildlife censuses in Selous-Mikumi ecosystem in 2006 and 2009 suggest a sharp reduction of 74 478 elephants in four years period (2006-2009) (MNRT, 2010; TAWIRI, 2012). There has been a comeback of poaching, which called for anti-poaching operations like Kipepeo One, Two and Three in 2009 and 2010 (Wandongo, 2011 pers. communication). This is a challenge not only faced by Tanzania. Researchers have found wildlife population decline to be a problem in other African countries as well. For example, in Eritrea, the number of elephants dropped due to poaching and currently there has been an estimate of two to eight elephants only (Macdonald and Norris, 2005). Though elephant poaching is a big challenge in Tanzania there are hopes of containing it. For example, in the Selous ecosystem, where, in the late 1980s and early 1990s elephant population had declined by 70.0% poaching was brought under control through Operation Uhai whereby carcass ratio dropped to 0.0% (MNRT, 2005).

4.6.3 Most liked species by poachers

Poaching for both subsistence and commercial purposes prevailed in all the sectors with some degrees of variation in species preference depending on the need (if it is for home consumption or for commercial purposes), economic activities and religion in the surrounding community. For example, it was mentioned by experienced game scouts that the local communities around Kingupira, Miguruwe, Kalulu and Liwale are mainly moslem. Therefore, they do not hunt warthog and bushpig (Munhu Ndunguru, 2011 pers. communication). In communities adjacent to big rivers, together with hunting mammal species including hippos, illegal fishing is widespread. Areas affected include those along Kilombero, Rufiji, Mkuju, Luwegu and Njenje rivers. Commercial poaching is common in all eight sectors of SGR.

4.6.3.1 Subsistence hunting

A total of 12 species were mentioned by questionnaire respondents to be targeted by meat poachers (Table 20). However, 48.8% of the respondents believed that only three species namely buffalo (19.5%), impala (17.1%) and hippopotamus (12.2%) were mostly targeted by meat poachers. Other most targeted were wildebeest, eland and hartebeest.

Table 20: Species targeted by meat poachers (N=8)

Animal	Responses		Percent of Cases (%)
	N	Percent (%)	
Buffalo	8	19.50	100.00
Impala	7	17.10	87.50
Hippo	5	12.20	62.50
Hartebeest	4	9.80	50.00
Wildebeest	4	9.80	50.00
Eland	4	9.80	50.00
Waterbuck	3	7.30	37.50
Zebra	2	4.90	25.00
Warthog	1	2.40	12.50
Reedbuck	1	2.40	12.50
Bushbuck	1	2.40	12.50
Fish	1	2.40	12.50
Total	**41**	**100**	**152**

Note: There were multiple responses

Estimate has shown that around 50 000 tons of game meat are consumed annually worldwide, which is about 8% of herbivore biomass (Macdonald and Norris, 2005). This might be ecologically unsustainable. Methods used in hunting are said to differ depending on the purpose of hunting and economic power of the people involved (Mfunda and Røskaft, 2010). In SGR five methods were reported by questionnaire respondents to be used by meat poachers (Table 21).

Table 21: Methods commonly used when poaching for meat (N=8)

Means of hunting	Responses		Percent of Cases (%)
	N	Percent (%)	
Firearms	8	40.00	100.00
Wire snares	6	30.00	75.00
Poisoning	3	15.00	37.50
Baiting	2	10.00	25.00
Pit snares	1	5.00	12.50
Total	**20**	**100**	**250.00**

Note: There were multiple responses

4.6.3.2 Study species most targeted by poachers

According to questionnaire respondents (N=8), two of the study species (buffalo and impala) were most important as a source of meat. According to Macdonald and Norris (2005), these two species are more prone since they live in herds/harems and their survival depends on protection. Effect of poaching increases when the poaching is not selective. For example, the use of wire snares does not consider species, age, status (whether it is pregnant or not) or size.

4.6.4 Commercial poaching

Wildlife plays an important role in economic spheres. According to the Sector Wardens, at the time of this study 38.0% of illegal commercial hunting was for elephants (Plate 4) followed by hippo (23.8%) and buffalo (19.0%) (Table 21). Other important species were hartebeest, crocodile and wildebeest.

Plate 4: A commercial elephant poacher caught by game scouts in Ilonga, SGR in 2011 (Photo by F. Malembeka)

From the six study species elephant and buffalo are said to be contributing highly in illegal wildlife trade either for trophies or for meat (Table 22).

Table 22: **Species preferred by commercial poachers (N=8)**

Animal	Responses		Percent of Cases (%)
	N	Percent (%)	
Elephant	8	38.10	100.00
Buffalo	4	19.00	50.00
Hippo	5	23.80	62.50
Hartebeest	2	9.50	25.00
Crocodile	1	4.80	12.50
Wildebeest	1	4.80	12.50
Total	**21**	**100.0**	**262.5**

Note: There were multiple responses

Different methods are used in the illegal hunting. Results from this study show that the methods commonly used are firearms (43.8%) followed by wire snares and, to a less extent, poisoning especially of fish and baiting (Table 23).

Table 23: Methods used by commercial poachers (N=8)

Method	Responses		Percent of Cases (%)
	N	Percent (%)	
Firearms	7	43.80	87.50
Wire snares	4	25.00	50.00
Poisoning	3	18.80	37.50
Baiting	2	12.50	25.00
Total	**16**	**100.0**	**200.0**

Note: There were multiple responses

Leader-Williams (2009) argues that there is no clear distinction between subsistence poaching and commercial poaching. Baldus (2002) also argues that, only the level matters because most illegal hunting is done for commercial purposes. Bush meat trade, which is illegal and which involves rural and urban trade, is generally a major threat to wildlife in sub-Saharan Africa since it causes dramatic declines of hunted populations (Holmern, 2010). It is argued that hunting in areas adjacent to protected areas for example, is an important integral part of life with cultural roots (Holmern, 2010) and is an important economic activity despite the species hunted (Nyahongo, 2010). The activity flourishes due to the increase in human population (Table 19) and, therefore, assured market (Mfunda and Røskaft, 2010). Other authors argue that the presence of natural resources, including wildlife, attracts a number of youngsters who sometimes get involved in poaching (TNRF, 2008). This influx affects negatively the available resources due to lack of cultural connection to the resource.

Poaching plays an important role in the communities adjacent PAs by offering alternative yet cheap and available source of protein, which is used to supplement food shortage and other losses caused by wildlife like depredation. Therefore, it remains to be a viable activity (Nyahongo, 2010). The same was observed in Burigi Game Reserve and other protected areas which were surrounded by refugee camps who poached to supplement the small food rations and for income (Jambiya *et al.*, 2007).

Experience from West Africa indicates that of the 71 mammals hunted there, 73% are from ungulates while over 50.0% are large-bodied species mostly snared while abundance was the main predictor of harvest levels (Fa *et al.*, 2005). In Serengeti National Park and its adjacent areas too buffalo and impala are among the most liked species due to habitat preference and snares are set on thickets (Holmern, 2010; Nyahongo, 2010).

Results from the current study are slightly different compared to the findings from Serengeti National Park where the method most used for poaching was wire snares which is preferred by poor locals with no ability to own firearms and who to avoid being caught by law enforcement units, while firearms are used by people with better income in areas adjacent Serengeti (Holmern, 2010). In SGR the most common method was the use of firearms. Laws and law enforcement are said to have improved the situation of bush meat hunting by providing quotas to locals to hunt legally, though poaching is still practiced using mostly wire snares (Holmern, 2010).

4.6.5 Human-wildlife conflicts

Human-wildlife conflict is one of the conservation challenges and a decimating factor to wildlife reported in SGR. Results from the current study reveal that, elephants and lions

are the species causing most of the problems (48.0%) followed by hippo and buffaloes (13.0% each) and, to a lesser extent, bush pig, leopard, crocodile and baboon (Table 24).

Elephants were reported to damage crops by raiding farms. Some of the preferred crops included cashew fruits especially in Liwale, rice, cassava, plantain and maize in all sectors. Furthermore, bush pig, hippo, buffalo and baboon were reported to either eat or destroy crops and sometimes guarding was required.

Table 24: Animals mentioned to be source of conflicts (N=8)

Animals reported	Responses		Percent of Cases (%)
	N	Percent (%)	
Elephant	6	26.10	85.70
Lion	5	21.70	71.40
Bush pig	2	8.70	28.60
Hippo	3	13.00	42.90
Baboons	1	4.30	14.30
Leopard	2	8.70	28.60
Buffalos	3	13.00	42.90
Crocodile	1	4.30	14.30
Total	**23**	**1000**	**328.60**

Note: There were multiple responses

Lion, leopard and crocodile were reported in areas where livestock keeping was practiced. They prey on livestock. This is caused by pastoralists grazing inside SGR or establishing settlements to the edge of the reserve encourages carnivores to go for easy prey. Sometimes herders kill wildlife. For example, two collared lions which were being monitored went missing and their GPS collars were later found outside SGR (Brink, 2010). This signaled the presence of conflicts caused by either the pastoralists or the lions. According to TAWIRI (2012) recently there has been more encroachment of SGR compared to previous years. Furthermore, the settling of pastoralists in Kilombero valley

increased the number of cattle in areas adjacent to the reserve, which resulted into more human-wildlife conflicts (Twaibu, 2009) especially ones involving carnivores. It has been reported that communities adjacent to SGR do not benefit from trophy hunting (Twaibu, 2009). This reduces their tolerance to problem animals.

Experiences from areas around Ruaha National Park show that, loss of cattle due to diseases was higher than that due to depredation (Dickman, 2010), signaling that human-wildlife conflicts reported frequently were more a matter of negative attitude of local communities towards wildlife. This requires attention of the wildlife managers.

Furthermore, human population growth along with expansion of cultivation in areas adjacent to SGR increases incidences of crop riding by elephants, baboons and bush pigs. Similar observations were seen in areas adjacent to Burigi and Biharamulo Game Reserves in Kagera region where people had established settlements in wildlife corridors (Mbangwa *et al.*, 2008). Also, hippos and crocodiles are reported to be in conflict with humans in areas such as Kilombero valley.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Tanzania has the most extensive area in Africa set aside for trophy hunting, which allows the off take of mature males from wildlife populations managed through setting of quotas that are thought to be ecologically sustainable and economically viable. Quotas were not fully utilized across the study period and were not supported by data. Generally trophy quality seemed to decline this suggests that, the hunting as currently practiced may be unsustainable, one reason being that hunters do not follow hunting regulations. However, hunting remains an important source of revenue in Tanzania, which is spent on anti-poaching activities and road network maintenance, to mention just a few. Poaching is the other major challenge, which must be addressed.

There have been efforts in SGR to keep trophy hunting records. However, inaccuracies in measurements and poor record keeping associated with frequent changes of managers make these efforts futile. Different managers have different priorities.

The study concludes also that, trophy hunting has benefits (economic and ecological).

5.2 Recommendations

Much more is needed in order to fully understand the trend of trophy hunting in Tanzania. This study recommends the following:

(i) Part of the revenue accrued from trophy hunting should continue to be ploughed back to same reserves to support conservation activities/efforts. Also, game fees

should be reviewed regularly by comparing with other countries since they affect the total revenue accrued from trophy hunting.

(ii) It is clear that trophy hunting needs major reforms especially on codes of conduct, if it is to be sustainable and beneficial. Wildlife Division must enforce the rules and regulations and the hunters must adhere to those rules and regulations.

(iii) The staff involved in trophy hunting should fill in the forms fully and properly. This is important for future reference and better decision making.

(iv) Research on spatial distribution of game species should be conducted in order to understand the distribution of hunted animals, to avoid overharvesting in some of the reserve.

(v) This study should be scaled up to get a complete picture of trophy hunting in the country.

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APPENDICES

Appendix 1: Administrative sectors of SGR and their sizes

Name of Sector	Number of hunting blocks	Total area (km^2)
Ilonga	10	7 521
Kalulu	3	4 989
Kingupira	7	9 345
Likuyu seka maganga	4	5 025
Liwale	4	4 716
Matambwe	3	1 738
Miguruwe	3	6 124
Msolwa	9	4 642
Total	**43**	**44 100**

Appendix 2: Actual quotas set for buffalo (2001-2005)

Block/Year	2001	2002	2003	2004	2005
LA1	16	16	16	16	16
M1	20	20	20	20	20
M2	25	25	25	_	25
U1	18	25	20	20	23
U2	18	25	20	20	23
R1	15	15	15	20	28
K4	25	25	25	30	30
LL1	17	_	17	17	17
LL2	17	_	17	17	17
MT2	17	_	17	17	17
L1	40	40	40	40	40
R2	22	22	20	20	20
R4	18	14	12	12	12
K3	14	12	12	12	12
MB3	6	6	6	_	6
ML1	6	6	6	_	6
MH1	6	6	6	_	6
MT1	8	8	8	_	8
N2	8	8	8	_	8
MJ1	6	6	6	_	6
MK1	54	50	58	50	_
K1	20	45	45	45	25
K2	20	45	45	45	25
MS1	15	15	15	15	15
U4	15	15	15	15	15
LL3	15	15	15	15	15
RU1	15	15	15	15	15
LU2	30	30	33	33	30
IH1	31	30	31	31	25
R3	20	20	20	20	20
LU1	25	25	25	25	25
LU5	10	12	20	20	20
MB1	23	23	23	_	26
MB2	28	28	28	_	28
LU6	22	22	22	_	22
LU7	20	20	20	_	20
LU8	20	20	20	_	20
N1	26	26	26	_	26
K5	18	18	14	14	14
Y1	20	20	_	_	_
MA1	15	25	25	25	_
U3	15	25	25	25	_
LU4	15	15	15	15	_
LL3	14	12	17	17	
Total	828	850	888	686	

Source: Department of Wildlife Management Library, SUA.

Appendix 3: Actual quotas set for impala and greater kudu (2001-2005)

	Impala					Greater kudu				
Block/Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2001**	**2002**	**2003**	**2004**	**2005**
LA1	8	6	6	10	10	1	1	1	1	1
M1	10	10	10	10	10	3	3	3	3	3
M2	10	10	10	_	10	0	0	0	_	0
U1	18	15	15	15	15	2	2	2	2	2
U2	18	12	12	12	12	2	2	2	2	2
R1	10	10	10	10	16	2	2	2	2	2
K4	18	18	18	18	18	4	4	4	4	4
LL1	13	14	14	_	14	5	5	5	_	5
LL2	13	13	13	_	13	5	5	5	_	5
MT2	13	14	14	_	14	5	5	5	_	5
L1	20	20	20	20	20	5	5	5	_	5
R2	15	12	12	12	12	4	2	2	4	2
R4	16	12	12	12	12	3	2	2	2	2
K3	9	12	12	12	12	3	3	3	3	3
MB3	4	4	4	_	4	2	2	2	_	2
ML1	4	4	4	_	4	2	2	2	_	2
MH1	4	4	4	_	4	2	2	2	_	2
MT1	4	4	4	_	4	2	2	2	_	2
N2	4	4	4	_	4	1	1	1	_	1
MJ1	5	5	5	_	5	1	1	1	_	1
MK1	31	30	30	30	_	6	6	6	6	_
K1	15	27	27	27	20	6	6	6	6	2
K2	12	25	25	25	20	4	4	4	4	2
MS1	9	9	9	9	9	4	4	4	4	4
U4	9	8	8	8	8	4	4	4	4	4
LL3	9	8	8	8	8	0	0	0	0	0
RU1	9	8	8	8	8	4	4	4	4	4
LU2	12	12	12	12	12	1	1	2	2	2
IH1	8	8	8	8	6	2	2	2	2	2
R3	13	12	12	12	12	0	0	0	0	0
LU1	13	12	12	12	12	4	4	4	4	4
LU5	6	7	12	12	25	3	3	3	3	3
MB1	9	8	8	_	8	4	4	4	_	4
MB2	11	11	11	_	15	4	4	4	_	4
LU6	9	9	9	_	11	4	4	4	_	4
LU7	7	7	7	_	11	3	3	3	_	3
LU8	7	7	7	_	9	3	3	3	_	3
N1	10	10	7	_	10	3	3	3	_	3
K5	13	13	13	13	13	2	2	2	2	2
Y1	15	15	_	_	_	2	2	_	_	_
MA1	10	10	10	10	_	3	3	3	3	_
U3	15	15	15	15	_	3	3	3	3	_
LU4	8	8	8	8	_	4	4	4	4	_
LL3	12	12	9	9	9	3	3	4	4	4
Total	**488**	**494**	**478**	**357**	**439**	**130**	**127**	**127**	**78**	**105**

Source: Department of Wildlife Management Library, SUA.

Appendix 4: Actual quotas set for leopard and lion (2001-2005)

Leopards						Lion					
Block/ Year	**2001***	**2002***	**2003***	**2004***	**2005***	**2001***	**2002***	**2003***	**2004 ***	**2005 ***	**2008****
LA1	2	2	2	2	2	3	3	3	3	3	3
M1	2	2	3	2	2	3	3	3	3	3	3
M2	3	3	4	_	3	4	4	4	_	4	4
U1	1	1	3	4	4	3	3	3	3	3	2
U2	2	2	3	4	4	3	3	3	3	3	2
R1	3	3	4	4	4	4	4	4	4	4	4
K4	1	1	2	2	2	5	5	5	5	5	5
LL1	4	5	5	_	5	5	5	5	_	5	4
LL2	4	5	5	_	5	5	5	5	_	5	4
MT2	5	5	5	_	5	5	5	5	_	5	4
L1	2	2	3	3	3	6	6	6	6	6	5
R2	5	5	4	4	5	5	3	4	4	3	3
R4	4	4	4	4	4	5	3	3	3	3	3
K3	3	3	4	4	4	3	3	3	3	3	4
MB3	3	3	4	_	4	2	2	2	_	2	2
ML1	3	3	4	_	4	2	2	2	_	2	2
MH1	3	3	4	_	4	1	1	1	_	1	1
MT1	3	3	3	_	3	1	1	1	_	1	1
N2	3	3	4	_	4	2	2	2	_	2	2
MJ1	3	3	3	_	3	1	1	1	_	1	1
MK1	2	2	3	3	_	5	5	5	5	_	4
K1	3	3	4	4	5	6	6	6	6	3	2
K2	3	4	3	3	4	5	5	5	5	3	1
MS1	3	3	3	3	3	5	5	5	5	5	5
U4	3	3	4	4	4	4	4	4	4	4	4
LL3	3	3	4	4	4	4	4	4	4	4	4
RU1	3	3	4	4	4	5	5	5	5	4	5
LU2	3	3	4	4	4	3	3	3	3	3	3
IH1	3	3	3	3	3	2	2	2	2	2	2
R3	2	2	3	3	3	1	1	1	1	2	3
LU1	3	3	3	3	3	5	5	5	5	5	4
LU5	2	2	4	4	4	2	3	3	2	2	2
MB1	4	4	4	_	5	5	5	5	_	5	5
MB2	4	4	5	_	5	5	5	5	_	5	5
LU6	4	4	5	_	5	4	4	4	_	5	4
LU7	4	4	4	_	5	3	3	3	_	3	4
LU8	4	4	3	_	5	3	3	3	_	4	4
N1	4	4	3	_	5	5	5	5	_	5	4
K5	3	3	3	3	3	5	5	4	4	2	2
Y1	2	2	_	_	_	5	5	_	_	_	4
MA1	2	2	3	3	_	5	5	5	5	_	4
U3	3	3	3	3	_	5	5	5	5	_	4
LU4	2	2	3	3	_	4	4	4	4	_	3
LL3	2	2	3	4	4	3	3	3	3	3	3
Total	**130**	**133**	**154**	**91**	**152**	**167**	**164**	**159**	**105**	**133**	**140**

Source: Department of Wildlife Management Library, SUA* ; Brink, 2010**

Appendix 5: Questionnaire for sector managers of GSR for assessing the trend of tourist hunting and trophy quality

A. Infomart's general information

1. Station/sector……
2. Respondent no. ….....
3. Sex (circle one) 1. Male 2. Female
4. Age …….(Years)
5. Current rank……..
6. How long have you worked in this sector…….years
7. How long have you worked in SGR?

B. Hunting of study species

8. What are your general views and perceptions regarding trophy hunting in SGR?

   ……

9. Is trophy hunting good? 1. Yes 2. No **(If your answer in No go to number 11)**
10. If your answer is Yes, mention the reasons which you think it is good.

    1……

    2…….....

    3…….

    4…….....

11. If your answer is No, mention the reasons why you think trophy hunting is not good.

    1……

    2…….....

    3…….

    4…….....

C. Elephant hunting

12. Were all of the elephant quotas utilized during the past 10 years? (Or for the period you have been the sector manager?

    1. Yes 2. No

13. If no, what were the reasons? (Rank 1- 3 according importance of the factor)

    -Unavailability of elephants with good trophy size

    -Small number of tourists demanding the elephant trophy in the sector

    -Other reasons (please specify)

    1……

    2……

14. If you think elephant quotas are underutilized in this sector, what solutions would you suggest?

    1……

    2……

    Do you think elephant hunting quotas are overutilized in this sector?

    (Please circle one)

    1. Yes 2. No **(If yes go to no. 16)**

16. What are the reasons for overutilization of elephant quotas in this sector?

    1……...

    2……

17. What has been the status/trend of elephant population for the past 10 years? (Circle one)

    1. Stable 2. Increasing 3. Decreasing

D. Lion hunting

18. Were all of the lion quotas utilized during the past 10 years? (Or for the period you have been the sector manager?

    1. Yes 2. No

19. If no, what were the reasons? (Rank 1- 3 according importance of the factor)

    -Unavailability of lions with good trophy size

    -Small number of tourists demanding the lion trophy in the sector

    -Other reasons (please specify)

    1……

    2……

20. If you think lion quotas are underutilized in this sector, what solutions would you suggest?

    1……

    2……

    Do you think lion hunting quotas are overutilized in this sector?

    (Please circle one)

    1. Yes 2. No **(If yes go to no. 22)**

21. What are the reasons for overutilization of lion quotas in this sector?

    1……...

    2……

22. What has been the status/trend of lion population for the past 10 years? (Circle one)

    1. Stable 2. Increasing 3. Decreasing

E. Leopard hunting

23. Were all of the leopard quotas utilized during the past 10 years? (Or for the period you have been the sector manager?

    1. Yes 2. No

25. If no, what were the reasons? (Rank 1- 3 according importance of the factor)

    -Unavailability of leopards with good trophy size

-Small number of tourists demanding the leopard trophy in the sector

-Other reasons (please specify)

1……

2……

26. If you think leopard quotas are underutilized in this sector, what solutions would you suggest?

1……

2…….

27. Do you think leopard hunting quotas are overutilized in this sector?

(Please circle one)

1. Yes 2. No **(If yes go to no. 28)**

28. What are the reasons for overutilization of leopard quotas in this sector?

1……...

2……

29. What has been the status/trend of leopard population for the past 10 years? (Circle one)

1. Stable 2. Increasing 3. Decreasing

F. Buffalo hunting

30. Were all of the buffalo quotas utilized during the past 10 years? (Or for the period you have been the sector manager?

1. Yes 2. No

31. If no, what were the reasons? (Rank 1- 3 according importance of the factor)

-Unavailability of buffalos with good trophy size

-Small number of tourists demanding the buffalo trophy in the sector

-Other reasons (please specify)

1……

2……

32. If you think buffalo quotas are underutilized in this sector, what solutions would you suggest?

1……

2……

Do you think buffalo hunting quotas are overutilized in this sector?

(Please circle one)

2. Yes 2. No **(If yes go to no. 34)**

33. What are the reasons for overutilization of buffalo quotas in this sector?

1……...

2……

34. What has been the status/trend of buffalo population for the past 10 years? (Circle one)

1. Stable 2. Increasing 3. Decreasing

G. Greater kudu

35. Were all of the greater kudu quotas utilized during the past 10 years? (Or for the period you have been the sector manager?

1. Yes 2. No

37. If no, what were the reasons? (Rank 1- 3 according importance of the factor)

-Unavailability of greater kudus with good trophy size

-Small number of tourists demanding the greater kudu trophy in the sector

-Other reasons (please specify)

1……

2……

38. If you think greater kudu quotas are underutilized in this sector, what solutions would you suggest?

1……

2……

Do you think greater kudu hunting quotas are overutilized in this sector?

(Please circle one)

3. Yes 2. No **(If yes go to no. 40)**

39. What are the reasons for overutilization of greater kudu quotas in this sector?

1……...

2……

What has been the status/trend of greater kudu population for the past 10 years? (Circle one)

1. Stable 2. Increasing 3. Decreasing

H. Impala hunting

40. Were all of the impala quotas utilized during the past 10 years? (Or for the period you have been the sector manager?

1. Yes 2. No

43. If no, what were the reasons? (Rank 1- 3 according importance of the factor)

-Unavailability of impalas with good trophy size

-Small number of tourists demanding the impala trophy in the sector

-Other reasons (please specify)

1……

2……

44. If you think impala quotas are underutilized in this sector, what solutions would you suggest?

    1……

    2……

45. Do you think impala hunting quotas are overutilized in this sector?

    (Please circle one)

    1. Yes 2. No **(If yes go to no. 46)**

46. What are the reasons for overutilization of impala quotas in this sector?

    1……...

    2……

47. What has been the status/trend of impala population for the past 10 years? (Circle one)

    1. Stable 2. Increasing 3. Decreasing

I. General views about trophy hunting

47. What are the negative impacts of trophy hunting on wildlife conservation in this sector?

    1……..

    2…….

48. Any other information regarding tourist hunting, which you would want to give? **(Feel free to use separate sheet)**

    ……

J. Challenges facing wildlife conservation

49. Please mention the main challenges facing wildlife conservation in SGR

    ……

    ……

50. From your experience which animal species are more targeted by poachers for meat?

    1……..2…….3……

    4……5…….6……

    7……8……9……..10……

51. Which methods are commonly used in poaching for meat? (Circle and number according the the most common method used)

    Snare wires……, poisoning……, baiting……., pit (ground)-snares…… firearms…….?

52. From your experience which animal species are more targeted by commercial poachers?

    1……..2…….3……

    4……5…….6……

    7……8……9……..10……

53. Which methods are commonly used for commercial poaching? (Circle and number according the the most common method used)

    Snare wires……, poisoning……, baiting……., pit (ground)-snares……, firearms……?

THANK YOU FOR YOUR TIME AND COOPERATION

Appendix 6: Trend of elephant death incidences in SGR during trophy hunting and off trophy hunting seasons (2006-2010)

Off trophy hunting season						Trophy hunting season					Grand-total
Year	Natural	Poaching	Tourist Hunting	Other	Sub-total	Natural	Poaching	Tourist Hunting	Other	Sub-total	
2006	6	19	-	1	26	13	12	40	7	72	98
2007	16	22	-	2	40	18	25	47	6	96	136
2008	7	30	-	2	39	7	41	40	6	94	133
2009	10	28	-	18	56	14	16	50	5	85	141
2010	12	17	-	6	35	13	61	54	9	137	172
Total	**51**	**116**	-	**29**	**196**	**65**	**155**	**231**	**33**	**484**	**680**

Note: Other= Deaths due to diseases, accidents and problem animal control