Masai Mara Report

Response to infringing Rhino habitat

by

Wolde Wesa, Bsc. Wildlife Management

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Commissioned at the Request of
Mr. Hassan Ole Kamwaro
Managing Director
OlKeju Ronkai Limited

Reference is made to the arguments propounded by the Chief Warden of the Mara Triangle, Samson Parsimei Lenjirr and others on nine ecological reasons why OlKeju Ronkai Camp poses a threat to Rhino populations in the Mara, and in response submission contained herein, based on scientific evidence will indicate to the contrary. Rhino status and population dynamics demands a holistic overview on trends and limiting factors for population growth rather than the selective dissemination of information as adopted by Samson Parsimei Lenjirr. It is a universal opinion based on qualified research the Rhino populations decline in the Mara are subject to various factors that included widespread poaching, habitat transformation through influence of fire, livestock interfaces, and unmitigated tourism practices afflicting a spectrum of wildlife rather than any individual species or just the Rhino. We quote from similar references used by Samson Parsimei Lenjirr and other comparative notes attributing factors that have precipitated such impacts, on a large scale, that contributed to species decline including referred species like the Kudu and Roan antelopes. We further give evidence the Chief Warden of the Mara triangle, Samson Parsimei Lenjirr, has chosen to selectively quote from references, which in whole include important limiting factors and negative attributes that impact on the Rhino.

As an opening statement, the principal argument presented by Samson Parsimei Lenjirr and others is based on research carried out by John Mukinya in 1971 and 1972 *(Mukinya 1973*) giving Rhino populations at 108 in 13 distribution areas (Figure 1 & Figure 2 A). It is to be noted this Rhino database was ***superseded*** by subsequent research carried out on the Rhino populations in the Mara indicating by 1995 a depreciation in Rhino numbers to fewer than 13 Rhinos (Brett *1995)* directly attributed to poaching, thinning of *Croton dichogamus* and increase in elephant populations (Dublin 1991; 1995)..

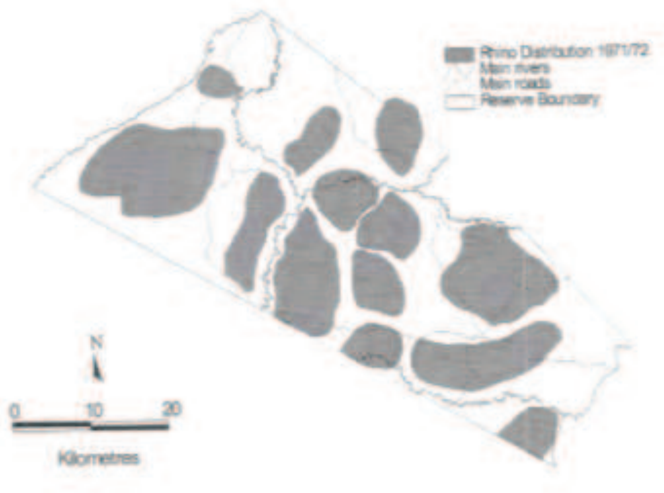

Figure: 1 Rhino distribution in MMNR in 1971/ 1972 (adapted from Mukinya, 1973)

Historical data provide Rhinos estimated populations between 150 - 200 in the Mara during the mid 1900's occurring in large numbers throughout the reserve and the ***majority located in the Mara Triangle***, some in Keekorok area and a few in the Musiara area *(Brett,1995).* Owing to extensive poaching, ***destruction of habitat by persistent uncontrolled bush fires***, and exceptionally ***heavy influx of elephants***, Rhino numbers declined *(Dublin 1991).*

These were most noticeable in the triangle area, west of the Mara River and between Sand River and in the Kuka Hills, were Rhinos were eliminated and a single Rhino survived in Musiara area. More recent studies revealed only 30% of the reserve is occupied by 40 Rhinos in 5 distribution area, A – E as shown in Figure 2 B. *(Morgan – Davis, 1996).* This clearly illustrates considerable changes in configuration of Rhino home ranges and distribution areas compared to the report by Mukinya. It is to be emphasized it ***was only after intensified surveillance and security measures*** that the Rhino population in the Mara rose to about 40 individuals in the period of study 1992-1995 *(Morgan – Davis 1996).*

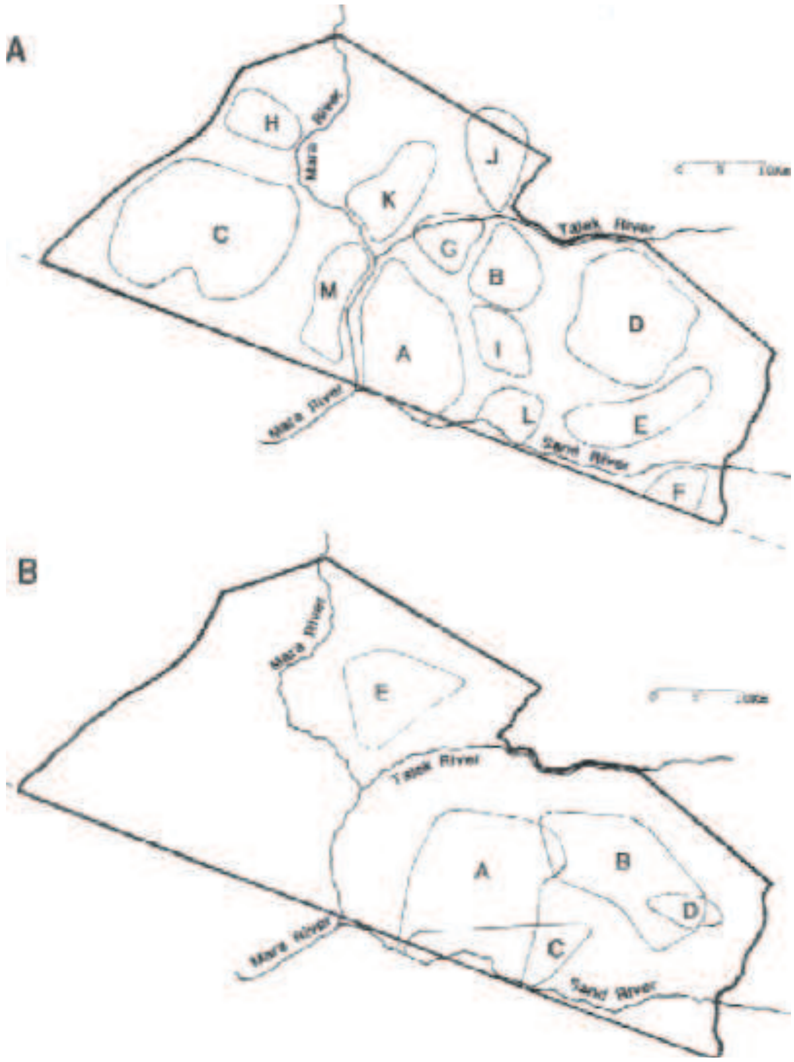

Figure 2: Comparative distribution area of Black rhino in MMNR in A) 1972 (Mikinya 1973 and B 1995)

Following the configuration changes *(Figure 3*) in relation to (*Figure 1A & 2 A)* discounts any reference to Mukinya's data used by Samson Parsimei Lenjirr as a basis for indication on population numbers, densities and distribution areas or Rhino proximity to the OlKeju Ronkai Camp. It must be noted that successive study of Rhino distribution in the Mara abrogates the 13 Rhino distribution areas as recorded by Mukinya (1973) reducing the Mara Rhino populations to 5 distribution areas *(Morgan – Davis 1996)* away from the Mara River woods, displaced either by elephants, reduced browse availability or disturbance. (Comparisons Figure 3 A & 3 B).

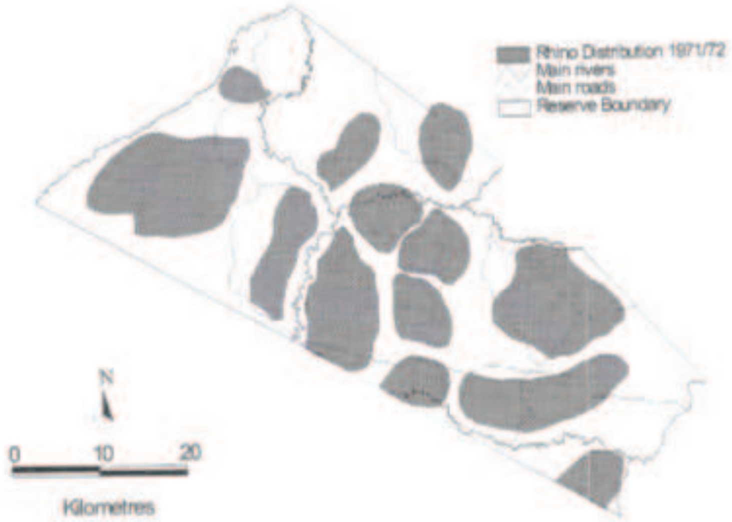

Figure: 3A Rhino distribution in MMNR in 1971/ 1972 (adapted from Mukinya, 1973)

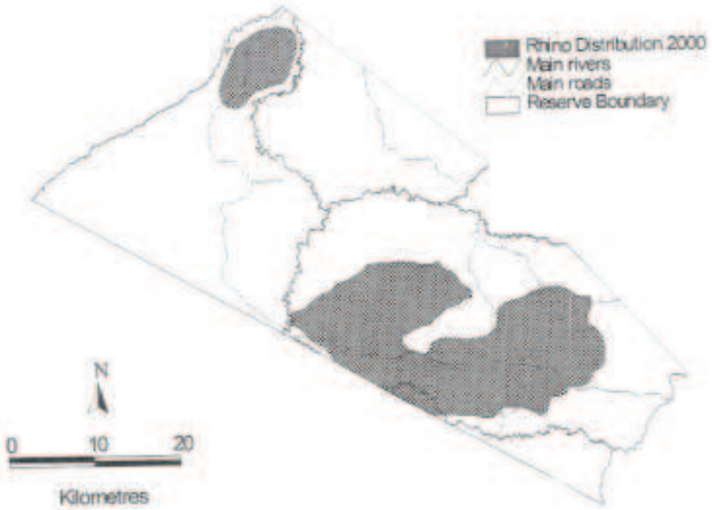

Figure: 3B Rhino distribution in MMNR in 2000

Further, Samson Parsimei Lenjirr argument that distribution area A holds the highest Rhino numbers, 22, in relation to other areas does not qualify as determinant factor for the area's suitability as Rhino ***home range increase by the corresponding index of declining habitat quality*** and ***changes in vegetation structure and composition contribute to Rhinos maintaining larger ranges in order to meet their nutritional requirements.*** *(C Reid - 2007).*

It is apparent from the configuration changes as occurred from earlier distribution areas as recorded by Mukinya 1973 suggests security and livestock incursions in the Triangle, Musiara and Talek areas as reported; ***It is in relation to historical high numbers, all the data on animal***

population stops somewhere in 2003, which is just two years after the Mara Conservancy started to manage the Mara Triangle in August 2001. It is no secret that before 2001 poaching was out of control inside the Mara Triangle; there is an area called Nyumba Nane (Eight Houses) and is named such because of the eight permanent poacher camps that were there - a no-go zone for both tourists and rangers. *(Source- Mara Triangle)*

The precipitating factor on the changes is hence explained; ***The two distribution maps suggest that cattle encroachment is more severe now than in previous years. This may in part be due to the de -gazettement of parts of the northern and eastern borders of the reserve two decades ago, and resultant human settlement of these areas. Human population growth in these areas has been high throughout the 1990s*** *(Boydston et al., in press)****, and this has fuelled the increase in cattle incursions into the Reserve*** *(Walpole et al., 2001)****).***

Adding onto the effects of poaching and cattle interfaces, elephant influx and their use of the Mara River woodlands collectively acting as limiting factors have caused a paradigm shift notably pushing Rhinos' in distribution A area further away from the riverine woods ***long before before*** OlKeju Ronkai came into the scene.

Results of long term research into habitat change reveals a decline in woody resources that Rhinos rely on. Aerial photograph analysis revealed large declines in both ***Croton thicket and Acacia woodland density between the 1950s and 1980s*** (Dublin, 1991). Further research in the 1980s and 1990s showed ***a continued decline in both of these habitats to 1998*** *(Obara 1999*). Equally, analysis of the recent Acacia woodland plots revealed lower species diversity at lower densities (Figure.4), suggesting that the remaining areas of woody habitat ***have lower plant diversity over small spatial scales.***

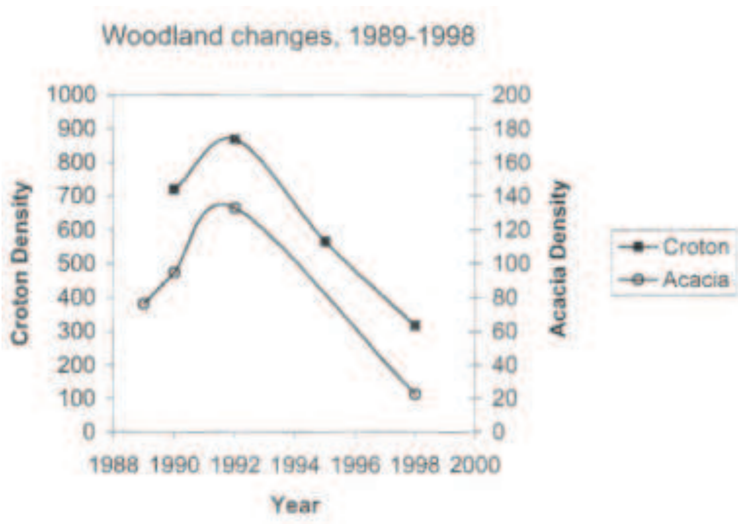

Figure 4: Croton and acacia decline, 1989 -1998 – (data from MMEMP)

Aerial surveys indicate that the elephant population in MMNR is increasing, thereby increasing the pressure on woody resources. At the same time, other wildlife is decreasing in the system, and browsers such as Eland and Giraffe appear to be decreasing faster than other species. This evidence supports the argument that MMNR is becoming less valuable for browsers such as Rhinos, partly due to elephant-induced habitat change. To infer elephants do not aggregate in the Mara riverine woods as emphasized by Samson Parsimei Lenjirr in reference to the KWS aerial survey map (Figure 5) of distribution of elephants in the Mara making the distribution area A suitable for Rhinos is ill conceived knowledge on demographic distribution of elephants that varies from wet to dry season, where in the wet season elephants ***disperse over wider geographical areas*** but ***converge in woodlands*** during the dry spell. The distribution map below could be a wet season survey as elephant counts are conducted both in the wet and dry season. The elephants represents the principal browse competitor for the Rhinos often displacing Rhinos as researched; ***The approaches included reduction and control of numbers of competing browsers in the sanctuary particularly elephants but also Giraffes and Buffaloes (which can take over 25% of their diet as browse).*** *(Brett and Adcock 2002; Okita-Ouma, Amin et al. 2005).*

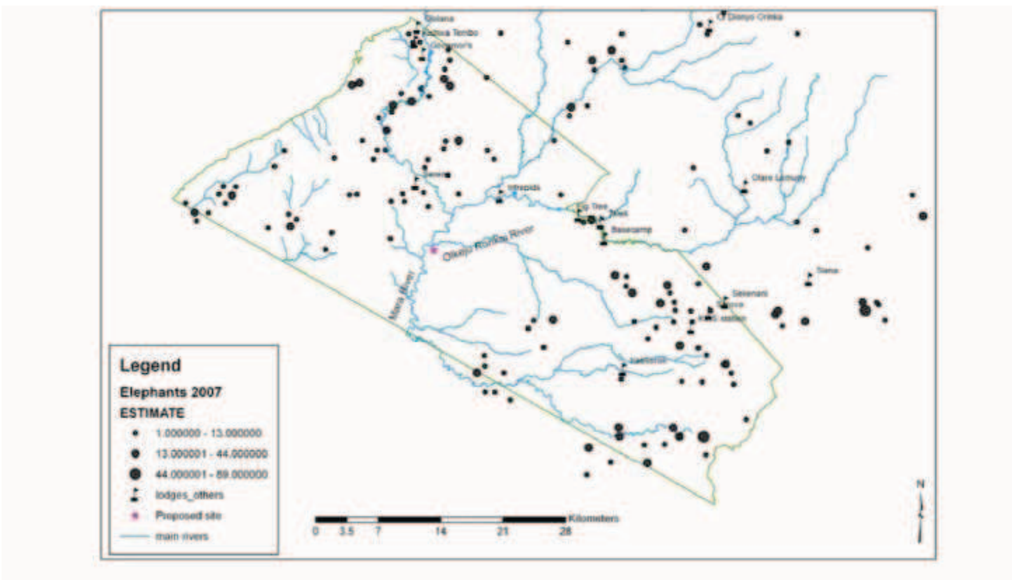

Figure: 5 Distribution of elephants in the Masai Mara Nov 2007(Adapted from KWS aerial count)

The influence of elephants on Rhino habitat is amplified in the 62 km^2 Ngulia Rhino sanctuary, a recognized safe haven for the Black Rhino established in 2006 compelling the Kenya Wildlife Service ***to remove elephants from the Rhino sanctuary owing to severe habitat degradation and browse competition*** (Figure 6). This intervention testifies to direct correlation of elephant densities and Rhino displacement. The deteriorating vegetation condition in the sanctuary details analysis of population data and assessment of habitat showed a 59% decline in the available Rhino browse between 1991 and 2005 (rhino food plants i.e. below 2 m high) and 100% decline of browse material above 2 m height (Figure 7). ***The analysis also showed that the Rhino population performance had been significantly declining over several years due to high densities of Rhinos and competing browsers particularly elephants*** (Figure 8). The annual growth rate had fallen to below the minimum national target of 5% *(Okita-Ouma and Wandera 2006)* and the situation warranted intervention.

The carrying capacity of the sanctuary had been reduced from an estimated 1-1.5 rhino/km2 *(Goddard 1969; 1970)* to approximately 0.6 rhino/km2 *(Brett and Adcock 2002; Okita-Ouma 2004).* The average body condition of both rhinos and elephants had also deteriorated from an average 'good' to 'fair' - 'poor' *(Okita-Ouma and Wandera 2006).* In such a situation, adverse or drought conditions could potentially irreversibly damage the future productivity of the area and cause a cessation of breeding by the Rhino population as well as a population crash. In similar situations, other black rhino populations have crashed *(Hitchins 1968; Emslie 1999; Emslie 2001)*

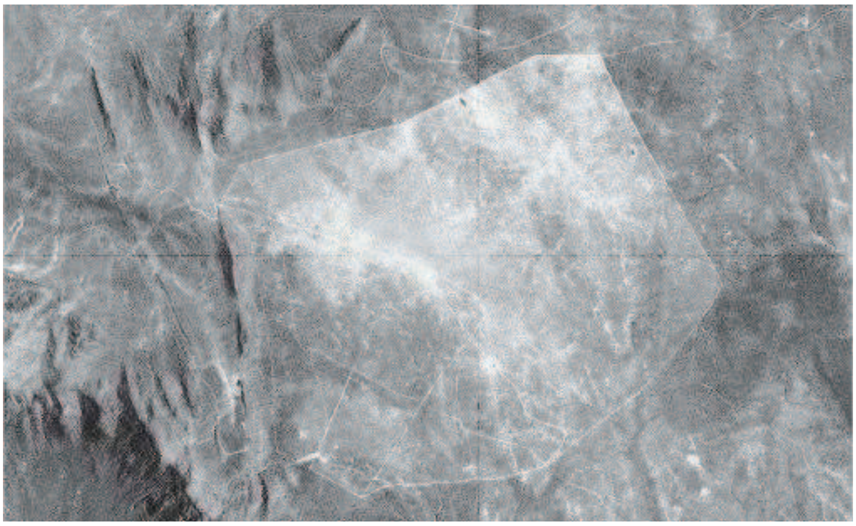

Figure 6: A LANDSAT TM satellite image (2001) of Ngulia rhino sanctuary showing the extent of vegetation degradation due to high density of browser species (Brett and Adcock 2002)

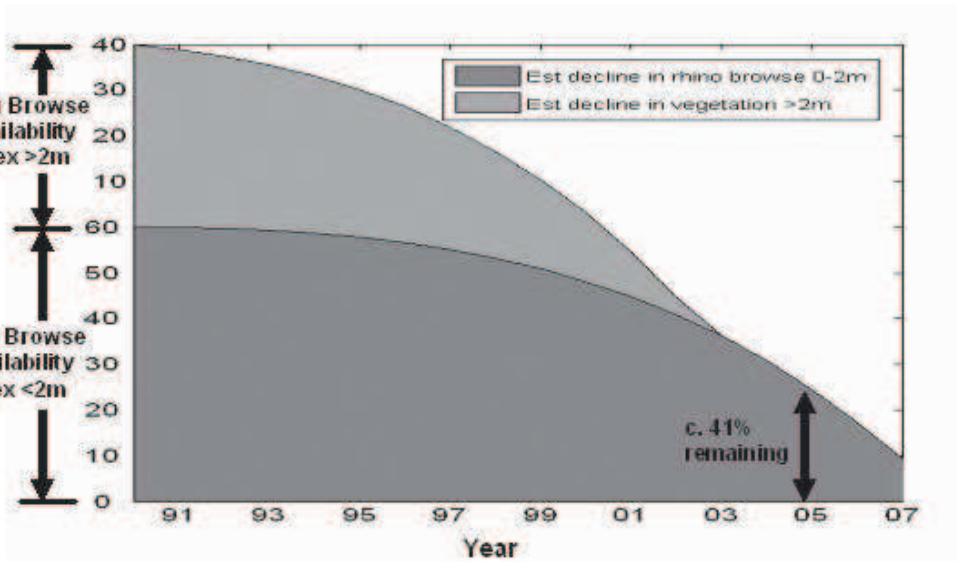

Figure 7: Estimated patterns of elephant impact on browse in the >2 m and of 0-2 m height ranges (updated from Brett and Adcock 2002).

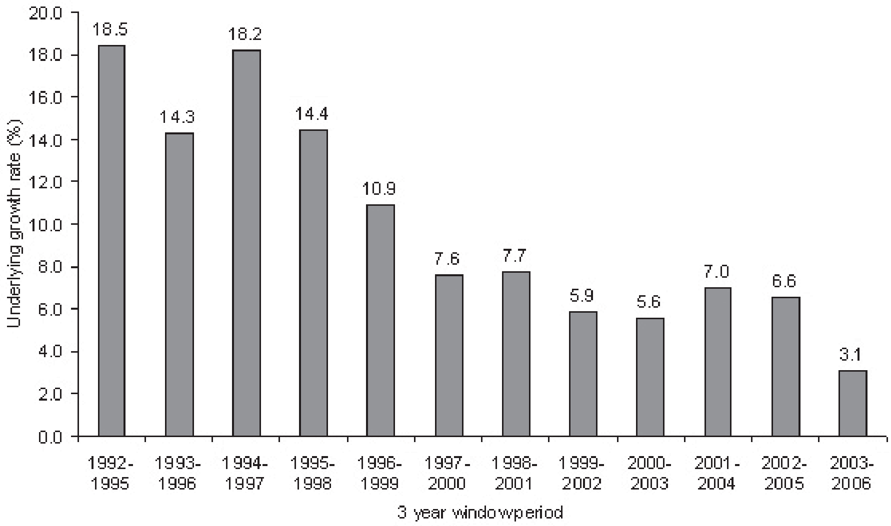

Figure 8: A 3-year moving average underlying growth rate of Ngulia black rhino population 1992-2006

In accounting for low Rhino numbers during the survey; ***The most likely explanation for the decline is dispersal out of MMNR (in the absence of carcasses as indicators of poaching and probable concealment in dense woodlands) principally into northern Serengeti as a continuous habitat for the Rhino. Several of the Rhinos living on the border have been seen south of Sand River within the Serengeti, so it is known that they can travel there. Moreover, a comparison of the age and sex structure of the current population with those animals known to have disappeared during the 1990s suggests that more sub-adults than expected have disappeared from the population, and that these are generally males*** *(Walpole et al., 2001).* Further Rhino surveys were carried out by *S. Milledge 1997 – 1998* and *M. J. Walpole 1998 – 1999* ***provides possible reasons of cross border movement into the northern Serengeti suggestive of sub adult movement in search of suitable less occupied habitat hence reasonable to assume permanent relocation*** *(M. J. Walpole 1998 – 1999).*

Although recent studies have shown that the current sex ratio of the MMNR Black rhino population is around 1:1.2 males to females, which is in line with other East African populations, and that recruitment and age structure is also close to that expected, concerns have been raised about slower than anticipated population growth and range expansion within the MMNR. This has been attributed to a number of possible factors, but most commonly the decline in woodlands within the reserve, which may have in turn reduced the area's ability to support Rhinos and resulting in the increased migration of individuals to the Serengeti. In addition it is difficult to confirm whether the current decline in the MMNR population increase is due to migration to the SNP, or other potentially more serious factors. *(Source - Biological management Programmes, MMNR Draft Management Plan 2009)*

Further evidence of a decline in resource quality can be gained from an analysis of Rhino food preferences. A total of 48 species from at least 25 families were found to be utilized by black Rhinos in the Keekorok sector of MMNR. The species with the most rhino browsing off take were *Grewia similis, Phyllanthus ovalifolius, Euclea divinorum, Croton dichogamus, Grewia bicolor* and *Flueggia virosa.* Together, these six species accounted for over 67% of all observed browse off take. Only 15 species comprised over 86% of all observed browse off take, suggesting that, whilst Rhinos utilize a wide range of plant species, they rely on ***relatively few species for the bulk*** of their diet. Evidence of Rhino feeding was found on plants in Croton thicket, Euclea thicket, bushy luggas, and open and bushy grassland. Of these habitat types, most browsing evidence was found along bushy luggas, where Phylanthus and Flueggia species were favoured, and also in open or bushy grassland with high densities of Grewia species.

Between 1972 and 2000, the favoured Acacia/Dichrostachys species declined in the diet considerably, whilst the less palatable Croton and Euclea species increased. Evidence proposes Rhino dispersal out of MMNR is driven by matched increase in woody resources in northern Serengeti *(Sinclair, 1995)*. It is also crucial to appreciate the methods adopted to determine browse availability for the Black rhino during the 1970's were not developed as is currently applied using the Rapid Visual Black Rhino Browse Availability (BA), *Adcock, 2004*, where browse availability (BA) is an "Index" that is correlated with the actual biomass of potential Black Rhino browse.

The woodlands of the MMNR have suffered dramatic declines over the previous four decades, primarily through a ***combination of impacts from both elephants and fire***. These habitats are vital for a number of species and evidence ***suggests increased competition amongst browsers for woody resources*** within the reserve. Croton-Euclea thickets have shown similar declines in the MMNR and evidence has shown that ***Croton-Euclea thickets over recent years are important food sources for Black rhinos (accounting for about 25 percent of their diet).***This importance has increased as other woodland species in the MMNR have declined**.** *(Source - MMNR conservation targets, MMNR Management Plan 2009)*

Whilst Rhinos are sedentary animals lending to recluse in shelter of woodlands, typifying behavioral ecology of Rhinos and other reclusive animals such as the Kudu and Leopard ***respond to anthropogenic disturbances by seeking the security of the wood cover***. The emphasized cover, of contiguous habitat when measured against current population and densities is no basis for arguing that in the construction of Ol Keju Ronkai camp in relation to the Mara river habitat would precipitate such disturbance to behavioral ecology, breeding or impact on wood cover for the 22 Rhinos in distribution area A (Figure 2B & Figure 3). It is to be noted that it is the Serengeti – Mara ecosystem that provides for the contiguous habitat and not constituted by Masai Mara in isolation.

Studies conducted in Sweetwaters indicate, ***Habitat preferences are shown in two ways, the amount of sign found in the different habitats, and the habitat content of home ranges and core areas. The rhinoceros at Sweetwaters show a preference for the denser bushlands, with home ranges containing mostly mixed bush and Euclea bush. The highest densities of middens and spoor were in riverine woodland, partly due to Rhino coming to drink, and may be artificially high due to the ease of finding spoor at the river's edge, and Euclea bush while most bedding sites were found in mixed bush and dense Euclea bush. The varying densities of rhinoceros sign***(*East African Wild Life Society, Afr. J. Ecol.)* ***in different habitats indicates a mosaic of habitats provide the optimum environment.*** The preference for dense bushland has been shown in other studies – Goddard (1970) found the highest rhinoceros densities in bushland and mixed woodland habitats. Other studies have had similar results, e.g. *Mukinya (1973)* and *Frame (1980).*

There can be no argument the Mara River woodlands complimented the existing extensive dry woodlands of the Mara, which for all purposes and intent has been destroyed and only remnants remain. However to emphatically insist on Rhino browse in the riverine woods, surveys in the Mara reveal; ***While the riverine woods and thickets provide shelter and security for Rhinos, it***

is the higher ground and hills with their shallow, porous, sandy soils, their greater cover of Croton and Euclea thickets, with the possibly greater abundance of herbs, legumes, shrubs and other favoured food plants that constitute the preferred habitat for the majority of Rhinos. *(Morgan - Davies 1996*)

A detailed study for an integrated management strategy for the conservation of Eastern black Rhinoceros (*Diceros bicornis michaeli*) in Kenya was conducted by KWS revealing in part, Rhino propensity depends on availability and quality of forage within habitats they are found as represented in Figure 9 below.

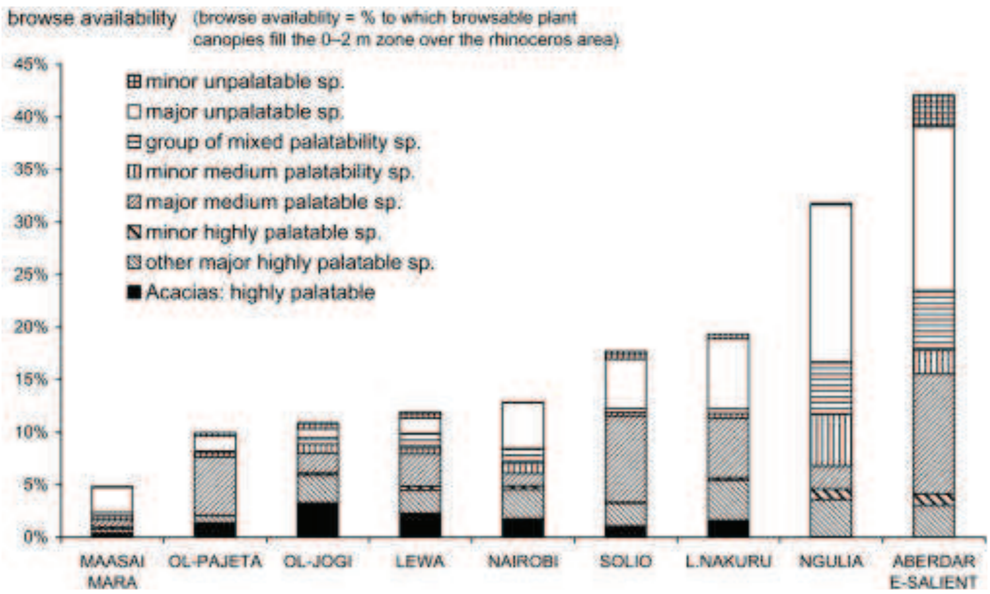

Figure 9: Amounts of available browse in each of the nine main black rhinoceros areas browse by palatability (i.e. the suitability of the browse component for black rhinoceros).

Black rhinoceros browse is almost totally within a 0–2 m height range and the browse availability (BA) measure indicates the percentage to which this 2 m layer is filled by browsable plant canopies. Further, monitoring habitats is important as ecological carrying capacity will change over time (in the medium to longer term) in response to habitat changes, which for Eastern black rhinoceros may be positive if there is increased browse availability of suitable plant species or negative with favoured food plants declining or growing out of reach, unpalatable species increasing at the expense of more palatable species, increases in alien plants (e.g. Lantana camara), frequent fire, increased grass interference and/or an increase in browsing pressure following a build-up in numbers of competitive browsers (e.g. African elephants *Loxodonta africana*, Giraffe, *Giraffa camelopardalis* and Cape buffalo *Syncerus caffer*) *(R. Amin, B. Okita-Ouma, K. Adock, R. H. Emslie, M. Mulama & P. Pearce-Kelly 2004)*

In emphasizing high ecological carrying capacity in distribution A, it is important to understand this is determined by coefficients for variables that represent among others, average annual rainfall, rainfall concentration (monthly spread), coldness or frost incidence, soil fertility, available standing browse biomass and browse suitability or quality. *(Keryn Adcock)* who further indicates; ***Note that the black rhino carrying capacity in an area is not fixed, It can and does***

change as habitat conditions change. Firstly, carrying capacity alters with year-to-year fluctuations in annual rainfall total and monthly distribution. Specifically, standing available browse, browse suitability (and condition) and climate may change over the medium and longer term. (E.g. with burning regime, vegetation succession, impacts of black rhino and other browsers on vegetation, global warming (dare we say)). Thus routine re-assessment of carrying capacity over time is needed to optimize black rhino management. (*Improving and standardizing methods of Black Rhino Carrying Capacity Assessment, Keryn Adcock*)

Rhino population growth may be restricted to a multiple of influences as JL Rachlow observes; applicable both to, *in situ* and *ex situ* populations; ***Because most African rhinos exist in relatively small reserves, an understanding of the implications of restricted dispersal and increased population density on their demography is critical to their conservation*** **in situ. *Managers need to consider trade-offs between enhanced safety from poaching and density-dependent effects on reproduction in developing conservation strategies for Rhinos and other rare, large species confined to reserve systems.*** *(JL Rachlow – 2001).*

In 1988, 20 rhinos were observed in MMNR. Considering only known births (n=25), deaths (n=7) and immigrations (n=5), the population grew to 43 individuals by 1999. However, by 'discounting' rhinos that had not been seen for two years or more (Leader-Williams, 1988), the population only reached a peak of 35 in 1993/94 before declining to 23 in 1998/99 (Fig. 13) (Walpole & Bett, 1999a; Walpole et al., 2001). It has since remained static at this level (P.Demmers, pers comm.).

Time Period	Area(km2)	Number of rhinos	Density (rhinos/km2)
1971/72 (Total)	749	108	0.144
1971/72 (Keekorok Sector)	395	72	0.182
1994/95 (Keekorok Sector)	345	31	0.090
1997/98 (Keekorok Sector)	370	27	0.073
1999/00 (Keekorok Sector)	254	22	0.087

Table 3. Black rhino distribution and density in MMNR *(after Walpole et al., 2001, incorporating data from Mukinya, 1973).*

There is no scientific documentation that suggests Rhinos go to a specific maternity area to breed and give birth rather Rhinos like most wildlife species seek the dense wood or thickets cover, and the Mara river woods are not the only wood cover available and if that is suggestive then we need to acknowledge the high loss of vegetation in the Mara from the 1950's – 1980's. It would be valuable to have documented data of all known breeding sites for the current Rhino populations in the Mara. The general rule of thumb is that for rhinos to breed most efficiently their numbers should be kept to 75% of the estimated carrying capacity and growth rates should be maximized to 7% if possible.

Deterioration of the environment in MMNR is also caused by excessive, off-road driving by thousands of tourist vans (Morgan – Davis, 1996). The increasing disturbance by tourist vehicles impacting on feeding areas, quantity and dynamics of browse availability in the open plains and dry woodlands of the Mara as is observed from the numerous uncontrolled roads and tracks, many of which are a result of illegal off-road driving that have more than tripled impacting negatively on the grassland ecosystem risking demographic changes in Rhinos and other herbivore species.

Figure 9: Off-road driving in the Masai Mara National Reserve resulting road tracks, which eventually lead to habitat degradation, were digitized from year 2000 aerial photographs, Remote Sens. 2009, (Charles Ndegwa Mundia, Yuji Murayama 2009)

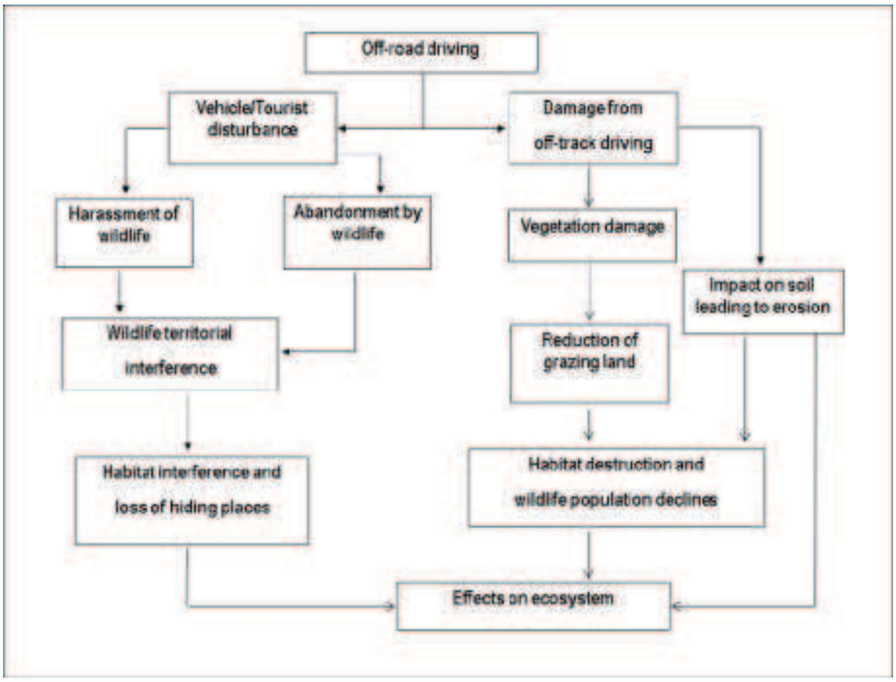

Figure 10. Effects of off road driving in the Masai Mara National Reserve and surrounding areas Remote Sens. 2009, (Charles Ndegwa Mundia, Yuji Murayama 2009)

The following observation on increased intensity of off road and impacts was recorded; All roads and tracks present in 1999 in MMNR were mapped using a hand-held GPS unit. At the time of mapping measurements of track and road widths were taken after every one kilometre. Additionally, roads and tracks that were present in 1991 were mapped from aerial photographs, to compare changes that may have occurred between 1991 and 1999. Results from digitized aerial photographs indicated that in 1991 the total length of roads and tracks in MMNR was 1,844.9 km. Most of these tracks were off the designated roads and game viewing tracks. Results from track mapping indicated that, in 1999, total lengths of tracks and roads were 2,166.7 km and 222.5 km respectively. There was, therefore, a total length of 2,389 km of tracks and roads in 1999. This translated to an increase of 544.32 km or 30% from what was present in 1991. *(Geoffrey Karanja 2001)*

The MMNR Draft Plan (2007 -2009) proposes additional facilities by inferring environmental appendages as Eco lodges and additional Special camp sites which would invariably increase visitors' occupancy of 180 beds in the MMNR and lead to exacerbation of vehicle pressure on the vegetation and constituting towards wildlife harassment and displacement. The Zonation & Visitor Use Scheme makes provision for off-road driving in the MMNR's Low Use Zone arguably having the potential of significantly enhancing the visitor experience but recognizes when inappropriately conducted, this activity can result in significant damage to sensitive habitats, as well as a deterioration of the visitor experience through harassment of wildlife, over-crowding, and visual impacts (*Source MMNR Draft Management Plan)*.

Table 12: MNR Low Use Zone accommodation and bed capacity prescriptions

	Site or Facility Name	Type	Maximum bed capacity
NAROK			
EXISTING	KJ5	Special campsite	16
	Kambi ya Nyoka	Special campsite	16
	KO3	Special campsite	16
	Don Young	Special campsite	16
	Ngorbop	Special campsite	16
	Tor Allan	Special campsite	16
	Kambi ya Chumvi/Olare	Special campsite	16
	Kambi ya Gnu	Special campsite	16
	Salt Lick Camp	Special campsite	16
	Olkiombo Base	Special campsite	16
	Kebololet	Special campsite	16
	Roof's Crossing	Special campsite	16
	Iseuri/Kigelia	Special campsite	16
	Oloibor Motonyi/OM1	Special campsite	16
	Losoito/OM2	Special campsite	16
	Podo Camp	Special campsite	16
	Sand River	Public campsite	20
NEW	Site to be identified	Ecolodge	30
	Site to be identified	Ecocamp	18
	Site to be identified	Ecocamp	18
	Site to be identified	Ecocamp	18
	Site to be identified	Special campsite	16
CLOSED	Ngenche	Special campsite	0
	Ol Ngaboli	Special campsite	0
	Oloibor Soit	Special campsite	0
	Olumutia	Special campsite	0
	Kampi ya Ndovu	Special campsite	0
	Freeman Safaris	Special campsite	0
	Olare Orok/Talek Junction	Special campsite	0
	Makari	Special campsite	0
	Mkindu	Special campsite	0
	Emboliei Nauyokie	Special campsite	0
	Il Macaun	Special campsite	0
	Franz Lang	Special campsite	0
Total Beds			*376*
TRANS MARA			
EXISTING	NO EXISTING FACILITIES		0
NEW	Site to be identified	Ecolodge	30
	Site to be identified	Ecocamp	18
	Ngiro-are	Special campsite	16
	Hammerkop	Special campsite	16
CLOSED	NO CLOSURES		0
Total Beds			*80*

Figure 11: MMNR Draft Management Plan 2007 – 2009 on proposed increase of bed occupancy

The concept is based on enforcement of regulations and entry of qualified driver / guides. While in theory this portends exceptional tourism value, experiences reflect the endeavour to adopt responsible practices convey the proposal as untenable where several policy enactments such as the Wildlife policy and Tourism policy that are already articulated are yet to be adapted by governing institutions and stakeholders of the tourism industry and may be wishful thinking given the apathy of the tourism industry in responding to sustainable tourism practices. It would be worth observing if the MMNR Management Plan, which obviously upholds correct principles in preserving PA's would be effected.

The high densities of visitors originate from outside the boundaries of the reserve with ***exceptionally high concentrations of tourism facilities***, and large proportion of visitors (77 %) who stay in lodges and camps outside the Reserve, but make heavy use of the reserve for their wildlife viewing – (*Source MMNR Draft Management Plan)*. According to the same draft it espouses measures need to be incorporated into the management plan designed to encourage tourism facilities located outside the reserve to make more use of the Greater Mara Ecosystem rather than relying on the reserve itself as their primary tourism product.- *(Source MMNR Draft Management Plan).*

The above recommendation is self conflicting in reference to ***exceptionally high concentrations of tourism facilities*** (*Source MMNR Draft Management Plan*) outside the reserve and constitutes a contravention of recommendations to limit impacts on dispersal and migratory areas that already is succumbing to settlements expansion, farming and increased livestock *(Lampery & Reid, 2004), (Sitati, 2003), (Coast, 2002), (Ogutu, 2000, Ottichilo et al 2000), (Serneels et al 2001; Thomson & Homewood, 2002: lamprey & Reid, 2004)* and *(Stelfox et al 1986*) affecting habitat heterogeneity outside the boundaries of MMNR that directly impacts on the MMNR.

To ignore the seasonal trends of wildlife and restrict conservation within the confines of PA's boundaries is simply failing to appreciate ecological tendencies of wildlife. There are numerous scientific references on loss of dispersal and migrating corridors regarding the movement strategies of large herbivores and their consequences for foraging efficiency in relation to resource density (Behavioral Ecology 18:1065–1072 (2007). Several studies show that animals often adjust their decision making in relation to the density of food resources *(Benhamou and Bovet 1989; Bell 1991; Turchin 1998; Farnsworth* and *Beecham 1999; Nolet and Mooij 2002; Benhamou 2004; Newlands et al. 2004)*. It is observed animals foraging in an area with high food abundance have a lower net displacement and decrease the chance of leaving the high resource density area, thereby increasing the utilization of resources *(Kareiva and Odell 1987; Turchin 1991; Focardi et al. 1996; Bartumeus et al. 2005).*

In aggregating the nine ecological reasons for disproval of the Ol Keju Ronkai Camp included the decline in wildlife abundance and the extinction of species, the Roan *(Hippotragus equinus*) and Greater Kudu *(Tregelaphus strepciceros*). The reference to these two antelope species that were decimated in the Mara Reserve due to illegal poaching *(Arcesce et.al, 1995)* is clearly an attempt to evoke sympathy against OlKeju Ronkai Camp rather than lend correct testimony on the extinction of the two species.

To appreciate contributing factors to wildlife species decline, evidence is provided;

The Lion (*Panthera leo*) is considered to be vulnerable (Bauer et al. 2004) as it has declined in two decades by 30-50% throughout Africa with a 60-80% decline in Masai land (Frank et al. 2006).. In 2004, East Africa's lion population was estimated at 11,000 mature individuals, with

2280 of these in Kenya, and with 558 of these within the MMNR *(Bauer 2006).* Retaliatory and pre-emptive killing of lions by the community, particularly livestock owners is the single greatest threat to lion populations *(Frank et al. 2006).* In recent past, other precipitating such as the outbreak of canine distemper virus in 1994 killed 35% of the Serengeti and Masai Mara lions and deliberate Furadan poisoning severely impacting on lion populations in the Mara.

The African wild dog (*Lycaon pictus*) is listed as endangered because the species has been virtually eradicated in East Africa, with its remaining strongholds being in Southern Africa (McNutt et al. 2004). There has been a dramatic decline over the past 30 years with wild dogs disappearing from 25 of the 39 countries they were once recorded *(Woodroffe 1997*). The species' major threats are human activities, including direct persecution, which is the single most important cause of wild dog declines throughout Africa, as well as disease (canine distemper and rabies*) (Woodroffe 1997, McNutt et al. 2004, Roelke-Parker et al., 1996; Morell, 1995).*

The downward trend of Kenya's eastern white-bearded wildebeest populations has continued and accelerated*. (R. Kock in litt., 2005) Darling (1960)* estimated the wildebeest population of the Mara-Loita Plains at 15,000 animals in 1958. In 1961, *(Stewart & Zaphiro 1962*) counted 17,817, while in October of the same year Zaphiro & Stewart *(Stewart, personal communication, 1967)* counted 22,961. Aerial surveys of Kenya's rangelands by DRSRS showed that Narok District had a greater decline in wildlife populations between the 1970s and 1990s than almost all other parts of the country. Estimated numbers of most of Narok's wild ungulate species showed a statistically significant decline because the expansion of large-scale wheat farming and small-scale agricultural settlement that was reducing areas for wildlife. The estimated total number of wildebeest in Narok District (excluding the Serengeti migrants) in the late 1990s was estimated to be only 25% of that in the mid-1970s *(Ottichilo et al. 2001).* During the last decade, the resident Kenyan population of the western white-bearded wildebeest has declined further, by 50% *(R. Kock, in litt. June 2005)*

Declining woodland cover in the MMNR (*Dublin 1995; Lamprey & Reid, 2004)* is associated with expansion of settlements *(Lampery & Reid, 2004)*, cultivation *(Sitati, 2003*) and human population growth *(Coast, 2002)*. Thus progressive habitat loss and fragmentation in the pastoral ranches also contributed to decline in wildlife abundance in MMNR. Declining woodland cover in the Mara is consistent with declining giraffe numbers in the Mara reserve and the ranches *(Ogutu, 2000, Ottichilo et al 2000).*

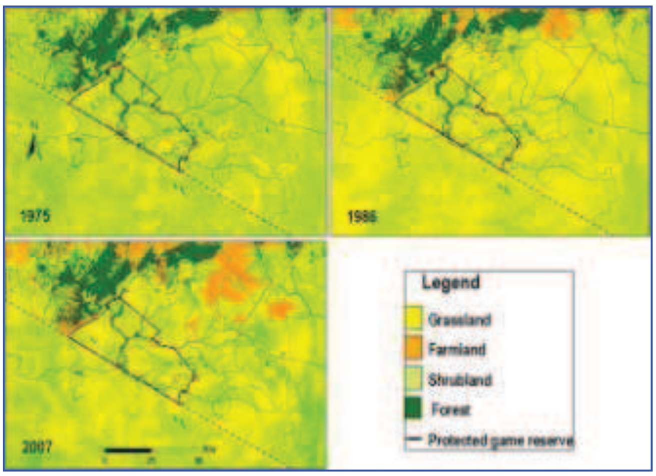

Figure 12: Land use/cover changes in Masai Mara Ecosystem derived from satellite images

The analysis of the land use/cover changes and wildlife population trends has revealed substantial changes in Masai Mara Ecosystem over the 32-year study period. Agricultural farms around Masai Mara National Reserve have expanded from about 15,000 ha in 1975 to over 147,000 ha in 2007, suggesting that agricultural expansion is one of the major driving forces of land use/cover change and wildlife decline. Over the last 30 years Masai Mara ecosystem (MME) has lost about 8% of its rangeland to crop farming. The wheat farms have taken over 50,000 acres while subsistence farms have increased five times within the same period. Along with the immigrant communities, the Maasai have also started to grow crops. Farms are now only 25km away from the Mara reserve. By 2004, there were about 300 acres of farms in Koyiaki, whilst in the Transmara side of the ecosystem, farms have expanded towards the reserve at a rate of 1.5km a year and 15,000 acres are now under cultivation.

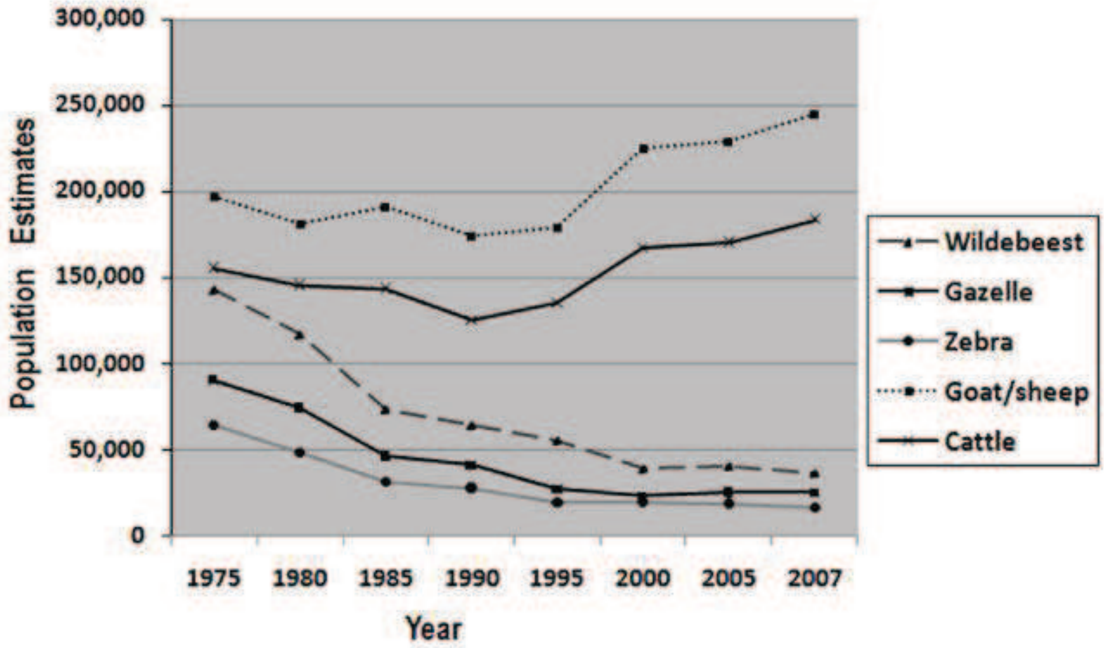

Figure 13: Wildlife and livestock population trends in Masai Mara Ecosystem, 1975–2007. Source: Aerial survey by Department of Resource Surveys and Remote Sensing (DRSRS).

Reduced spatial habitat heterogeneity due to widespread clearance of wooded cover for settlements, cultivation, fuel wood *(Serneels et al 2001; Thomson & Homewood, 2002: Lamprey & Reid, 2004)* ***displaced or excluded wildlife from the ranches and compressed them in the reserve denying wildlife access to water and forage in the seasonal dispersal and migratory movements*** *(Stelfox et al 1986).*

Between 1989 and 2003 the ILRI scientists carried out monthly ground counts of seven ungulate species - Giraffe, Hartebeest, Impala, Warthog, Topi, Waterbuck, and Zebra. They found significant declines in Giraffe, Impala and Topi, and even greater declines in Warthog and Hartebeest.

The trends they observed are backed up by a separate, aerial count of wildlife undertaken between 1979 and 2002, by the Kenyan government Department of Resource Surveys and Remote Sensing. By 2002 studies provides the most detailed evidence to date on declines in the ungulate populations in the Mara and how this phenomenon is linked to the rapid expansion of human populations near the boundaries of the reserve. For example, an analysis of the monthly sample counts indicates that the losses were as high as 95 percent for Giraffes, 80 percent for Warthogs, 76 percent for Hartebeest, and 67 percent for Impala.

In the past, population estimates have only been based on identifiable animals, which provided a minimum index rather than an estimate of the true population size monitoring method undertaken. Improved and efficient technologies are today adopted in the application of mark–recapture methods (using the continental level Rhino Bayesian Mark–Recapture software tool *(Emslie & Amin, 2003)*, for estimating population size to ensure accurate recording of sightings of both identifiable and clean rhinoceros, with equal emphasis on each sighting *(Okita-Ouma 2004).*

To recapitulate, the following critical observations are made,

1. That the OlKeju Ronkai camp is located within the close proximity of the Rhino distribution A (Figure 2 A, Mukinya 1973) is a flagrant disregard of the subsequent surveys carried out that configures distribution A away from close proximity of the OlKeju Ronkai camp (Figure 2B 1995, & Figure 3B, 2000).

2. Samson Parsimei Lenjirr and others emphasized, based on study by Mukinya (1973), on the high density of Rhinos of 0.14 Rhino per km^2 yet records testify following configuration as occurred, was 0.09 Rhino per km^2 (Morgan – Davis 1996).

3. Samson Parsimei Lenjirr profiles from the NCC Rhino surveys following construction of the OlKeju Ronkai Camp, fewer sightings of Rhinos in distribution area A as a consequence to disturbance (his reference has been consistent with Figure 2A; Mukinya1973 rather to Morgan Davis 1996, Walpole 2000) fails to explain no sightings of the Rhino in April prior to the construction of the complex. Several possibilities may emerge; a) owing to sedentary nature of Rhinos any level of disturbance, whatever the attributes, Rhinos seek cover or resort to nocturnal feeding. b) even if during the construction period Rhinos were displaced, as indicated this report Rhinos would return to the home range, ***such with temporal distribution of wildlife, unless the disturbance remained constant,*** compelling permanent emigration.

4. The argument that distribution area A holds the highest numbers of Rhinos reflecting the most suitable area hence high ecological carrying capacity. Ecological carrying capacity (ECC) (sustainably) is defined as the maximum number of a species (Rhino) that can be supported by the resources of a specific area and measured browse availability (BA) as an “Index” that correlates actual biomass of potential Black rhino browse at a given site. Several studies show that animals often adjust in relation to the density of food resources *(Benhamou and Bovet 1989; Bell 1991; Turchin 1998; Farnsworth and Beecham 1999; Nolet and Mooij 2002; Benhamou 2004; Newlands et al. 2004)* and specifically for the Rhino, larger home ranges are largely dictated by browse availability, the bigger the home range, the less suitable browse is available and ***changes in vegetation structure and composition contribute to Rhinos maintaining larger ranges in order to meet their nutritional requirements.*** *(C Reid - 2007).*

5. That intensive monitoring since the mid 1980’s have shown the majority of Rhinos reside in the Keekorok sector, with numerous sightings along the Olkeju Rongai stream. This may be the case during the 1970’s to 1980’s (refer to Mukinya 1973, figure 1, 2A, 3A) but is ***highly debatable*** demanding proof as ***it is not consistent*** with mapping of Rhino distribution areas carried out in the 1990’s (refer to figure 2B and figure 3B).

6. Declining woods and excision of prime Rhino habitats is keeping the Mara Rhino population below a third of its historic population levels (about 150 animals in 1960). To begin with these numbers were substantially reduced through poaching and in several instances in this report have we quoted references to habitat degradation through induced elephant and fire influences throughout the 1970 – 1980 periods. It has to be stressed poaching of Rhino continued into the late 1990's coupled by competition with other browsers and emigration into northern Serengeti could explain low levels in populations. The construction of Ol Keju Ronkai Camp commenced in 2006 and gathering from recorded variances, population numbers have fluctuated averaging 40 individuals, attaining a peak of 35 in 1993/94 *(Morgan – Davis 1996),* declining to 23 in 1998 *(Walpole & Bett, 1999a; Walpole et al., 2001)* never once recovering to half the 1960's population and has since remained static at this level *(P. Demmers, pers comm.).* Interestingly during the period of variances and peak indicated, half of the numbers of accommodation found within the reserve did not exist during this time frame giving clear indications that the prime limiting factors for Rhino population growth has been either sustained poaching, food competition with other browsers, reduced food availability or all the combined factors.

7. The small number of the Mara Rhino population raises serious concern on their long term genetic viability. This is responded by two important aspects for the species a) The Mara ecosystem transcends beyond the Loita plains provided for wider geographical area that previously formed the home range of this genetically pure population reducing the risk of in breeding. The outlaying areas being excluded and narrowed to localized areas in the reserve as defined by Mukinya 1973 and owing to poaching and livestock interfaces precipitated the confinement of the Rhinos to distribution areas as defined in figure 3B, b) the Serengeti – Mara ecosystem forms the contiguous habitat for the Mara Rhinos and several records show the cross border movements of the Rhino could limit the risks as the Serengeti Rhinos form the same genetic pool. The risks of genetic viability is acknowledged, however this alarm should have been voiced during the study period between 1980 – 1990's by several research authorities and even during which time Samson Parsimei Lenjirr was the Warden in charge and having worked for the Kenya Wildlife Service Rhino committee for 12 years.

8. On massive decline in numbers of species requiring riparian habitats, this has been adequately analyzed in this report and submitted researched testimony on extinction of species, the Roan, Kudu and wild dogs that were poached or persecuted to extinction. It is also important to recognize predation is seldom considered in the management of black rhinoceros but should be when attributing cause to poor population performance of this critically endangered species.

9. The riparian habitats and species that abode in these habitats are dependant on the retention of the Mau forests as a water tower that feeds the Mara basin. The Mau forest has been the focus of this country's attention following massive deforestation and illegal occupation of the water tower that the Mara reserve and its wildlife is dependant upon. The obvious failings of Samson Parsimei Lenjirr is in recognizing the ***fundamentals and dynamics of functioning ecosystems*** and seems to determine the conservation and future of the Mara reserve and its Rhino population in isolation and without regard to other wildlife densities.

10. It is ironical that having served as warden in charge of the Rhino and ecological monitoring in the Mara from August 1995 to July 2007, Samson Parsimei Lenjirr in the span of time failed to recognize ecological indicators that posed a threat to the Rhino population in the Mara, a period of intensive degradation and mushrooming of tourism facilities within and on the boundaries of the Mara reserve. It seems apparent the task was limited to Rhino counts rather than ecological monitor that would have raised the red flag and adequately identified limiting factors attributing

to static Rhino populations in the Mara in relation to sustained growth targets met in other Rhino conservancies.

11. That the MMNR second draft Management Plan for the Mara that has taken two years in the making, and yet to be ratified, not only recognized the high densities of visitors originate from outside the boundaries of the reserve with ***exceptionally high concentrations of tourism facilities***, and large proportion of visitors (77 %) who stay in lodges and camps outside the Reserve, but make heavy use of the reserve for their wildlife viewing – (*Source MMNR Draft Management Plan),* failed to address high tourists numbers and set ceiling but rather proposes added numbers, and in justification, use eco labels.

12. An inter-ministerial audit indicates 108 units in the Greater Mara Ecosystem with almost 4,000 beds where only 29 per cent are in business legally and operating under poor waste management is a source of pollution of the Mara ecosystem. The audit further identifies 92 of these facilities did not have the mandatory Environment Audit Assessment certification while 98 facilities did not have a physical plan. The audit testifies the poor status and quality of accommodation in these facilities because of lack of standards and non-enforcement of existing regulations. Alarmingly the audit reports dismal compliance with all existing laws, including the Local Government Act, the Forest Act, Tourism Regulations, Kenya Revenue Authority laws and regulations and those which govern regional authorities and holds the National Environment Management Authority accountable to why this state of affairs has persisted under its watch (*Source- Daily Nation 18th February 2010)* and certainly the mute silence of Samson Parsimei Lenjirr and others over these developments that occurred in over a decade.

13. OlKeju Ronkai Camp recognizes the value of conservation of the Rhinos and its status and is not in opposition to the protection of the species. OlKeju Ronkai was not a party to the turbulence of the Rhino during the 1960 – 2000 period or to any of the intensive degradation that occurred during described herein during the same time span. There seems apparent prejudice towards OlKeju Ronkai Camp where none of the existing facilities currently within the Mara reserve, particularly in the Mara River ecological zone have proper waste management systems or any effort to audit disposal of effluence and solid waste that holds serious environmental ramifications for the Mara River.

The submission by Samson Parsimei Lenjirr as Chief Game Warden, Mara Triangle and others in opposition of the construction of OlKeju Ronkai Camp deliberately ignores these fundamentals, and fails to appreciate the holistic factors that contribute to wildlife displacement throughout the greater Mara ecosystem. The report shows selectivity and is highly opined and seems to discount a range of historical and current limiting factors on population dynamics in several well researched and documented records.

It then qualifies to state that Samson Parsimei Lenjirr and others have chosen to influence, through prejudiced information, to arouse opposition to the OlKeju Ronkai Camp by appealing to emotive responses generated from the status of the Black Rhino listed by IUCN as endangered species rather than present the underlying reasons for the static Rhino populations spanning almost two decades, the spiraling effects of land use changes in the ancestral dispersal and migratory areas that constitute the Mara ecosystem and have severe ramifications on the Mara reserve, its wildlife populations and retention of habitat heterogeneity crucial to wildlife and species survival.