



The Effectiveness of Anti-Poaching Techniques in Combating Wildebeest Poaching in Serengeti National Park

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ABSTRACT

Wildlife poaching is a global problem that has been resulting in the decline of the population of wildlife species. The objectives of the study were to examine techniques used by poachers to conduct wildebeest poaching, availability of anti-poaching techniques and to evaluate the obstacles in the efforts of effective anti-poaching techniques the Serengeti National Park (SENAPA). Purposeful sampling and documentary review were adopted for data gathering. Interviews were conducted to key informants from SENAPA as well as to the adjacent villages. Data were analysed by using SPSS, descriptive statistics and content analysis. Results revealed the persistence of wildlife poaching, wildebeest being highly poached species compared to other species. Poaching techniques used were hiding and killing and the major anti-poaching techniques were revealed to be patrols, intelligence-led, conservation education, de-snaring team and sniffer dogs. Political interference, budget limitation, inadequate manpower and the use of modern technology were identified as the main obstacles for successful curbing of the problem. The study concludes that fighting against poaching is difficult and always needs a combination of techniques. It is recommended that SENAPA management should increase effectiveness in patrols, rangers' surveillance and deterrence of poachers by significantly investing in anti-poaching activities.

Keywords: Poaching - Anti-poaching – Wildebeest - Techniques- Effective – Combating.

INTRODUCTION

Wildlife poaching and trafficking are the most noticeable and widespread phenomena that compromise the integrity of biodiversity at the global level (Haas and Ferreira 2018). It is a global problem that has been resulting in population decline and local extinctions of some wildlife species (Anderson and Jooste 2014). Consequently, the increase in wildlife poaching and trading have of recent, necessitated global concerted efforts to halt and probably reverse these unfavourable situations and trends (Duffy and Brockington 2015).

Wildlife poaching is not a new phenomenon (Lewis-olsson and Mann 2016). For millennia, human beings have poached wildlife using customary techniques (Hoffman 2015). Furthermore, poaching techniques differ from one region to another (Obour *et al.* 2018). Different poachers employ varieties of techniques during wildlife poaching (Duffy and Brockington 2015). According to Anderson and Jooste (2014), poaching is increasing and poachers' techniques are also becoming more complicated. Determinants of poaching technique depend on the level of technology and targeted animal species (Duffy *et al.* 2016). In addition, Hoffman (2015) reported technological advancement to facilitate the extensive poaching of



wildlife populations. Worldwide, the major threat of wildlife diversity remains to be illegal hunting and unsustainable consumption of wildlife resources (Postolovska 2010).

The costs of poaching to the wildlife-rich African countries, apart from decline and extinctions of some wildlife species, include reduction in foreign currency earnings from wildlife tourism (Anderson and Jooste 2014). According to WWF (2007), the loss to the African tourism sector due to elephant poaching was estimated at an average of \$25 million per year. To trim down the effects of wildlife poaching, numerous strategies were established worldwide (Department of Wildlife National Parks 2003), with the main focus being on detection and deterrence of poachers (SADC 2015).

This study focused on Wildebeest poaching in Tanzania, specifically at the Serengeti National Park (SENAPA). Wildebeests (*Connochaetes taurinus*) are predominantly found in the favourable habitat ranging from short grass plain to adjacent acacia savannah and woodland (Charles 2010). In Africa, wildebeest habitat ranges from southern Kenya, northern and south-eastern Tanzania, south-western Zambia, south-eastern Angola, Namibia, Botswana, and the major river valleys of Mozambique (East 2009). According to East (2009) since the 1960s status of wildebeest population has been fluctuating from one country to another due to various factors including poaching, habitat loss and diseases.

Scholars such as Msoffe *et al.* (2019), Ndibalema and Songorwa (2008) reported that poaching is the main cause of instability of the wildebeest population in African countries. Wildebeest poaching together with other migratory herbivores has increased in the past decade to the extent that it is termed as the “bush-meat crisis” (Staley 2002). Customarily, bush-meat has been a source of protein for local people in Africa (Ndibalema and Songorwa 2008). Additionally, UNEP (2013) reported-meat

poaching has been threatening the population of wildebeest and other migratory herbivores in Maasai Mara Kenya.

The survey in the 1990s indicated that the wildebeest population was stable (East 2009). However, the increased poaching of wildebeest could cause the population to collapse (UNEP 2013). In Serengeti National Park, wildebeests stand for the most poached migratory species of herbivores (Ndibalema and Songorwa 2008). Serengeti National Park (SENAPA) management reported an average of 1,155 wildebeest (*Connochaetes taurinus*) species were found killed by poachers per year followed by zebra (*Equus burchelli*) totalling 521 for the last period of five years (2013/2014 to 2017/2018) (SENAPA 2019). Msoffe *et al.* (2019) reported poaching as a primary threat of the wildebeest population in SENAPA.

Wildebeest poaching in SENAPA is mainly conducted during the dry season (Campbell *et al.* 2001). The period of the dry season is when wildebeests move from open grassland to wooded grassland (Msoffe *et al.* 2019). Wildebeests are being poached using various methods including wire snares which is the common method used by many poachers (Gandiwa *et al.* 2014, Lindsey *et al.* 2013).

For years, SENAPA management has been investing and implementing various anti-poaching approaches and techniques to curb wildlife poaching. A great number of conservation expenses have been incurred by respective authorities all of them aiming at protecting wildlife from poaching. However, wildlife poaching is still persistent and rampant, hence prompting the need for more research that goes extra miles than just identifying anti-poaching methods and techniques (Cheteni 2014). Examining obstacles for anti-poaching approaches and techniques can help to inform better patrol efforts in the future. Identifying gaps in the effectiveness of anti-poaching techniques is important for understanding where and how



anti-poaching techniques can be most effective with limited resources and personnel. Despite a long history of wildebeest poaching in SENAPA, there has been no sufficient study to explore the obstacles for effective anti-poaching techniques in curbing poaching. This study, therefore, intends to provide useful information to SENAPA management and other protected areas in Tanzania on the underlying obstacles that hinder the effectiveness of anti-poaching approaches and techniques. This study specifically aimed to examine the techniques used by poachers to conduct wildebeest poaching in SENAPA, to examine the anti-poaching techniques in combating wildebeest poaching in SENAPA and to evaluate the obstacles to the effectiveness of anti-poaching techniques used by SENAPA.

MATERIALS AND METHODS

Study area

The study was carried out in the Serengeti National Park (SENAPA) in Tanzania and adjacent villages in its western side, located in Bunda, Serengeti and Tarime Districts. SENAPA is geographically located at geographical coordinates of Longitude 34° - 35°15' E, Latitude 1° 15' - 3° 20' S and covers 14,763 square kilometres. The Park is also considered as a centre of the Serengeti Mara Ecosystem (Kijazi 2017).

SENAPA lies on the north-western of Tanzania, bordering Kenya to the north, where it is continuous with the Maasai Mara National Reserve.

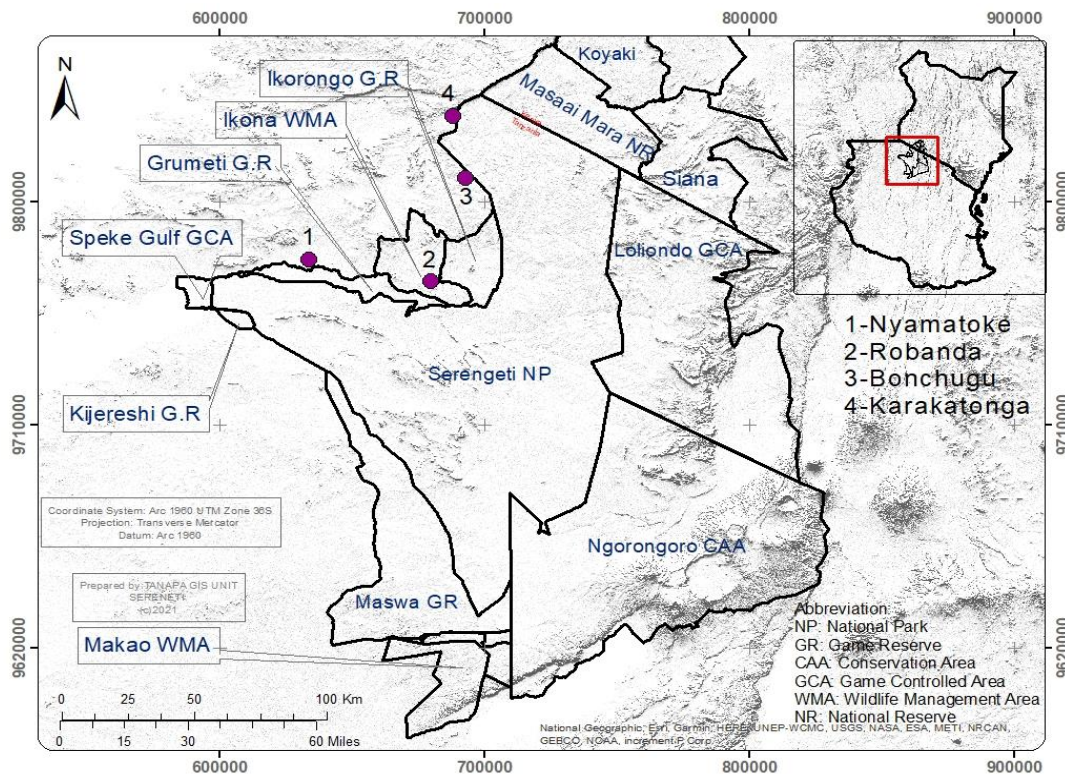


Figure 2.1: Map of Serengeti Ecosystem showing the location of the study area (Source: TANAPA GIS Centre 2021)

To the south-east of the park is the Ngorongoro Conservation Area, to the south-west lies the Maswa Game Reserve, to the west are the Ikorongo and Grumeti

Game Reserves, and to the north-east and east, lies the Loliendo Game Control Area (Figure 2.1). The Serengeti National Park is internationally recognized as a World



Heritage Site, and a Biosphere Reserve (Kideghesho 2010).. Although the park lies within the same ecosystem with other protected areas, the governing system is different and resources exploitation restrictions vary. The most restrictive area being the national park, other protected areas provide a buffer zone (Schmitt 2010).

The SENAPA consists of various vegetation mosaic including plains that harbour the well-known stunning wildebeest (*Connochaetes taurinus*) migration and many other ungulates and most diverse large carnivore populations in the world (Nuno *et al.* 2014). The park is also home to the endangered black rhinoceros and African wild-dog (TANAPA 2006).

The researchers selected the Serengeti as a case study because of its value as well as the severe challenges of wildlife poaching it has been facing (Schmitt 2010). SENAPA is the most restricted protected area within the Serengeti Mara Ecosystem on natural resource exploitation, thus prohibiting all consumptive uses including human settlement, livestock grazing, fuel-wood collection, and wildlife poaching (Knapp 2012). Therefore, the researchers assumed that SENAPA anti-poaching techniques could be most effective.

Data collection methods

The study adopted triangulation method to collect data. Triangulation method is defined as a process of combining data from different sources to study a particular social phenomenon (Rugg 2010). The data collection methods for this study included: key informant interviews and document review. The use of triangulation method increases the credibility of the findings as the researcher relies on multiple data to check the authenticity of the results. Generally, the researchers need to record any potentially useful data thoroughly, using field notes, sketches, audiotapes, photographs and other suitable means (Alvi 2016). Triangulating the results with two or more different methods, in a complementary

way offers an opportunity to conclude (Nyumba *et al.* 2018).

The study employed interviews framed on the research questions to allow extensive discussion on various issues which were raised during the interview (Gandiwa *et al.* 2014). The study considered three categories of population in collecting the desired information. The first category was SENAPA staffs that had been involved in anti-poaching activities; the second category was ex-poachers and the third was village leaders and elders both obtained from the chosen village adjacent to SENAPA.

The selection of individuals from the target populations was done through the use of purposive, and snowball sampling technique. The sampled and interviewed key informants from SENAPA staff included four (4) Park wardens (conservators) who were predominantly supervising rangers on anti-poaching patrol, five (5) Prosecutors who were involved in prosecuting anti-poaching cases and fifteen (15) Park Rangers. Ex poachers are those individuals who previously were involved in wildlife poaching and had either retired due to some reasons including age, conservation awareness, being arrested and sentenced to imprisonment and fearing of anti-poaching rangers. A total of 17 ex-poachers were identified using snowball techniques and then interviewed. Additionally, 8 village elders and 6 village leaders from the chosen village were interviewed. The selection of the villages to be involved in the study was based on the proximity to the park boundary and presence of high number of previously arrested poachers, data which were collected from SENAPA anti-poaching unit. The selected villages included Ikoma, Robanda and Bunchungu in Serengeti District, Karakatonga in Tarime District and Nyamatoke in Bunda District. Generally, 55 respondents from all categories of the targeted population were interviewed as shown in Table 1. All respondents were good sources of information regarding



poaching, anti-poaching activities in SENAPA and the prevailing obstacles.

Table 1: Categories of the respondents involved in the study.

Respondents /Title	No of respondent	Percentage
Village elders	8	14.5
Village leaders	6	10.9
Park ranger	15	27.3
Ex-poachers	17	30.9
Park warden	5	9
Prosecutors	4	4
Total	55	100.0

Data analysis

Mixed methods for data analysis were employed due to the nature of the study. Both the qualitative and quantitative approaches were used. The collected data from the interviews conducted to key informants were coded and arranged according to certain subjects and themes as per specific objectives and other themes that emerged out of data to answer the research questions. Qualitative information obtained from verbal discussions, reports and other documents were analysed using content and narrative analysis.

Descriptive analysis was done to determine the frequencies and percentage of the respondents. Besides, evaluation and analysis of variables both dependent and independent using statistical Package for Social Sciences (SPSS) was also done. Comparison of some variables between the data collected from all targeted population was done to check for any correlation which was then used to interpret the information. Furthermore, where multiple responses were possible on an open-response question, data were presented as the percentage of the respondents giving each response and may sum to over 100 %.

RESULTS AND DISCUSSION

Techniques used by poachers to conduct Wildebeest poaching in SENAPA

The study findings revealed that there were several techniques that were being used in wildlife poaching. These techniques are grouped into three categories; hiding techniques (that is, techniques used by poachers who enter the park and conduct poaching without being detected); killing techniques that is those techniques used for catching and killing animals and the high-tech or escaping techniques as presented in Table 2.

Table 2: Techniques used to conduct poaching of wildebeest in SENAPA.

Poaching techniques	Frequencies of responses	Percentage of cases
Hiding Techniques	171	67.1
Killing Techniques	69	27.1
High- tech techniques	55	12.9
Total	255	100

As shown in Table 2, 67.1% of the respondents revealed that poachers were always using hiding techniques to avoid being spotted by patrol rangers. During a personal interview with ex-poachers, several hiding techniques were mentioned which included: avoiding unnecessary movement, avoiding setting fires, poaching at night and using bushy areas with thick plants for cover. This finding indicates that poaching is not an easy task, it is an art that requires skills, knowledge and professionalism in catching and killing animals and escaping without being detected. Sinha *et al.* (2017) also reported that poachers always stay away from intensive patrol areas and tend to poach in areas which are common and well-known to them. Generally, during the patrol, it is hard for rangers to notice poaching sign in the thick and dense vegetation for there are no routes to pass through. Furthermore, Ijeomah (2012) reported that poachers can easily hide in the bush once they have detected the presence of Rangers on patrol.

During personal interview with park rangers, they mentioned that poaching



techniques changes following the nature of the area and culture of the adjacent communities. It was pointed out that in the area where the terrain was dominated with open wooded grassland and plain areas, motorcycles were being used while on the areas dominated by scattered bushes and many hills particularly on the northern part of the park, observations using binoculars were being employed to spot and detect the patrol rangers and be able to escape. Vegetation types, the season of the year (i.e. wet and dry season) are the main predictors of poaching activities within a given area (Piel *et al.* 2015). Interview with rangers revealed that it was tricky for patrol rangers to identify time and location for poaching actions because poachers did not let someone know their preferences. The findings match with Mukwazvure and Magadza, (2014) who found out that the presence and location of poacher proved to be a major challenge to patrol rangers and that, among the hard jobs to patrol rangers was arresting poachers during the night.

The findings in Table 2 reveal that 27.1% of the respondents agreed that killing techniques were also being used by poachers. It was found that animal species being poached determined the techniques and tools to be used. Interviews with the Park Ranger mentioned that wildebeests in SENAPA were mostly being killed by using tools mentioned. This is similar to the findings by Gandiwa (2014), who reported that the killing of some species in Gonarezhou National Park, south-eastern Zimbabwe included: Impala (*Aepyceros melampus*), kudu (*Tragelaphus strepsiceros*), buffalo (*Syncerus caffra*) and zebra (*Equus quagga*).

The other reported group of techniques used by poachers was the use of high-tech techniques (5.9%, Table 3). During interview with rangers and ex poachers, they mentioned the uses of binoculars and cell phones to spot rangers on patrol and for communication among themselves. The other thing mentioned was the use of

spotlights to confuse wildebeests when it was dark, and motorcycle to facilitate transportation of meat and chasing animals. For example, in Kainji Lake National Park of Nigeria, poachers were reported to have been using trinkets “African technology” to confuse the rangers and get away without leaving something behind to trace them (Ijeomah *et al.* 2012). Travelling during night was reported to be the common technique used by poachers to escape patrol rangers in SENAPA. On this particular aspect, one of the ex-poachers had this to say:

“After killing and packing the meat, we would normally hide in the thick bushes waiting for the night to set in for us to start travelling back to the village”

During interview, the rangers argued that it was hard to detect a poacher at night without modern equipment like thermo image. Additionally, it was reported that in South Africa the organized poachers were using helicopters and high-tech gears such as night-vision goggles and tranquillizer drugs to kill animals and escape (Ijeomah *et al.* 2012).

Tools used for catching wildebeests

Results presented in Table 3 show that the most used tools for hunting wildebeests were wire snares (12.9%), bows and arrows (12.9%), machetes (12.9%) and domestic dogs. These were followed by knives (12.6%) and spears (12.6%) whereas the least ones were pit traps (9.8%), motorcycles (7.7%) and firearms (5.6%). These results correlate with the data collected from SENAPA anti-poaching unit database presented in Figure 1 where the highest recorded recovery tools/weapons from the field for the period of ten financial years were: wire – snares (1,306,924), followed by bows & arrows (2,603) (5,917), spears (4,007), knives (3,079) machetes (2,360), dogs (256), motorcycle (159) and assorted firearms (141). These results suggest that the most used tools were locally obtained, cheap and easy to use with



exception of motorcycle and firearms. According to Kilewo and Mpanduji (2012), wire-snares are the most and widespread tools used by poachers for catching wildebeests. Snares are made of different materials including metal wires, often taken from worn-out tyres, abandoned telephone lines, twisted nylon fishing line or rope, and another type of steel cables.

Table 3: Responses on poaching tools used to catch and kill animals.

Anti-poaching tools	Frequencies	Percentage
Wire – snares	55	12.9
Pit traps	42	9.8
Bows & Arrows	55	12.9
Spears	54	12.6
Machetes	55	12.9
Firearms	24	5.6
Domestic Dogs	55	12.9
Motorcycle	33	7.7
Knives	54	12.6
Total	427	100.0

A survey from all sampled targeted populations revealed that poachers were

using many tools to kill and catch animals in the game. The respondents mentioned that the main determinants of the tool's selection were types of animals targeted, their size and behaviour. Effectiveness of the tools and methods in killing and catching animals easily is another criterion for selection.

A study by Aziz *et al.* (2017), reported that methods for poaching were site and species-specific for example poisoned baits and snares were reported to be effective in catching and killing a tiger in Sundarbans Reserved Forest of Bangladesh. Another study revealed that the uses of poaching tools/techniques were determined by the available animal species, the terrain of the area, vegetation types and culture of the society (Ndibalema and Songorwa 2008).

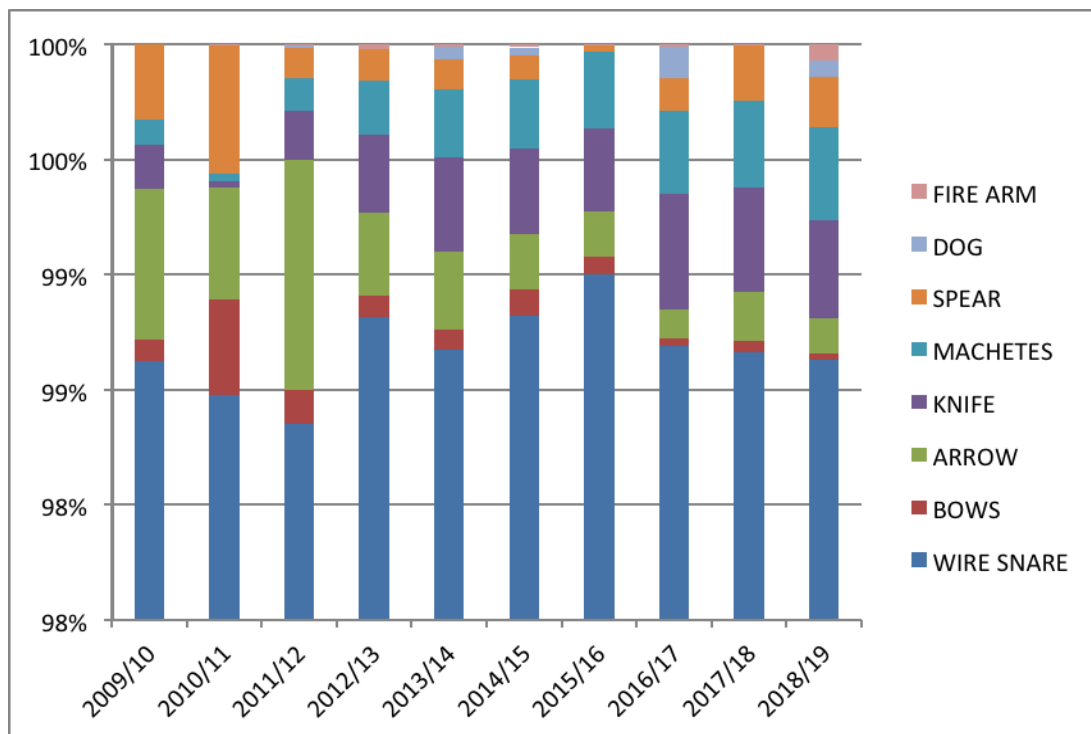


Figure 1: Weapons/tools used by poachers in SENAPA as recovered by patrol rangers for ten years. Source: SENAPA Protection Unit Annual Reports 2019.

The study results from the SENAPA Anti-poaching Unit (Figure 1) show that poachers were mainly using wire-snares for

catching and killing wildebeests and other animals. A total of 1,306,924, wire-snares were collected from the field by patrol



rangers, an average of 130,692.4 wire-snares per year. This is also similar to Knapp (2010), who reported that the principal tools used for poaching wildebeests (*Connochaetes taurinus*) and zebra (*Equus burchelli*) throughout the migratory period in SENAPA were wire snares and other traditionally made tools such as bows and arrows, spears, knives and machetes. Furthermore, the findings by Lindsey *et al.* (2015) indicate that snaring is the most common illegal hunting method and unwanted as it is extremely efficient, hard to control, unselective in terms of the genders or species of the captured animals. Wire-snares also known as silent killers and non-selective are effective in catching animals (Kilewo & Mpanduji 2012, Lindsey *et al.* 2013). Also, 'wire snares are cheap to obtain' one of the ex-poachers insisted.

During the field survey, it was noted that the magnitude of snares collected in SENAPA was very high to the extent that SENAPA Management in collaboration with other conservation stakeholders came up with other techniques to curb the snaring problem. These techniques included the establishment of a de-snaring team and the use of sniffer dogs. The de-snaring team which is composed of retired rangers and ex-poachers conducts patrols by following the movement of wildebeests and removing all snares found within the areas. The team collects snares and rescues trapped wildebeests as observed in Plate 1 and 2. It was also reported that for the period of May, 2018 to December 30th, 2018 a total of 16,366 wire-snares were collected by de-snaring team only; apart from those collected by rangers. Additionally, the same group collected 12,298 snares for the period of January to November 2019. The interview with the Chief Park Warden of SENAPA indicated that the de-snaring team had been established to assist in curbing poaching.

According to the SENAPA anti-poaching unit annual reports, it is also indicated that the number of recovered snares for the period of five years has decreased from 100,406 snares F/Y 2014/15 to 56,508 snares, F/Y 2018/19. This suggests that the declining of snares recovery has been contributed to by the increased surveillance by patrol rangers, deployment of de-snaring team, and increased deterrence due to the increased access roads for game drives and tourism facilities in the prone areas. This suggests that increased frequencies of ranger patrol surveillances within the area and tourism activities have increased the deterrence of poachers. Piel *et al.* (2015) reported that as the frequency of patrol increases within an area, snares encounter rate decreases.

Spears, knives, machetes, bows and arrows, domestic dogs and flashlights are the mostly used tools (12.9% each, Table 3). Interview with ex-poacher revealed that spears, knives and machetes were being used to assist in killing and chopping, even if snares could sometimes catch the animal; the animal may not die as this depends on the part of the body tied by the snare. Spears were reported to have been used for killing before starting slaughtering and chopping the animal's parts using knives and machetes. Domestic dogs and flashlights were being used during night for chasing wildebeests aimed at directing them to traps.

The other techniques and tools least used include pit traps (9.8%) and motorcycles (7.7%) and the firearms of various calibres (5.6%), (Table 3). This finding tallies with studies by Ford (2005) and Gandiwa *et al.* (2014). Motorcycles were reported to have been used in the plain area for catching animals like eland (*Taurotragus oryx*), wildebeest (*Connochaetes taurinus*), and zebra (*Equus burcherii*) in which animals would be chased to the extent that they could not run any more.



Plate 1: Wire-snares collected by de-snaring team, November 2019.



Plate 2: A Wildebeest trapped by snares in northern part of SENAPA as observed during the field survey

Firearms were also reported to be used to kill various species of animals ranging from middle to larger size including wildebeests (*Connochaetes taurinus*) although this was not very often done.

Available Anti-poaching Techniques and Methods

According to Cheteni (2014), the complexity of poachers is how they have developed various tactics of poaching. SENAPA management has been using a variety of anti-poaching techniques to

reduce poaching. These techniques range from tactical to social-educational methods.

Table 4: Responses on anti-poaching methods and techniques (N-55).

Anti-poaching methods and techniques	Frequencies	Percentage
Scheduled Patrol	212	46.6
Intelligence led patrol	105	23.1
Education and awareness	44	9.7
Other methods and techniques	94	20.7
Total	455	100.0



As shown in Table 4, a big number of the respondents (46.6%) admitted that patrol was the major technique used in combating poaching. This result could be due to the reason that patrol is the basic technique, which is assumed to provide an effective deterrence to illegal activities within the park. Patrols are mainly conducted on daily bases using vehicles, foot and plane (aerial patrol). Obours (2018) in his findings reported shrinking in poacher's arrests and poaching activities in Mole National Park in Ghana due to the increased number of field patrols. This was also supported by Moore *et al.* (2018) who said that well-organized ranger patrols certainly increase the apprehension of poachers and prevent poaching activities.

Table 4 indicates that 23.1% of the respondents reported the intelligence-led patrol as being effective where information regarding poaching is collected using informants and other intelligence means. Effective field intelligence is among the most important proactive measures that are used against wildebeest poaching. In addition, intelligence led patrols have been successful in apprehending poachers before they have committed crime.

Other anti-poaching techniques such as the use of de-snaring team and the use of sniffer dogs were accepted by 20.7% of the respondents whereas community education and awareness under outreach programmes came last by 9.7%. These results concur with Lo'pez-Bao *et al.* (2017), who reported that anti-poaching unit could increase the likelihood of arresting poachers through improved patrolling techniques and other methods (e.g., use of un-manned aerial vehicles or surveillance cameras) and intelligence derived from local informants.

During interviews with SENAPA staff, it was noted that there were other techniques that were supplementing the patrols and intelligence. Many of these techniques were related to outreach programmes which included raising the community awareness; Conservation Education Programme;

Poverty reduction programme e.g., Community Conservation Bank (COCOBA); involvement of communities in combating poaching and increasing punishment to offenders (amendment of Law). Moore *et al.* (2018) stress that, to save wildlife, we need not only stronger institutions and law enforcement, but also combating poverty, through establishment of economic opportunity, and the full involvement of communities in decision-making. Biegus and Bueger (2017) argue that participation of local community in conservation law enforcement efforts can help address poaching and the problematic aspects of current anti-poaching actions.

Personal interview with the Chief Park Warden revealed that SENAPA management in cooperation with Frankfurt Zoological Society had established around a total of 120 groups of COCOBA in all adjacent districts (i.e., Bunda - 8, Bariadi - 8, Meatu - 20, Loliondo -16 and Serengeti - 68) (SENAPA Outreach Unit 2019). In addition, Game Scouts participating in anti-poaching patrols in communities under outreach programme, were included in giving information regarding poaching activities. In Kruger National Park, South Africa, Game scouts have been playing an important role in the effort to protect Rhino population. They have been doing this through conducting monitoring and patrol outside the park and providing intelligence to patrol groups (Biegus and Bueger 2017).

The underlying obstacles in SENAPA's efforts to effective anti-poaching techniques

Studies by various scholars suggest that improved anti-poaching techniques will significantly reduce poaching of wildebeest and other wildlife (Frankfurt Zoological Society *et al.* 2014), and also as pointed out by Knapp (2012) decreased wildlife poaching in SENAPA was intensified by improved anti-poaching techniques. In general, effectiveness of anti-poaching techniques is affected by various factors



including the adaptation of poachers to those techniques (Cheteni 2014).

The findings of the study revealed that the major and leading obstacles for effectiveness of anti-poaching techniques in combating poaching were political interferences (15.5%), budget limitation (14.4%), understaffing (13.4%), technological change (13.4%), and corruption (2.6%). Other obstacles which were listed included judicial procedures (10.5%), inadequate motivation to patrol rangers (10.1%) and inadequate equipment (10, 1%) (Table 5).

Table 5: Respondents' suggestions of obstacles to effective anti-poaching techniques (N=55).

Obstacle for effective anti-poaching techniques	Frequencies of responses	Percentage of cases
Inadequate Manpower	32	13.4
Inadequate Modern Equipment	24	10.1
Technological change	32	13.4
Political interferences	37	15.5
Corruption	30	12.6
Inadequate motivation to Patrol Rangers	24	10.1
Judicial Procedures	25	10.5
Budget Limitation	34	14.3
Total	238	100.0

The findings as presented in Table 5 are similar to Kideghesho (2019), who found out that the driving force for increased poaching activities and which turns out to be the obstacle on anti-poaching techniques if not properly addressed, were corruption, inadequate conservation budget, political interference, and immorality. It has been noted that politicians have been frustrating anti-poaching operations in the park because they defend their voters who might include the poachers (Kideghesho 2016a). SENAPA Anti-poaching Annual Report of 2017 and 2019 reported politicians to interfere operations that were being conducted to obstruct encroachment of livestock grazing and poaching in the areas adjacent to villages in Ngorongoro (Loliondo) and Tarime districts. The Park conducted an operation in July to November 2017 to deter livestock from grazing within

the park by the villagers in Loliondo. However, the Member of Parliament interfered the operations by condemning its staff that they were acting against the livestock and human rights. The other operations were conducted from April to May 2019 to deter encroachment of poachers and livestock grazers from the adjacent villages in Tarime District, which was also interfered and impeded by the District chairman of the ruling party.

Generally, politicians have been mentioned by many scholars such as Songorwa (2015) and Kideghesho (2016) to interfere with the anti-poaching efforts and decisions. Generally, politicians have been reported to influence wildlife crime in many countries (Harrison *et al.* 2015). Kideghesho (2016) observes that, it is due to political obstruction that some wildlife officers are unable to apply their professionalism and put into effect the wildlife laws efficiently. Other politicians tend to use political power to obscure anti-poaching operations in their area of jurisdictions by planting false allegations to Conservation Rangers. Anti-poaching staff have been condemned and victimized by politicians during their operations. Kideghesho (2019) further reported on politicians' pressure to the government to downgrade a number of protected areas in order to support agriculture and livestock grazing activities, which are detrimental to the survival of wildlife.

The findings in Table 5 show that 14.3% of the respondents reported that budget limitations tend to weaken activities of wildlife poaching control which plays an important role in the effort to combating poaching. Personal interviews with Conservators and rangers revealed that the park was understaffed due to limited funds for recruitment. Furthermore, most of the anti-poaching equipment including vehicles were donor funded. It was also mentioned that the park had not been able to adopt improved techniques like the use of



helicopter and other advanced surveillance instruments due to limited budget.

Findings by Ijeomah *et al.* (2012) in Kainji Lake National Park of Nigeria argued that increased number of arrests was attributed to by morale of rangers after adequately being supplied with anti-poaching equipment. Budget limitation has also led to inadequate man power and equipment to facilitate anti-poaching activities (Lindsey *et al.* 2015). Kideghesho (2010) in his study reported that in Tanzania, the least funded sector was the natural resource sector, where smallest funds were being allocated to individual parks during budgeting session. The government of Tanzania in three consecutive years 2010 to 2012, allocated only 10% of the budget requirements to cater for wildlife conservation expenses (Kideghesho 2016b). Furthermore, according to Andrew *et al.* (2013) and Lindsey *et al.* (2015) the effectiveness of anti-poaching techniques is determined by the morale of patrol rangers after being paid enough salaries, supplied with equipment and good supervision. In general, limited budget allocations undermine the implementations of anti-poaching techniques including, patrols, prosecution, investigations and intelligence activities.

Respondents particularly SENAPA staff believed that the emerging of technology has increased poaching success, where poachers are able to evade detection. On the other hand, poachers are now using cell-phone and binoculars to facilitate communications and observations among themselves on site and to notice the presence of patrol rangers. Motorbikes are used to chase animals in the plain areas. They are also used to ease transportation of poachers and meat from the park to the village. For example, 151 motorbike and 6 binoculars were confiscated from poachers arrested inside the park for the period of ten years (2009/10 to 2018/19). Serious investments are to be directed to anti-poaching techniques for the purpose of

curbing wildlife poaching (Cheteni 2014). Rangers on patrol require high-tech equipment such as thermal images, unmanned-vehicle, night vision goggles and GPS to ease anti-poaching operations.

Corruption is a problem in curbing poaching (Anderson, and Jooste 2014). Corruption is complicated and tricky to judge (Sekgwama 2012). During field survey, 12.6% of the respondents reported corruption to obscure the war against poaching in SENAPA. Corruption has been involving some rangers and other law enforcers such as police and the judiciary. During personal interview with wardens, they mentioned some rangers to have been involved in corruption with offenders. Few cases were reported between the year 2016 to 2019 where 6 rangers were caught and terminated from employment after approval. Additionally, during the interview, one of anti-poaching wardens claimed that:

“Although there is no clear evidence but there is some indication of corruption that has been causing the park to lose some anti-poaching cases during court proceedings”

Sekgwama (2012) reported that delays in dispensation of justice are bound to result in corrupt practices. Similarly, Lindsey *et al.* (2015) reported that corruption can also trim down the efficiency of wildlife law enforcement. Kideghesho (2016) reported that the current wildlife poaching is linked to corruption. High corruption rates in a country rich in wild animals result to various cases of poaching disappearing into thin air without the criminals being convicted (Sekgwama 2012). Furthermore, corruption can affect politicians' ability to formulate good policies related to wildlife conservation (Mareto 2018). The study findings in Table 5 also indicate that judicial procedures hinder anti-poaching techniques in curbing poaching as supported by 10.5% of the respondents. During personal interview with the rangers, it was mentioned that some provisions in Criminal Procedure Act (CPA) were not friendly to poaching fighters as they were giving room for



collusion between the arrested poachers and the actors (i.e., magistrates and police officers).

Furthermore, it has been reported that many arrested poachers have been absconding from court proceedings after being granted bail (researcher's personal experience and observation). For example, the SENAPA prosecution unit reported that for the last two years (2018 and 2019), with regard to the 56 poaching related court cases, the accused implicated in these cases absconded during the proceedings after being granted bail. On the other hand, Lindsey *et al.* (2015) argued that punishment given to convicted offenders in many countries do not reflect the value of the resource being destroyed. Knap (2016) also claimed that, the survival of wildlife population is the matter of increasing length of jail for the arrested and convicted poachers.

Awareness raising to the judiciary and other law enforcers is vital for promoting understanding of wildlife values (Andrew *et al.* 2013). Frankfurt Zoological Society *et al.* (2014) stressed that for anti-poaching techniques to be effective, it depends on the basis of institutional competences and functions. Patrol rangers' ability, motivation and dedication to fight against wildlife poaching are always determined by the number of factors including training and availability of equipment.

Findings in Table 5 also indicate that 10.1% of the respondents reported on inadequate equipment as one of the obstacles for effective anti-poaching techniques. This result could be due to the fact that technology has been changing over time. In that context, poachers have also been changing some of the poaching techniques. Given this fact therefore, Patrol Rangers need to have modern equipment, which will enable them to patrol a wide range of area precisely within a short time. A survey discovered that the park did not have any helicopter for quick aerial patrol and thermal image for night patrols. Ogogo *et al.* (2014) also reported that the low

performance of the anti-poaching operations in Cross River National Park, Okwango Division in Nigeria was attributed to by poorly equipped rangers.

CONCLUSION

Based on the findings and discussion, this study concludes that fighting against wildlife poaching is not an easy task; it always needs a combination of techniques. Furthermore, poachers are aware of patrol rangers and their techniques of detection and arresting, therefore they have developed their own /techniques that help them to enter into the park and conduct poaching without being detected. Hiding and killing techniques are the main means for successful entering hunting and escaping. Locally and effective available tools are the mostly used tools for killing animals. In addition, the poachers have also adopted the use of modern equipment and technology for facilitation of transport, communication and detection of patrol rangers.

RECOMMENDATIONS

Generally, this study ascertains that intensifying and improving the available anti-poaching techniques will significantly reduce wildlife poaching in SENAPA and other protected areas. Additionally, there should be a strategic means that will get rid of the identified obstacles that cause ineffectiveness of anti-poaching techniques. It has been reported that Patrol rangers' ability, motivation and dedication to fight against wildlife poaching are always determined by the number of factors including training, moral support and availability of equipment.

The identified poaching techniques and tools used by poachers for entering and killing animals could only be curbed by reducing the prevailing and documented obstacles. Nevertheless, with limited budget allocation in anti-poaching activities, anti-poaching techniques will remain inefficient.



This study suggests that SENAPA management should increase effectiveness in patrol rangers' surveillance and deterrence of poachers by significantly investing much in anti-poaching activities. This is due to the reason that the major techniques used in catching and killing animal are locally available although with few modern ones. Furthermore, there should be a means in which poaching tools/weapons particularly snare trading should be prohibited within the communities. Additionally, there is a need to involve elders and influential people in order to integrate indigenous knowledge in combating poaching. In order to rescue wildlife from poaching, a well-built political will and commitment of the government is of vital importance.

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