Trophy Monitoring of lion and leopard trophies in Niassa National Reserve, Mozambique: 2007 Hunting Season

Prepared for:

SRN

(Sociedade para a Gestão e Desenvolvimento
da Reserva do Niassa, Moçambique)

As part of the

Niassa Carnivore Project

By

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Principal Sponsors

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1.0 Recommendations for 2008 Hunt Season

Based on the results presented in this report, we recommend the following actions for 2008.

Trophy quality

1. The number of underage lions taken as trophies is gradually declining, and the SRN Lion Regulations with their associated points system appear to be having a positive effect. We therefore recommend that they remain in place and continue to be strictly enforced.
2. Additional measures need to be taken by SRN or the Niassa Hunters Association against specific professional hunters (PHS) that consistently show poor hunting practices and continue to shoot underage individuals. We suggest that individual PHs who take an underage lion or a female leopard as a trophy, or fail to supply complete information of their lion and leopard hunts on more than one occasion should be barred from hunting lions or leopard for a season (similar to a match ban in sports). By making the PH listed on the Hunt return form personally responsible for a leopard or lion trophy should also minimize the ongoing practice of non-resident, unregistered PHs bringing their clients into Niassa for a single hunt, hunting under a resident PHs license. At the very least this will ensure that the resident PH plays an active role in trophy choice.
3. It is essential that a meeting of PHs be held at the beginning of each hunting season (perhaps at Mbatamila) to pass on information, new regulations and discuss visual aging cues for trophy animals. Information provided at the SRN operators meeting is not filtering down to all the PHs.
4. As recommended in the 2007 report, it is essential that a greater effort be made by PHs to utilise a greater proportion of the hunting concessions to prevent over utilization of certain areas, particularly the narrow band along the Lugenda River and at concession boundaries. Quotas are set based on the entire area of the concession and higher quality trophies (and older individuals) are more likely to be found in areas not heavily utilised in recent years.

Monitoring

1. The proportion of lion hunts that are unsuccessful in a season provide important information on hunting effort and lion density. To better understand why lion hunts are unsuccessful, we suggest that PHs should fill out the short lion questionnaire for each lion hunt irrespective of whether a trophy is taken or not. In addition we recommend that PHs continue to fill out questionnaires for each leopard trophy and be required to take the appropriate measurements (head-body length, neck circumference, weight)
2. Grid map codes should no longer be acceptable for the recording of the position of trophies. All PHs must provide a GPS position in decimal degrees.
3. Disposable cameras will no longer be provided for lion trophies; however operators must ensure that digital images of the lion nose, mane, and side view of the body are provided when skulls are aged.

4. The onus should be on the operators to compile all the information required by SRN before the trophies are inspected, not on the NCP team to gather this information after inspection. As stated in the Niassa Lion Regulations, incomplete information (including unusable photographs) will result in zero points being given for the trophy in question.
5. Agostinho Jorge (SRN Monitoring officer) will accompany the Niassa Carnivore Project team to age skulls in November 2008 and will be given experience in aging live lions and leopards through fieldwork and the lion call-up survey.

2.0 Objectives

A detailed report on lion and leopard trophy monitoring was prepared in 2007 (Begg & Begg 2007) and a comprehensive update will again be provided in 2011 as part of the final Niassa Carnivore Project (NCP) report. This interim report serves to provide an annual review of the lion and leopard trophies taken in 2007 and the trophy-monitoring component of the NCP. Additional information on the NCP is provided in a separate report.

The overall goal of the NCP is to ensure that viable populations of the large carnivore populations (lion, leopard, spotted hyaena, African wild dog) are secured in NNR and their status and threats are effectively and systematically monitored. With regards to sport hunting, the NCP aims to:

a) Ensure that by 2010 less than 20% of the lions taken as trophies in Niassa each year are underage (< 6 years).
b) Establish a sustainable and effective SRN trophy monitoring system for lion and leopard that is not researcher driven.
c) Validate visual aging cues for leopards and lions that can be used by PHs to minimize the number of young and female individuals taken

Plate 1: Monitoring and aging of leopard and lion trophies in 2007 (Block L8)

3.0 Lion Trophy Monitoring

2007 TROPHY MONITORING RESULTS

Plate 2: The oldest lion taken in NNR during the 2007-hunting season by Johan Calitz Safaris (Block L2)

3.1 Methods

- At the NNR Operators Meeting held in Lichinga (May 2006) all operators were provided with lion kits for each lion on quota. These contained a questionnaire, map, and disposable camera. In addition a booklet on aging lions (A Hunters 'Guide to Aging Lions in eastern and Southern Africa, 2006), the 2006 trophy report and two printouts illustrating acceptable lion trophies in Niassa were provided to each operator.
- All hunting concessions were visited in October / November and skulls were aged from tooth wear and measured and one premolar was taken from each skull to X-ray pulp cavities.
- Additional information on opportunistic sightings of lions, problems with aging etc was gathered and discussed with PHs wherever possible.
- Each lion trophy was then independently aged based on tooth wear, closure of the pulp cavity, mane development, nose pigmentation and general body condition, using criteria developed specifically for Niassa lions since 2004 and from other research (see Begg & Begg 2007), and placed in one of three age categories: < 4 years of age, 4-6 years and older than 6 years.
- 2008 Quotas for each hunting concession were then calculated according the SRN Niassa Points System (Table 1) and SRN lion regulations (Appendix A).

Table 1: Niassa Points System: Points are assigned to lions in different age categories based on the quotas for each concession

Lion Quota	Number of Points for each trophy				
	> 6 yrs	**No trophy**	**4-6 yrs**	**< 4 yrs**	**Incomplete info**
For Quotas of 3 or more	4	3	2	-3	0
For Quotas of 2	4	3	2	0	0
For Quotas of 1	6	3	0	0	0

3.2 Results of 2007 Hunting Season

3.2.1. Monitoring by PHs

- Professional Hunters provided information (date, number of individuals, position, condition), photographs for all eight of the animals. However, nose photographs were not provided for two lions (R1, L2), and the nose photo of one lion could not be used as it was not focused (L9).
- Only two PHs used the disposable camera, all other photographs were provided digitally.
- Many PHs had not received the information provided to operators at the Lichinga meeting. The aging booklets and printouts were in most cases not easily available in camps for PHs to consult.
- Additional information on carnivore sightings were provided by all concessions. The sightings book regularly filled in by Kambako PHs was particularly useful.

3.2.2 Off take

- The Ministry of Tourism (MITUR) assigned a quota of 16 lions to NNR in 2007, however only 15 lions were allocated to the hunting blocks by SRN based on the Niassa Points System and the quality of the trophies taken in 2006 (Begg & Begg 2007). In addition Block L1-Nkalapa (formerly Block D1) was not operational in 2007, and the quota of 3 lions assigned to this concession were not used.
- An effective quota of 12 lions in five hunting concessions was therefore available in NNR in 2007 (Table 2), and all of these lions were purchased by the sport hunting operators.
- An off-take of 67% of the available quota was recorded in 2007 (eight of the 12 lions), which represents 50% of the MITUR assigned quota (Table 2).
- Individual concessions showed two interesting changes in off-take in 2007. Luwire, which currently manages hunting concession L9 and L7 has consistently taken 80-100% of the approved quota over the past five years (2002-2006, Fig.1.) but showed a marked decrease in their off-take in 2007. Only two of a possible 5 lions on quota were taken, despite these lions having been purchased. At least four lion hunts were unsuccessful, as suitable lions were not seen. This reflects positively on the PHs and suggests the trophy monitoring and Niassa Points System is having the desired effect of assisting PHs with how to age Niassa lions and ensuring they remain cautious about shooting underage lions.

However, it also suggests that at least in Luwire there are currently few lions over the age of six in the more heavily hunted areas, and perhaps the population has been over hunted in these areas.

- Kambako (L8 concession) hunted lions for the first time after a three-year rest period; two lions were taken.
- By plotting where lion trophies have been taken since 1998 (n= 63, Fig 2) it is apparent that lion hunts are concentrated in a narrow band along the Lugenda River. Of particular concern is the heavy concentration of lion hunts around river boundaries between concessions with operators on either side of rivers that form the boundaries utilising the same subpopulation of lions. This is particularly obvious in the L2- Sable Camp-L7 Metarica area (n = 8 lions; Fig 1), along the boundary between Block L7 and L8 (Luambezi River, n = 8 lions, Fig. 1) and between L8 and L9 (n = 8 lions). It is unlikely that lions over the age of six will easily be found in these areas as the older pride males have already been killed. If PHs wish to find high quality trophies we suggest they need to bait further afield and utilise more of their concessions, particularly the inland woodland sections and give these more heavily utilised areas a rest. There also appears to be some confusion about the R1 and L1 boundary (Fig 1). As two of the lions taken in 2006 by L1 and a lion taken in 2007 by R1 are in the same block.

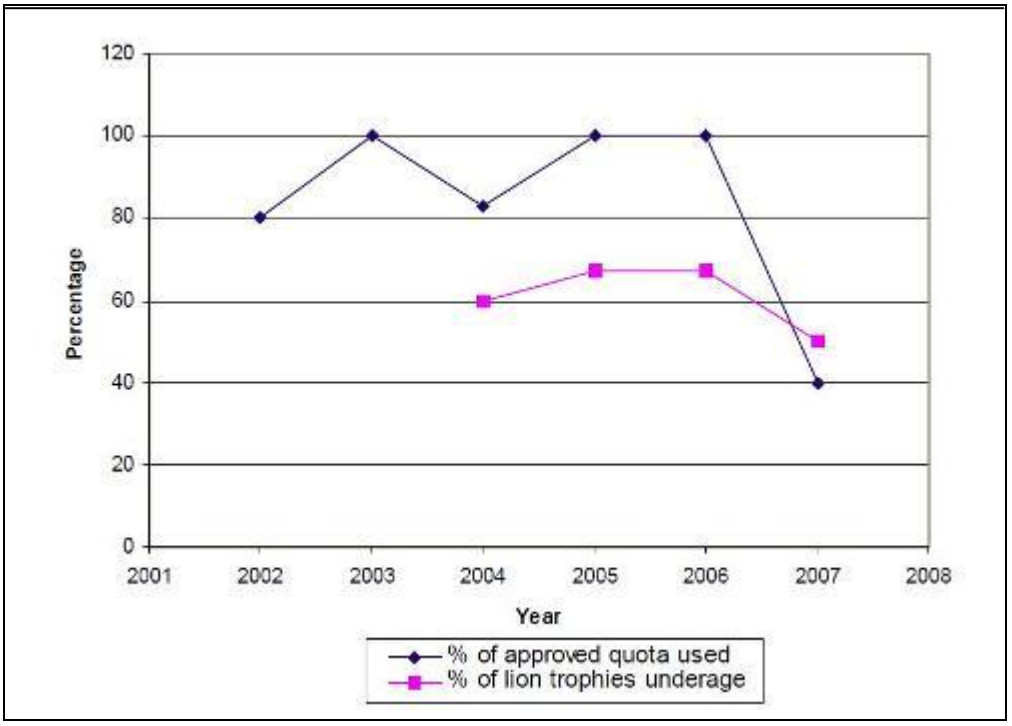

Fig. 1. Off-take as a percentage of available quota in LUWIRE (Block L7 & L9) showing the marked decrease in off-take in 2007 (40% compared to 100%). The percentage of the off-take that comprises underage lions is also plotted showing the slight decrease in 2007, this follows the slight decrease in underage lions taken over all the concessions. More data is required to assess whether this is a significant trend.

Table 2: Lion off-take in Niassa National Reserve per hunting block and overall

Category	Hunting Blocks in Niassa National Reserve						
	Block L9	**Block L8**	**Block L7**	**Block L1**	**Block L2**	**Block R1**	**Total**
2007 Results							
Allocated lion quota 2007	2	3	3	3	2	2	15
Number (%) of lion quota used 2007	1 (50%)	2 (67%)	1 (33%)	0	2 (100%)	2 (100)	8 (53%)
Percentage of 2007 lion trophies older than six years.	0	50%	100%	Inactive	50%	50%	50% acceptable
Overall 2004 – 2006	**Block L9**	**Block L8**[a]	**Block L7**	**Block L1**[d]	**Block L2**[b]	**Block R1**[c]	**Total**
Total lion quota allocated 2004-2007	8	12	15	7	9	10	61
Total lion quota used (%) 2004-2007	6 (75%)	4 (33%)	12 (80%)	2 (29%)	6 (67%)	4 (40%)	34 (56%)
Underage lions as a percentage of off-take between 2004-2007.	67%	75%	67%	0%	67%	50%	55.9 (19 lions)

[a] Block L8-Kambako was taken over by new management in 2005. Since 2005 only 50% of lions have been underage, no lions were taken in 2005 and 2006.

[b] Block L2 had a lion quota of 2 in 2004 and 2005; this was increased to 3 in 2006, decreased to 2 in 2007 due to low quality of 2006 trophies.

[c] Block R1 had a lion quota of 3 in 2004 and 2005; this was reduced to 2 in 2006.

[d] Block L1 was not operational in 2007

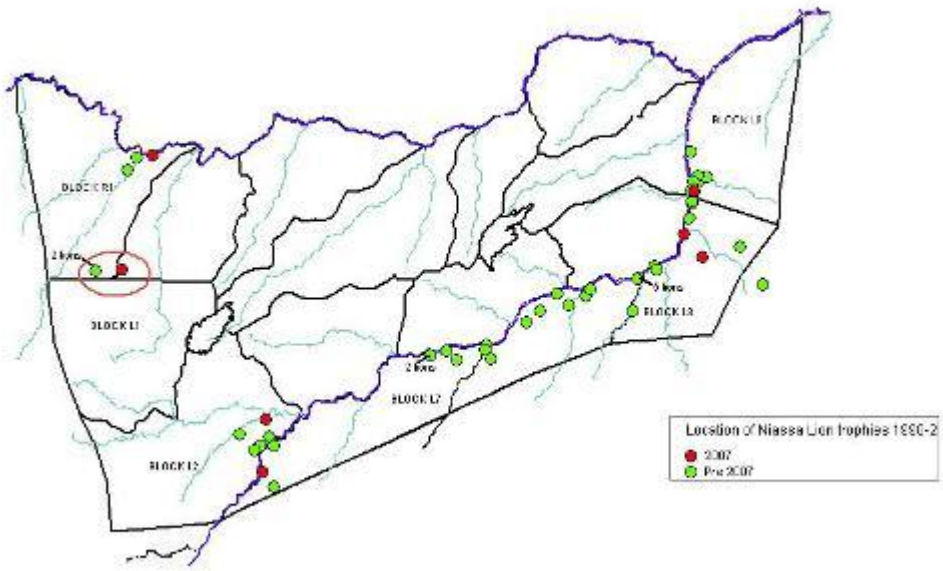

Fig. 2. Location of lions shot as trophies since 1998 (where information is available, n = 63). The positions of lion trophies taken in 2007 are shown in red. Note the concentration of trophies shot along rivers that form concession boundaries (L2 & L7; L7&L8; L8&L9). There also appears to be confusion about the R1-L1 boundary. Two lions taken by concession L1 in 2006 now appear to be in Block R1

3.2.3. Trophy quality

- Photographs of the eight lion trophies and aging criteria are shown in Plate 3. Four lions were over six years of age (50%) and considered acceptable trophies (a-d). The remaining four lions were neither acceptable trophies in terms of age nor in terms of mane development and were placed in the 4-6 year age category. Of these, two lions were on the upper end of this age category (5-6 years old, Plate 3e & 1f) and two lions were on the lower end of this category (Plate 3g & 1h). No lions under the age of four were taken as trophies. One underage lion was taken by each of the operators hunting in 2007 (Kambako, Luwire, Johan Calitz Safaris and Niassa Hunters)
- All four of the acceptable trophies showed full manes with hair filled in between and behind the ears (no "mohawks"), noses more than 50% black, thin pulp cavities closed at the base in premolars. All teeth showed significant wear particularly on the enamel ridges of the canines.
- Two of the lions taken as trophies were very old animals, and particularly good trophies (from concessions L2, R1), with the lion taken in Block L2 (Plate 2, Plate 3b) the oldest lion taken since trophy monitoring began in 2004.
- Note that the two youngest lions taken both showed wide pulp cavities which correlates visually with the visual assessment of tooth wear and mane development.
- In 2007, the young lions taken in 2007 were taken under the following circumstances:

- There was an unfortunate incident where a particularly difficult client was left in the blind at a bait without a PH present and he killed the lion before the PH (who had gone to move the vehicle) returned to assess it. A number of issues are related to this incident. The first is the PH and Operator (Jumbo Moore) is commended for immediately reporting the incident to SRN and taking responsibility for his actions. The second is the obvious lesson that clients should never be left unattended as they seldom have the experience to accurately age Niassa lions. The Points System takes account of these types of inadvertent mistakes and allows for a margin of error. Fortunately for the PH, this lion was considered in the 4-6 age category (though only marginally) and thus this incident did not result in an immediate decrease in quota.
- Two of the young lions were taken on the last day of the safaris when both PHs were under immense pressure to deliver a trophy. Both PHs have experience in aging lions in Niassa but it appears they succumbed to client pressure.
- A young lion was taken by a PH who was only in Niassa for one safari with his client and who did not know how to accurately age Niassa lions and had not been to any of the Operator meetings. He insists the lion was over 6 years of age, however the mane of the lion was typical of a young lion in Niassa and the lion was not a good trophy in terms of mane or the various age criteria. No nose picture was provided for this lion.
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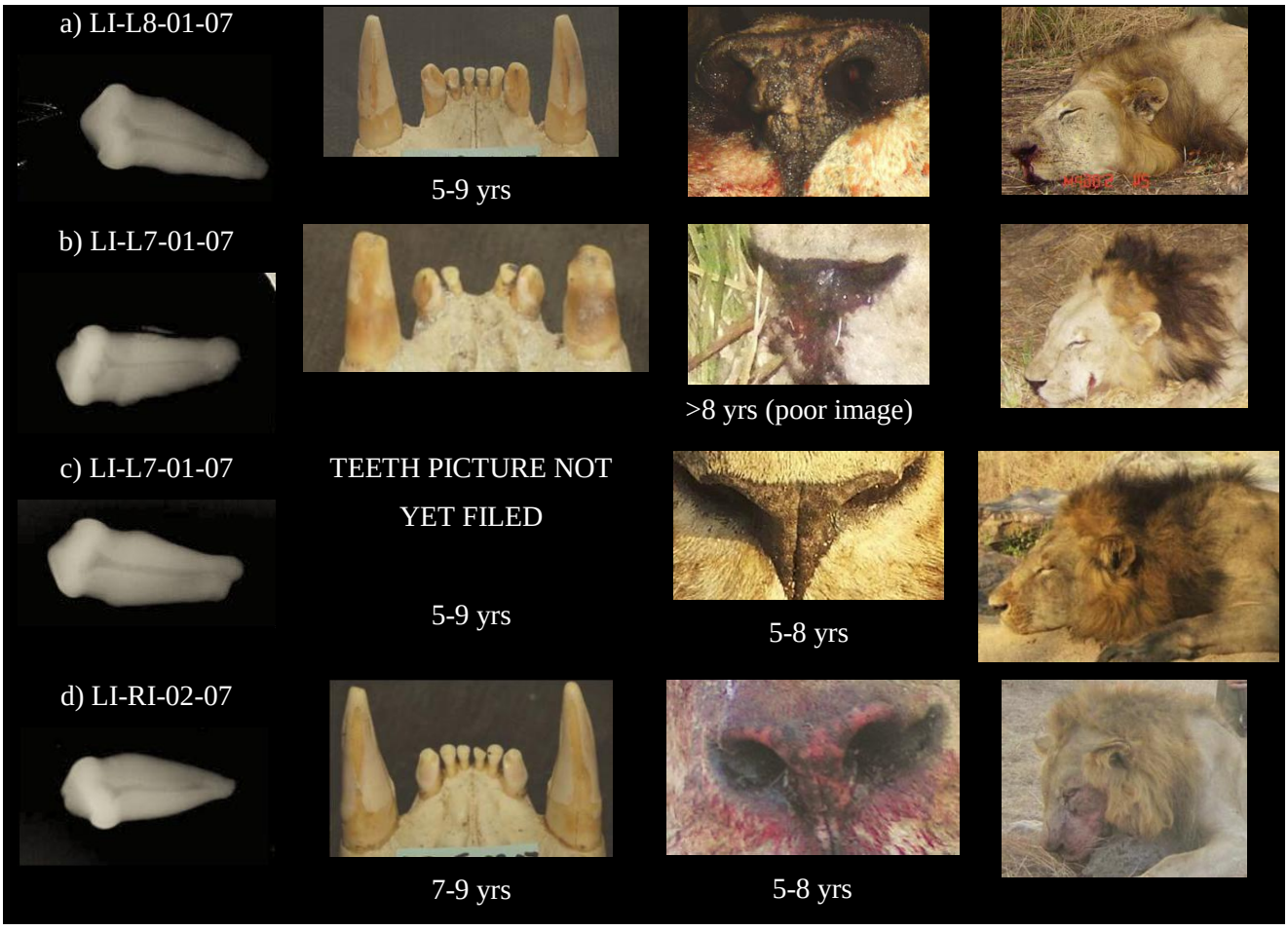

Plate 3A: Individual lion trophies taken in 2007 showing X-rays of the pulp cavities, tooth wear, nose discoloration and mane developed in all lions considered over the age of six years with (a) and (b) the oldest lions. Note that all the acceptable trophies had noses more than 50% black, significant wear on canines, full manes, filled in behind the ears.

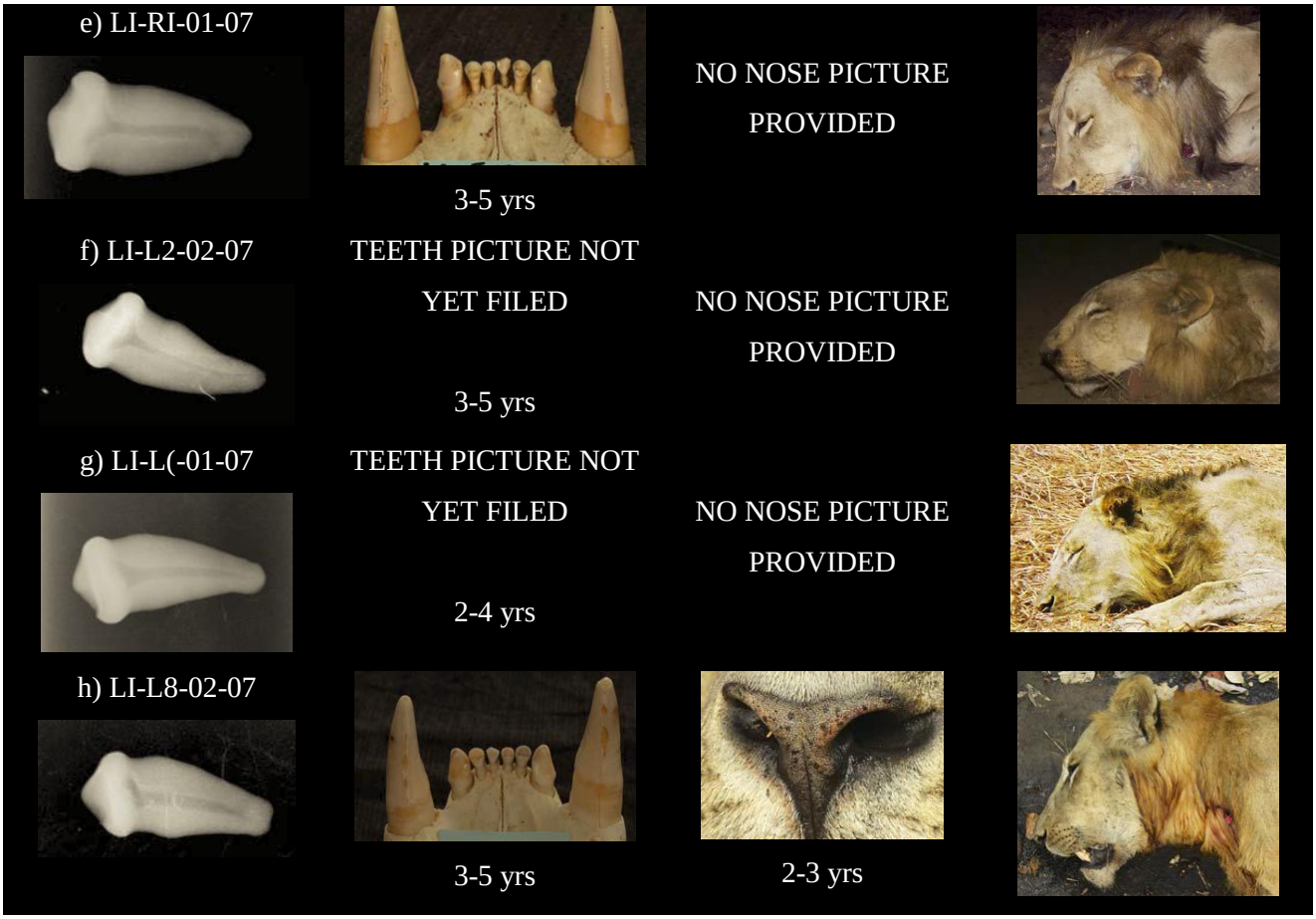

Plate 3B: Individual lion trophies taken in 2007 considered to be between 4 to 6 years of age, with (g) and (h) the youngest lions (note in particular the wide pulp cavities).

3.2.4. Quotas for 2008 – Niassa Points System

- According to the Niassa Points System quotas for 2008 have been assigned independently for each block based on the total points achieved (Table 3).
- In 2008 no concessions received a change (either an increase or decrease in quota for 2008) and it is important that the quotas stay at the 2007 level. However note that three PHs did not provide suitable nose pictures and in future trophies for which incomplete information is provided will receive zero points as stipulated by the Lion Regulations (Appendix 1).
- We suggest that the quota for L1 concession (the non operational concession) be reduced to two animals for the new concession holder for the first year. This follows the SRN Lion regulations, which stipulate that all new operators should start with a quota of two, and only be increased if

suitable trophies are taken in the first year. This appears to be the case with the two lions assigned to the new hunting block-L3 for 2007

Table 3: Recommended quotas for 2008: Assigned for each hunting concession according to the age of the trophies taken in the 2007 hunting season, as calculated by the Niassa Points System

Hunting Block	Quota 2007	Used Quota	Number of lions taken in each age category				Points assigned based on age	Quota 2008	Change in quota
			<4	4-6	>6	None			
Block L9	2	1	0	1	0	1	2+3=5/3=1.6	2	No change
Block L8	3	2	0	1	1	1	2+4+3=9/3=3.0	3	No change
Block L7	3	1	0	2	1	2	4+3+3=10/3=3.3	3	No change
Block L2	2	2	0	1	1	0	2+4=6/3=2	2	No change
Block L1	3	Unoccupied	-	-	-	-	Unoccupied	2	Decrease of 1
Block R1	2	2	0	1	1	0	2+4=6/3=2.0	2	No change
Block L3	-	Unoccupied	-	-	-	-	New concession	2	New
TOTAL	**15**	**8**	**0**	**4**	**4**	**4**		**16**	

3.3 Overall Progress towards achieving Conservation Objectives

1. There has been a steady decrease in the number of underage lions taken as trophies since the initiation of the Niassa Lion project in 2004 and implementation of Niassa Points System (Fig.3, Table 2) and no further lions under the age of four have been taken as trophies.

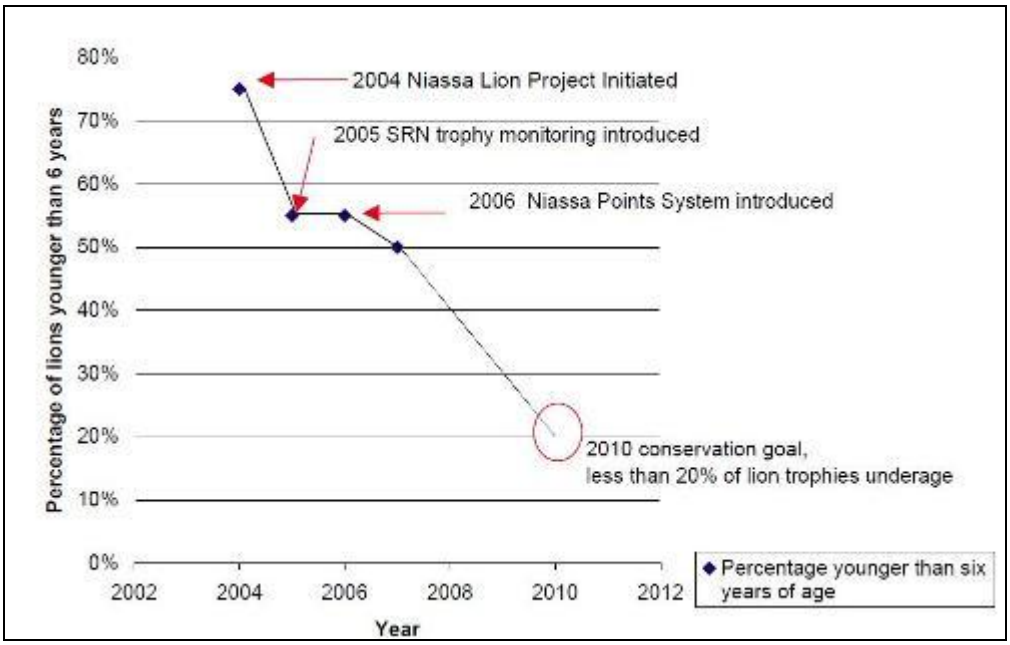

Fig.3. Percentage of underage lion taken as trophies between 2004 and 2007. Note the immediate decrease in the percentage of underage lion taken as soon as trophy monitoring was initiated (between 2004 & 2005) and a further decrease once the Niassa Points System was in place (between 2006 & 2007).

2. At present four methods for aging lions and lion trophies are being investigated and calibrated: tooth wear, nose colouration, closure of the pulp cavity in premolars, and mane development, with additional information provided on general body condition including blackening of hind legs etc. Aging data have been collected from 35 lions in NNR between 2004 and 2007, with four years of information on nose colouration, tooth wear and mane development and two years of data on pulp cavity closure. Aging methods that are shown to be effective will be calibrated by 2010 and guidelines provided to SRN trophy monitors.
3. A new possibility for aging lions, gum line recession, will be investigated in 2008. This technique has been shown to be useful in cougars (Laundre et al. 2000) and would provide an additional simple, inexpensive aging technique that could be used to provide a known age population of live lions against which nose colour, manes and tooth wear could be calibrated. This technique will not assist professional hunters with visually aging the animal before it is hunted. Lion mane development remains the most useful visual cue for aging a lion before it is shot.
4. In terms of monitoring, all operators provided adequate information on their lion trophies through use of the lion questionnaires, provided the skulls for measuring and aging from tooth wear and continued to work closely with the Niassa Carnivore Project. However usable nose pictures were not provided for three of the young lions (but were provided for all the older lions). In future, failure to provide a nose picture will result in zero points being given for that trophy. Additional effort needs to be made to reach the PHs not only the operators. While the onus has been on the operators to pass the information on this is not happening effectively.
5. In 2007 it was unfortunately not possible for SRN employee, A. Jorge to accompany the NCP team trophy monitoring in 2007 for training due to prior commitments, however this will be rectified in 2008. In addition A. Jorge will spend three months with the NCP assisting with the lion-hyaena call-up survey, radio collaring and camera trapping.

4.0 Leopard trophy Monitoring

4.1. Methods

- This is the second year of leopard trophy monitoring in NNR and the first year PHs were required to fill in a simple questionnaire (similar to the questionnaire provided for lions) for each leopard taken as a trophy. At the NNR Operators Meeting in Lichinga in May 2006 all operators were provided with leopard questionnaires, details of measurements to be taken and a map for each leopard on quota. As a result PHs provided information (date, number of individuals seen, position and condition of the trophy and baits) and measurements for all of the leopard trophies.
- All hunting concessions were visited in November. All but two of the skulls were measured (skull width, skull length, jaw width, length, canine width and length). Two leopard trophies in R1 were taken after the trophy-monitoring visit. For these trophies full details and photographs were provided by the PHs and photographs of the skulls allowing aging from tooth wear were taken by the security officer of NNR in Lichinga.
- All trophies were placed into an age category (<2 years, 2-4 years, > 4 years) based on tooth wear according to a datasheet. A premolar or incisor was taken for pulp cavity X-rays. All skins were examined to ensure the scrotum was attached to confirm the sex of the animal and skin samples were taken for a sexing and a phylogeographic study of leopards conducted by Dr Conrad Matthee (University of Stellenbosch).
- The aging of these trophies is preliminary based on aging criteria that have been developed in other areas. These criteria still need to be ground-truthed in NNR; however data from 2006 suggested that canine wear, chipping of the enamel ridge allowed leopard to be placed in three age categories (Plate 4).

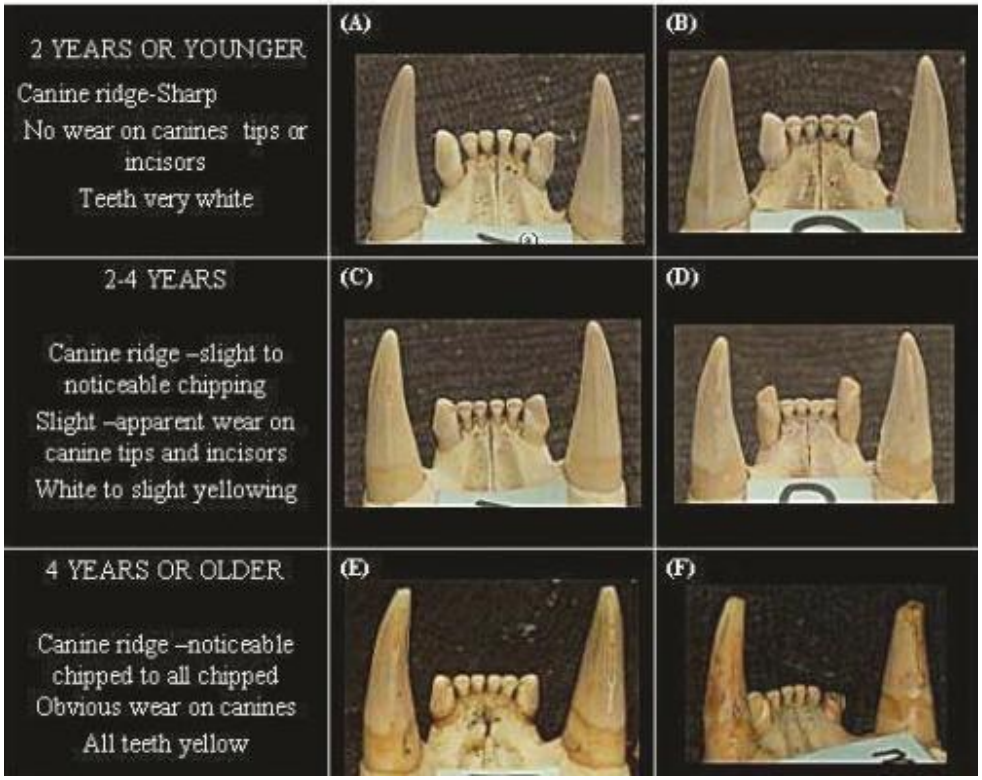

Plate 4: Aging on the basis of tooth wear in leopards. Preliminary results suggest that leopards can be placed in broad age categories based on canine and incisor wear, chipping of the enamel ridge, exposure of the dentine below the gum line and the colour of the teeth. Images A-E are from trophy leopards taken in the 2006 hunting season. Image F is from an old male killed as a problem animal in a Mashamba in Milepa (taken from Begg & Begg 2007.

4.2 Results of the 2007 hunting season

4.2.1. Off take

- In 2007, the national leopard quota for Mozambique was doubled to 120 animal following the CITES meeting in 2007. This did not affect the quotas for 2007 but will affect Niassa quotas in 2008. Detailed information on leopard density in NNR to inform quotas is currently not available but is a goal of the Niassa Carnivore Project.
- In 2007, 18 leopards were taken as trophies an off-take of 94% of the approved quota (19). All active concessions (L9, L8, L7, L2, R1) purchased and utilized 100% of their allocated quota. In addition Luwire purchased an additional two leopards from L1, which was inactive in 2007. These leopards were shot in L7 and not in L2.
- Leopard quota utilization was similarly high in 2006 when it was 111% as two extra leopards were purchased from Chipanje Chetu, neighbouring R1 and again shot in L7.

4.2.2. Trophy quality

- Two females were taken as trophies in 2007 (11% of off-take), both admitted by the PHs concerned. All other leopards were males as confirmed by the scrotum attached to the skins.
- A client took one male leopard without permission from the PH (M. Hulley Miller, L9). No further details were provided by the PH of the circumstances surrounding this incident.
- Four of the 16 (25%) male trophies were very young showing no wear on the canines and no noticeable chipping of the enamel ridge. Both the females were also young animals. According to available aging criteria, none of these individuals are likely to be much over two years of age and several are possibly younger. In total 33% of the trophies were not acceptable in terms of age.
- Nine of the male trophies were placed in the 2-4 year old age category (56%), and 3 (19%) were considered excellent trophies and were undoubtedly old animals. This indicates an increase in the off take of older trophies compared to 2006, where only one leopard was obviously an old animal.
- As was the case in 2006, there does appear to be a clear correlation between pulp cavity closure and tooth wear in leopards (as there is in lions) but these needs to be calibrated with age (Plate 5, Plate 6).
- While aging of the trophies from tooth wear suggests that many of the leopards hunted in NNR are below four years of age, a minimum age limit cannot be instituted in NNR at present as reliable visual aging characteristics have not been yet been developed and tested.
- In conversation, Niassa PHs suggested that older leopards have a thicker neck, shorter hair (less fluff), and darker fur colour. Males can be distinguished from females by larger size, more prominent ears, thinner neck, and smaller spots. In addition PHs suggest that indirect measures such as track size, the height, width and depth of scratch marks in bait trees and amount of bait eaten provide additional indications of age and sex.
- In Tanzania a minimum body length measurement of 2.4m is required for leopard trophies. This assumes that head-body length is related to age. For the first time in 2007 all the PHs provided a body length-measurement for their trophies as requested and most provided a weight (although this was affected by how much bait the animal had eaten previously) and additional measurements of shoulder height and neck circumference were provided for 12 of the animals (Table 4).
- Only two leopards were larger than 2.4m, both were aged in the 2-4 year category and both were remarked on by the PHs as being in excellent condition, but these two leopards were not the oldest individuals. While PHs suggest that neck circumference indicates an old male leopard there is currently no clear relationship between neck circumference and tooth wear (age), but sample sizes are still small and this requires further investigation. While two of the oldest leopard had the biggest neck circumferences (56cm), the third did not (50cm).

- There may be a relationship between shoulder height and age, with the animals considered younger than two years of age all shorter than 64 cm, and the older leopards all taller than 66cm, with the leopards in the 2-4 age categories showing no clear pattern. Once again, more data are needed to look at this relationship more closely.
- As expected the two smallest animals in body length and weight were the females with mean head-body length of only 1.75 m and an average weight of 28kg. It should be fairly easy for PHs to distinguish females from males given how much smaller and lighter in mass they are compared to the males (Table 4)
- Of the 2007 male leopard trophies (n = 15) average skull measurement (skull width in inches + skull length in inches) was 14.6 (range 13.49-15.56). Five leopards (33%) were below the SCI minimum of 14 and eight were below the Roland Ward minimum of 15.
- The NCP initiated a study of leopards (late 2007 –Dec 2010) to assess leopard density in NNR through camera trapping and GPS radio collaring. In addition data will be collected on developing visual cues that can be used by PHs to age and sex leopard before they are taken as trophies as well as data pm habitat use, prey, human-leopard conflict and illegal killing of leopards. Two male leopards have already been radio collared and camera trapping along the Lugenda River in the intensive study area has been initiated. Further details of the leopard research project are provided in the NCP annual report and are not provided here.

Table 4: Measurements of 2007 male leopard trophies taken by Professional Hunters in NNR

Measurement	Average	Range	Sample Size
Head-body length (cm)	211	178-290	16
Weight (kg)	57	48-70	15
Shoulder height (cm)	65	59-84	14
Neck circumference (cm)	52	48-56	12

Tooth wear on a leopard older than 4 years
LE-L9-02-07

Tooth wear on a leopard younger than 2 years
LE-L9-03-07

Plate 5. Differences in tooth wear on two leopards taken as trophies in 2007. The pulp cavities corresponding to these leopards are shown in Plate 7 a, and b) respectively

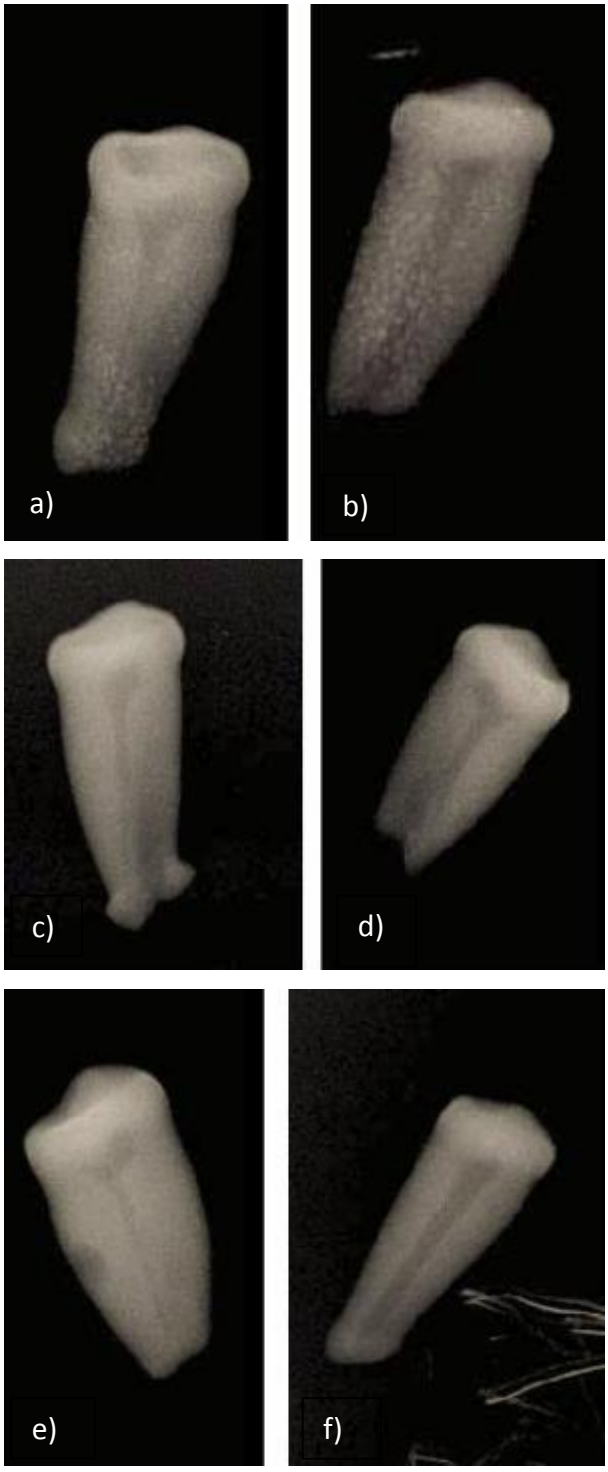

Plate 6. Pulp cavities from all three leopards considered older than four years from tooth wear and from three leopards considered younger than two years from the 2007 hunting. Note the smaller area taken up by the pulp cavity in the older leopards and the cavity in the tooth of leopard (e). Once more data is available the area covered by pulp cavities will be calculated, calibrated and correlated with other age criteria.

4.2.3. Additional information

- For the first time GPS positions of leopard hunts were consistently provided. A map showing where leopard trophies were taken in 2007 is provided in Fig. 4. Note the concentrations of leopard hunts in riparian vegetation along the Lugenda River and its major tributaries. PHs are consistently using the same sites to hunt leopards, in some cases hanging baits in the same trees year after year.

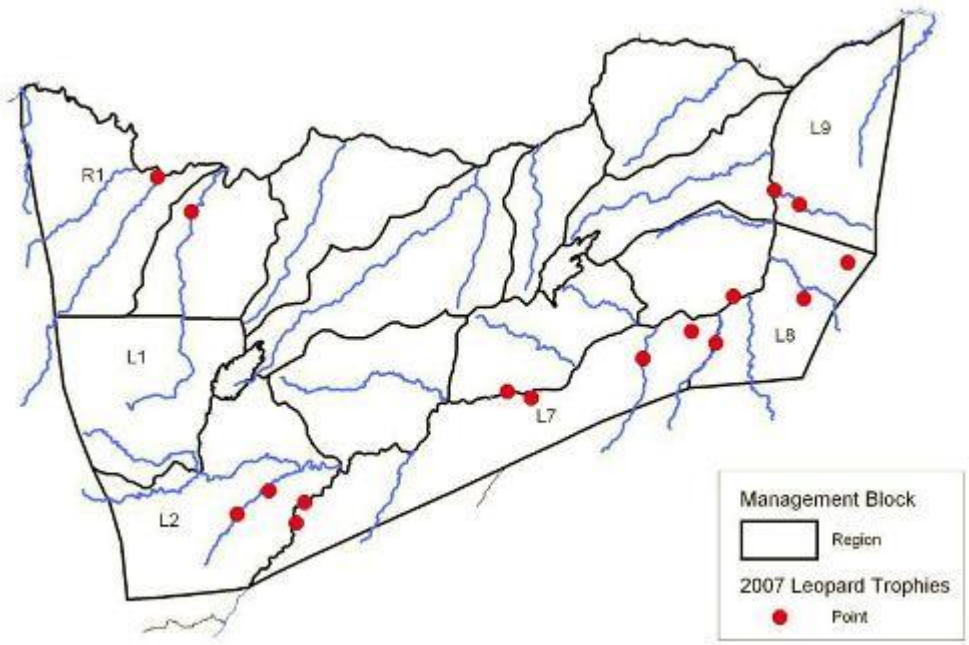

Fig. 4. Positions where leopard trophies were taken in 2007. The position for one leopard hunt in Block L9 and one leopard hunt in L7 were not provided.

- Nine of the leopards were taken after sunset; we assume spotlights were used from a blind at bait. On average five baits were used but this varied from one bait to as many as 22 baits being set for a single animal.
- Overall, PHs were very cooperative, the questionnaire datasheets were filled in and all the skulls were provided for measuring and aging and in most cases digital pictures were provided of the leopard trophies. One PH from Luwire (M. Hulley Miller) did not provide complete information for either of his leopard hunts and despite repeated request to do so did not respond to follow up emails.
- Two leopard skins were stolen from the Luwire skinning shed after the trophy monitoring exercise. These skins have not been recovered despite a reward being offered by Luwire. Given the status of leopard on Appendix I of CITES and the controversy surrounding the increase in leopard quota to Mozambique, this situation is potentially very damaging to NNR. This confirms our suspicions that there is a trade in leopard skins taken from NNR and is supported by other evidence (snares set specifically for leopard).

4.3. Progress towards achieving objectives

- Monitoring of the leopard trophies has been formalized with an aging datasheet and all PHs are now providing information on their leopard trophies particularly the location where the trophy was taken, the number of baits set and days into safari when leopard was taken, which are a good indication of hunting effort. PHs are also providing critical measurements. Datasets are currently too small to determine visual aging cues at present; however a good start has been made.
- Data on aging criteria (tooth wear, pulp cavity closure, body length, mass, shoulder height) are all being systematically collected. In 2008, as in lion, measurement of gum line recession will be measured in live animals to assess whether this correlates with other aging criteria.
- Determination of a leopard density and additional aging information from live animals in NNR has been initiated with the radio collaring of two males and camera trapping in riparian vegetation along the Lugenda River where the majority of sport hunting is taking place (see NCP progress report, 2007 for more details).

5.0 Selected References

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Launder, J.W., Hernandez, L., Streubel, D., Attendorf, K., Gonzalez, C.L 2000. Aging Mountain lions using gum lion. Wildlife Society Bulletin 28 (4): 963-980.

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Appendix A: SRN Lion Regulations

LION HUNTING IN NIASSA NATIONAL RESERVE

Revised Lion Hunting Rules – 26th April 2006

In order to manage African lion hunting in the Niassa Reserve, SRN has established the following revised criteria and rules that should be strictly adhered to by all safari operators. These replace all previous criteria and rules concerning lion hunting and take affect from the date of this document unless otherwise indicated. The aim is to maximize trophy quality and economic returns from lion hunting in Niassa Reserve (NR), while maintaining the viability and growth of the Niassa lion population.

1. General Rules

1.1 Elected trophies:

- Only male lions may be hunted.
- Only adult males, which are a minimum of 6 years old, may be hunted as the hunting of young lions can cause severe disruption to pride structure and, if excessive, can cause a population to collapse.
- Lions may only be hunted on a minimum of an 18 day safari (effective 2007).
- As a rule no problem lions (e.g. man eaters) should be sold as trophy animals. However, should a client be in a position to hunt a problem lion (and specifically man eaters) the issue of the operator/client retaining and exporting the trophy will be assessed by SRN on a case by case basis. Furthermore, if an operator/client does shoot a problem lion this must be reported to SRN within 48 hours to allow for further investigation by the Reserve Warden or an SRN representative.

1.2 Trophy monitoring:

- For each lion on quota, a monitoring kit will be provided by SRN containing a disposable camera, map, datasheet and blood sample paper.
- For each lion trophy, the Professional Hunter is expected to take photographs (side view, front view of head and shoulder, nose and full body), and a blood sample from bullet wound while in the field.
- All questions on the datasheet must also be completed.

2 Trophy Quality Control

2.1 Responsibility: monitoring of trophy quality shall be conducted by the SRN representatives, currently K & C Begg.

2.2 Procedure: the safari operator shall notify representatives before lion trophies are removed from the Hunting Block at the end of the hunting season so that the SRN representatives can arrange a visit to collect trophy kits (photographs, blood samples and datasheets) and measure and age the skulls.

3. Assigning of Quotas:

3.1 Niassa Points System:

- Quotas will be assigned independently for each concession dependant on the age of lion trophies taken in the previous hunting season according to the Niassa Points System.
- The points system is self-regulating; it rewards ecologically sound hunting by allowing an increase in the quota to a maximum of five. Hunting of young lions under the age of six years is penalized. PH's receive no decrease in quota for not shooting a lion.
- Using this system, the off-take in each block will increase or decrease in accordance with real densities in each concession, accounting for hunting effort, anti-poaching measures (i.e. decreased illegal off-take) and natural population fluctuations (disease, drought etc.).
- The maximum of five lion for each concession is in place initially to ensure that the quota remains within 2 - 4% of the predicted adult male population. It is considered unlikely in the foreseeable future that more than five male lions of appropriate age will be available in each block. However this can be reassessed in the future.
- New concessions will be awarded an initial quota of two lions.
- If the quota is reduced to zero (i.e. only young lions are shot in the previous year), no quota is provided for the next year, but the quota will start at one lion the following year.
- Details of all trophies (datasheets, photographs of mane, teeth and nose) will be kept on file with SRN. If any disputes arise about a particular lion's age, a premolar can be sent for aging by Carbon-14 analysis at the cost of the concession holder ($500). It is recommended that a premolar be made available from each trophy so that field aging techniques can be fine-tuned over time.

3.2 Procedure:

The Niassa Points System is a three-step process:

Step 1:

At the end of each hunting season (November) each lion trophy taken is aged by SRN representatives (currently K & C Begg) based on teeth, nose colour, mane development and general body condition.

Step 2:

Points are assigned to each trophy according to the following system.

Quota	Number of Points for each trophy				
	> 6 yrs	**No trophy**	**4-6 yrs**	**< 4 yrs**	**Incomplete info**
For Quotas of 3 or more	4	3	2	-3	0
For Quotas of 2	4	3	2	0	0
For Quotas of 1	6	3	0	0	0

For each concession, points are tallied for that year, divided by 3, rounded up to next whole number up to a maximum of 5 lions and that is the quota issued for the next hunting season. See examples in Appendix 1

Step 3:

SRN will endeavour to inform operators of the new quota to allow time for marketing at safari shows in January.

3.3 Unethical Behaviour: in case of Safari Operations or Professional Hunters behaving unethically (according to the applicable law in Mozambique), SRN may apply more severe actions, which might include trophy confiscation or PH License confiscation or cancellation of the lease agreement with the operator.

4. Trophy Export

The standard operating procedures apply