CML
Institute of Environmental Sciences

Report of a Lion Training and Survey In Northern Cameroon

1-23 April 2004

Dr. H. Bauer

Mission jointly funded and organised by:
Institute of Environmental Sciences, Leiden University (CML)
Van Tienhoven Foundation (VTS)
Foundation Dutch Zoos Help (SDH)
Garoua Wildlife Training School (EdF)

Introduction

The African lion, *Panthera leo* (Linnaeus 1758), is a keystone and flagship species of the African savanna. The former means that it is an important predator with a high impact on prey populations and on the ecosystem at large. The latter means that it is an important species for conservation (high value for trophy hunting and viewing tourism, high cultural value, good indicator species, easy example for communication about conservation to the general public, etc.).

There has been much publicity around lion numbers over the past two years, among others due to two publications: the IUCN African Lion Database (Bauer & Van Der Merwe, 2004; see Table 1 and Fig 1) and the IGF Lion Report (Chardonnet, 2003). These publications independently assess the number of free-ranging lions in Africa, with some differences in methods (e.g. the first is limited to a conservative estimate of known populations and the second is more speculative including extrapolations to unsurveyed areas). Despite the differences in some specific figures, the two publications have an identical bottom line:

- lion populations in protected areas in Eastern and Southern Africa are relatively large, stable and viable, some populations outside protected areas are stable, especially those used for consumptive use (trophy hunting), but other populations are declining (mainly due to conflicts with cattle holders);
- lion populations in West and Central Africa are small and almost entirely limited to protected areas, amongst others due to naturally low densities and lion-livestock conflict, regional extinction risk is higher than in Eastern and Southern Africa.

Lion - livestock conflict leads to considerable livestock losses and to retaliatory killing of predators (e.g. with poisoned carcasses) or Problem Animal Control (shooting known conflict animals). This conflict is widely recognized as the main threat for lion survival; conflict management is therefore the main challenge for lion conservation. This course featured many conflict management tools, in an attempt to build the necessary human capacity in the region.

Table 1: Summary of conservative African lion population estimates.

Region	Estimate	Minimum	Maximum
West Africa	850	450	1,250
Central Africa	950	500	1,550
East Africa	11,000	8,000	15,000
Southern Africa	10,000	7,500	12,500
Total	23,000	16,500	30,000

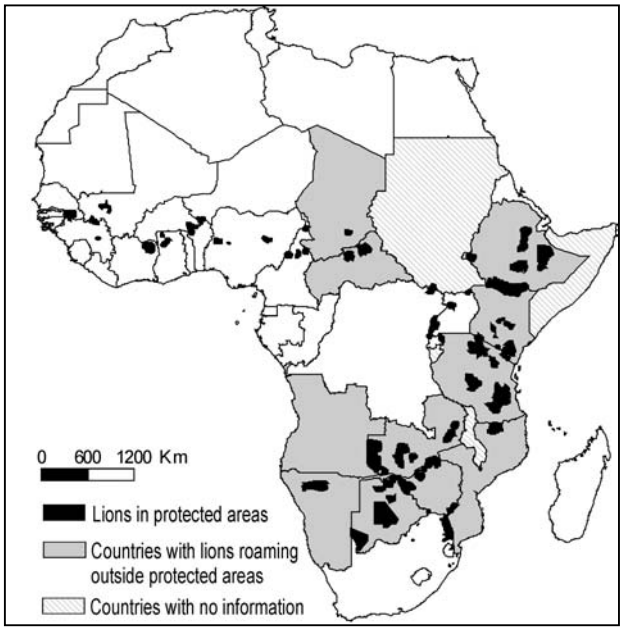


Fig. 1: Map of Africa showing lion dispersion. Protected areas with lions in black, countries with substantial numbers of lions outside protected areas shaded.

The Institute of Environmental Sciences of Leiden University (CML) has been doing research on lion conservation in Cameroon (Central Africa) since 1995. Results were published in a PhD thesis by Bauer (2003) and several other media. This research is still ongoing, currently executed in the field by Stephen Van Der Mark. In 2001, CML joined hands with the IUCN African Lion Working Group (ALWG) and the Foundation Dutch Zoos Help (SDH) to organise a conference in Limbe, Cameroon, to discuss regional lion conservation issues with representatives of several West and Central African countries. In 2002, CML and SDH organised the first West and Central African Lion Conservation Course at the Garoua Wildlife School, Cameroon (EdF). During this event, 10 participants signed a declaration launching a West and Central African Lion Conservation Network. The students of EdF who participated in the 2002 course have all graduated, and EdF now has a new batch of 37 students from 13 different countries in the region. This report covers the second edition of the West and Central African Lion Conservation Course, organised in Garoua, Cameroon, from 4 to 21 April 2004. This course was jointly organised and funded by CML, EdF, SDH and the Van Tienhoven Foundation (VTS).

The programme consisted of three parts. The main part of the course was taught in the first week. One element, however, could only be taught in the third week due to the limited availability of the teachers. This was an actual survey of lions and hyenas in Benoue National Park, and a demonstration of biopsy darting and an explanation of lion immobilisation by a veterinary doctor. The week in between these two events was used to perform a lion and hyena survey in Bouba Ndjida National Park (see Fig. 2 and Table 2).

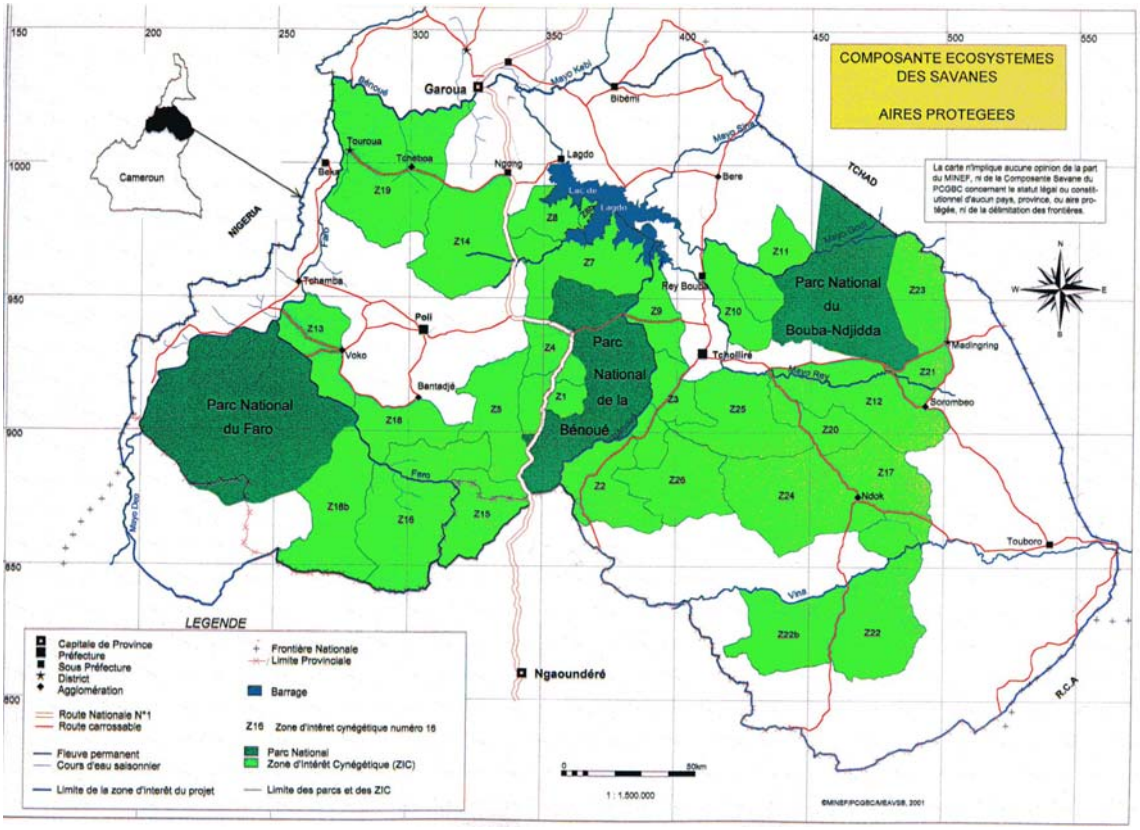


Fig. 2: Fieldwork areas, Benoue National Park and Bouba Ndjida National Park.

Part I: theoretical course in Garoua

The first week consisted of lectures, working groups, classroom demonstrations and a short visit to the Benoue NP (see Table 2). Participants and lecturers were (see also cover photograph):

- Mr. Joseph Tiebou, representing the Director of Wildlife and Protected Areas of the Ministry for Environment and Forests (MINEF) in Cameroon;
- Mr. Alain Bengono, Provincial Delegate of MINEF in the North Province;
- Mr. Issolo Dipanda, Provincial Delegate of MINEF in the Far North Province;
- Mr. Saleh Adam, Warden of Waza NP (the wardens of Benoue, Bouba Ndjida and Faro NP were also invited but were unable to attend);
- Mr. Francis Tarla, director of the Garoua Wildlife School (EdF);
- Mr. Hatungimana, Babale and Kwabong, three teachers of EdF (several other teachers attended some lectures voluntarily);
- 37 students of EdF from 13 different French-speaking West and Central African countries;
- Dr. H. Bauer, lion researcher at CML
- Mr. S. v.d. Mark, lion researcher at CML/CEDC
- Dr. N. Vanherle, lion researcher working in Zakouma NP, Chad;
- Dr. F.P.G. Princee, consultant, specialised on small population management;
- Dr. B. van Luijk, veterinary doctor working in The Netherlands.

Table 2: timetable of course components.

Day	Time	Responsible person	Subject
5 / 4	8-10	J.P. Kwabong	Biology of lion (description, taxon., behaviour, etc.)
	10-12	H. Bauer	Lion distribution (numbers, trends, red list, etc.)
	13-15	S. v.d. Mark	Lion survey methods (telemetry, calling station, etc.)
6 / 4	8-10	S. Adam	The Waza lion research project
	10-12	S. v.d. Mark	Lion – livestock conflict
	13-15	F. Princée	Small population management
7 / 4	8-9	N. Vanherle	Calling stations and individual recognition of lions
	9-10	H. Bauer	Synthesis: lion conservation in practice
	10-12	All teachers	Questions, evaluation, other contributions
	12-14	F. Tarla	Closing ceremony and cocktail / lunch
8/4	8-16	J.P Kwabong	Departure to Campement Buffle Noir (Benoue NP)
	16-24	N. Vanherle	Calling station
9/4	6-10	S. v.d. Mark	Telemetry demonstration
	16-24	N. Vanherle	Calling station
10/4	6-10	J.P. Kwabong	Prey identification and inventory
	10-16		Return to Garoua
11/4 16/4	6 days	H. Bauer	Large Carnivore survey in Bouba Ndjida NP
17/4	5 days	J.P. Kwabong	Large Carnivore survey in Benoue NP
21/4		H. Bauer	Lecture in lion immobilisation
		B. Van Luijk	Demonstration of biopsy darting

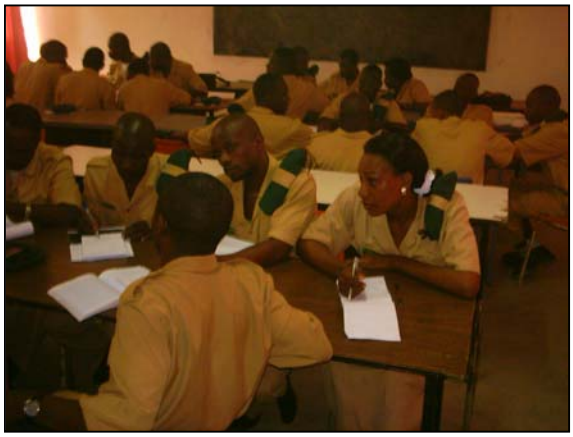
All lecturers used the overhead projector, and several lecturers distributed handouts (a copy of all the documentation that was provided to the participants is separately available). In addition, all participants were provided with a CD-ROM that was especially compiled for the

purpose, this CD contained a wealth of documents such as all relevant IUCN, CML and lecturers' publications, recent scientific articles and books, and the software needed to read PDF files.

In addition to classroom lectures, there was a session of working groups (6 groups of participants from the same region) to discuss cases of human-lion conflict in participants' areas. Furthermore there were two demonstrations outside the classroom: calling station and radio-telemetry (see Fig 3 & 4).

Fig 3 radio-telemetry demonstration and exercise.

Fig 4: working groups in classroom.



Each lecture was followed by a limited number of questions from the participants, but two hours were spent on the last day to answer all the remaining questions. The course was evaluated using an anonymous evaluation form, the results are shown in Table 3. This shows that the course was very highly appreciated. The only lecture that was rated below 'good' was the only lecture that was not given in French but in English with literal translation into French, correcting for this influence would give an even higher appreciation.

Table 3: evaluation results

Lecturer	Title	1 (very bad)	2 (bad)	3 (suf-ficient)	4 (good)	5 (ex-cellent)	Mean
J.P Kwabong	Biology of Lion (description, taxon, behaviour)			4	22	10	4.16
H. Bauer	Lion distribution (number, trends, red list, etc.)				17	21	4.55
S. Van der Mark	Lion survey methods (telemetry, calling station, etc.)		1	3	24	8	4.05
S. Adam	The Waza lion research project			1	19	11	4.35
S. Van der Mark	Lion-livestock conflicts		1	1	19	12	4.27
F. Princee	Small population management			6	13		3.68
N. Vanherle	Lion conservation in pratice, calling station, etc.				19	17	4.47
All	Questions and synthesis				15	8	4.34
Total		0	2	15	148	87	4.26

After 3 days in class, the lecturers and EdF teachers went to Benoue NP for a 2-day field trial. Due to logistic constraints we could not do this with all the course participants, but by training the teachers and supplying them with the necessary equipment EdF students are expected to obtain field experiences during their regular fieldwork. EdF was especially grateful to the donors of this event for funding a complete set of broadcasting equipment (for calling stations) that remained property of EdF after completion of this mission. During this field trial we did not observe lions, but we did find lion traces. We could practise calling stations, spoor tracking and interpretation and prey inventory.

This section ends with a quote from one of the evaluation forms:

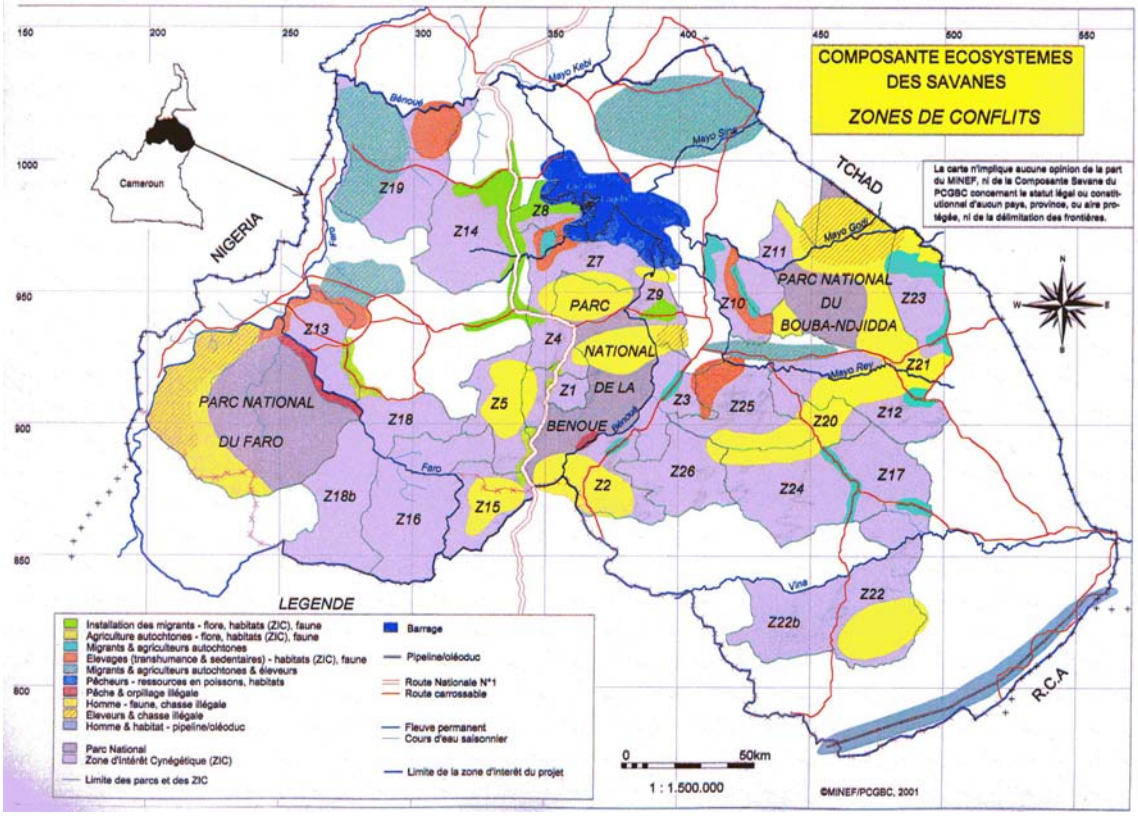
> *"This training was of capital importance for us, it was very enriching for our knowledge of lion conservation, despite the short duration. We sincerely thank the organisers of this course, which will enable us to better manage these felids in our respective countries."*
> (source : anonymous evaluation)

Part II: lion and hyena survey in Bouba Ndjida National Park

The second week of this mission was not part of the training itself, it was an opportunity for the author of this report to make good use of the 5 days between the two elements of the course.

Bouba Ndjida National Park is a 2,200 km^2 savanna ecosystem on the Cameron – Chad border (see Fig 1, 6 & 7). The website *www.boubandjida.com* gives a good impression of its nature and facilities. The southern sector, covering roughly 2/3 of the park, is relatively well managed, despite the inadequacy of the means (low budgets, few guards, inappropriate equipment). The park has one warden, 16 guards (of whom only 7 are operational) and a number of local guides and seasonal employees. The northern 1/3 of the park was not patrolled for a number of periods in the past, due to the security situation and the proximity to Chad. It is currently patrolled sporadically, but there is no real solution to the presence of large numbers of poachers, cattle and migrant fisherfolk (see Fig 5)

Fig. 5: main conflict areas in the survey zone, showing *inter alia* insecurity in the northern sector of Bouba Ndjida NP and the scale of human wildlife conflict.



The main prey species include reedbuck, oribi, waterbuck, kob, roan, hartebeest, giant eland, bushbuck, Grimm's and red-flanked duiker, warthog and buffalo; the larger species (>200 kg.) occur in very low densities. To my knowledge, there are no census data available, hardly any research has been done in this area. This was the main reason for my curiosity and desire to do a lion and hyena survey in this park.

The survey consisted of a total of 25 calling stations. The protocol was based on the protocol defined by Ogutu & Dublin (1998) and adapted based on the experiences of Hans de Iongh (through his students in Waza NP in 2002), Frank Princee (working in Uganda), Iliara Di Silvestre (working in Benin) and Nathalie Vanherle (working in Botswana and Tchad). I used a tape of 60 minutes continuous calf distress and hyena sounds, played on a 12 Volt cassette player connected to a 400 Watt amplifier and two speakers of 50 Watt and 16 Ohm positioned on top of a LandCruiser 4x4 vehicle. This system was assumed to have an effective range of 2.5 km, audible range exceeded 3 km. Other materials used included nightvision binoculars, a small and large torch, a 12 Volt spotlight, a GPS receiver (Garmin e-trex), etc. (see Fig. 5).

Fig 6: research materials used for calling station.

Fig 7: park entrance.

An ideal survey night was as follows:

18:30 Arrival, installation, 5 minutes of silence
18:35 First broadcast, 10 minutes turning the speakers several times
18:45 Silence for 10 minutes, if animals approach use small torch, if they accept try spotlight
18:55 Second broadcast, 10 minutes turning the speakers several times
19:05 Silence for 10 minutes, if animals approach use small torch, if they accept try spotlight
19:15 Third broadcast, 10 minutes turning the speakers several times
19:25 Silence for 10 minutes, then check surrounding with spotlight and move 5 km.

19:45 Second call-up (same sequence as above)
21:00 Third call-up
22:15 Fourth call-up
23:30 Fifth call-up
00:45 Sixth call-up
4:00 Seventh call-up
5:15 Eighth call-up
6:15 Breakfast at the site of last calling station

Of course, variations occurred, depending on extra time needed for observations, rest or travelling between stations. However, we have not had major setbacks or equipment malfunctioning throughout the survey period.

If lions approached the car they were observed for some time using the spotlight, which did not seem to disturb them (see Fig 6). If hyenas approached the car, I counted them in the dark, based on sounds and based on eye reflections from a very weak torch. When satisfied, I switched on the spotlight in the direction where they were last heard, allowing for a few seconds' observation while they ran off. If neither lions nor hyenas responded, the call-up was concluded by switching on the spotlight pointing to the sky, slowly lowering and then turning 360 degrees, to confirm the absence of lions and hyenas.

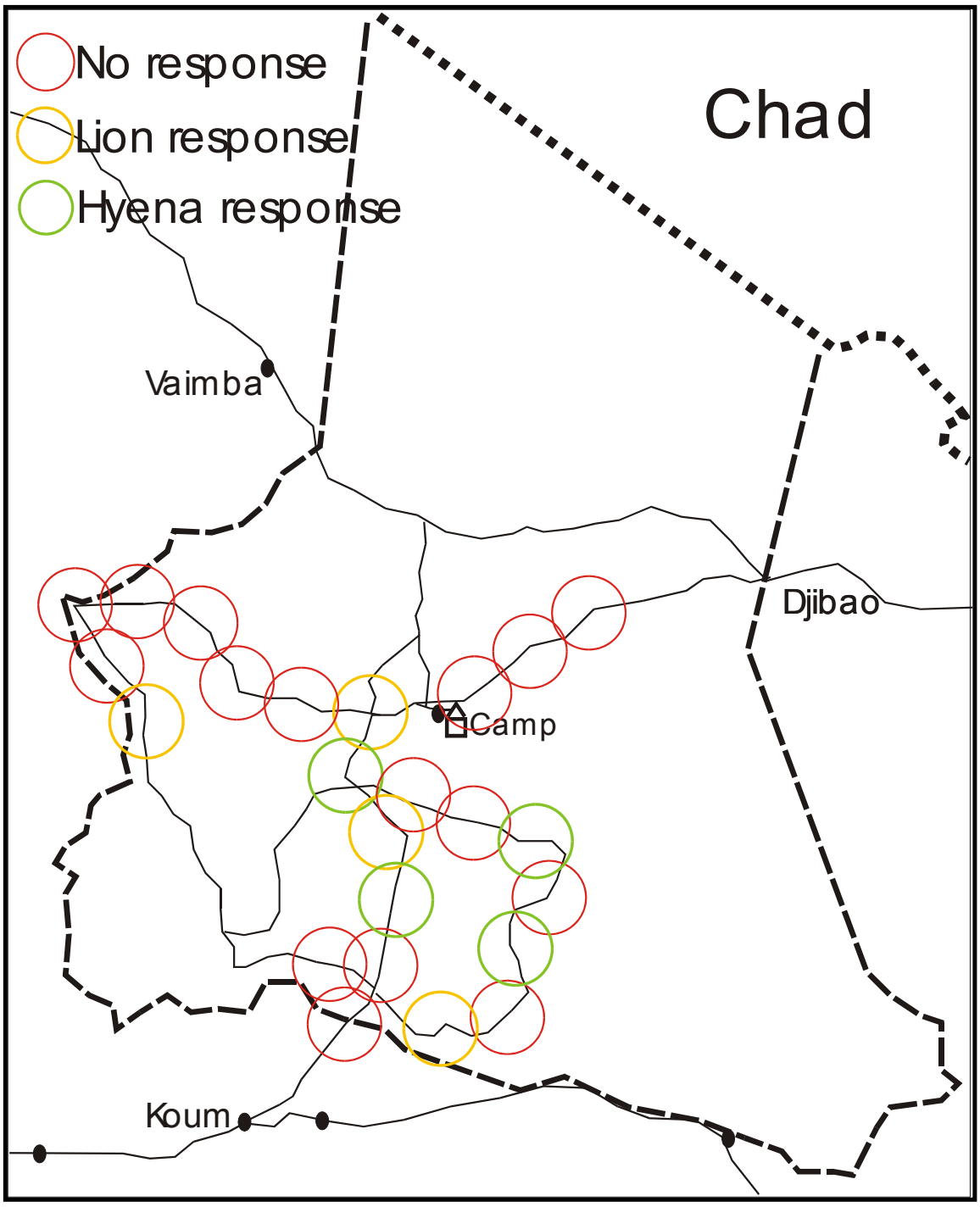
Fig 6: lioness in the spotlight at a calling station

On the last night, 15/4/04, we tried to cover a part of the northern sector of the park. During the third call-up, however, fieldwork was aborted due to the large number of poachers or herders that were observed. In fact, one person approached the car after the first broadcast of the third calling station, so we actually fled in a hurry. From this experience we concluded that research is currently not possible in the northern sector, and we limit our analysis to the southern 2/3 of the park. In the southern sector, we did 22 call-ups, as displayed in Fig. 7.

In total, 9 lions responded to three calling stations, both in the evening and in the morning, both at the start and at the end of a sequence. I observed a male and a female adult lion with 3 juveniles close to the camp, the male and juveniles fled when the spotlight was turned on – though not in great haste. Further South, two adults approached the car, a male and a female, they apparently did not fear our presence or the spotlight at all. Towards the West, I observed one male at a large distance, he did not approach the car; a second individual was heard but not observed.

The number of hyena responses is more difficult to assess, because hyenas in Cameroon are generally very skittish. I present the number of confirmed individuals, either observed or heard simultaneously or coming from different directions, but it is likely that more hyenas were present. The resulting estimate is therefore conservative: the minimum number of hyenas having responded is 12. In almost all cases they were observed, be it shortly because they fled when turning on the light, but in two cases the estimate is based on calls only, close to the car but not visible.

Fig. 7: Map of Bouba Ndjida NP, circles represent the surface covered by the calling stations



For a good interpretation of these figures, one should empirically assess effective range and response rate. That is, one should find lions first, then call from 5 km. and progressively come towards them and assess the distance at which they react (effective range) and the percentage of lions that does not react at all (non-response rate). The effective range then becomes the radius used in calculating the area covered by each calling station, and the resulting lion density should be corrected for non-response. If at least 20% of a relatively homogeneous habitat is covered by calling stations, the resulting figure can be assumed representative and extrapolated to give lion density for the entire park (Ogutu & Dublin, 1998). In our case, we could not assess these parameters, and we assume an effective range of 2.5 km and 100% response rate, leading to a conservative estimate.

Twenty-two calls in the southern sector of the park cover 432 km^2, which represents 20% of the surface area, and which gives a lion density of 0.02 km^{-2} (or 2 per 100 km^2) and a hyena density of 0.028 per 100 km^2. We aborted the survey in the northern sector after 3 calling stations, but available information suggests that large carnivore density in that sector is probably considerably lower due to the widespread presence of cattle. The minimum number of lions in Bouba Ndjida NP is therefore 30, and the speculative number (correcting for non-response and assuming 0.01 density in the northern sector) is probably around 50. The minimum number of hyenas in Bouba Ndjida NP is 41, and the speculative number (correcting for non-response, underestimate due to hyena shyness and assuming 0.01 density in the northern sector) is probably around 100 (see Table 4).

Table 4: lion and hyena estimates for Bouba Ndjida NP.

Species	Southern sector density (conservative)	Minimum number (southern sector)	Speculative number (entire park)
Lion	0.02 km^{-2}	30	50
Hyena	0.028 km^{-2}	41	100

Part III: lion and hyena survey, biopsy darting and immobilisation lecture in Benoue NP.

The third week of this mission was the second part of the training course organised at the Garoua Wildlife School. The objective was to exercise a full-fledged survey in the presence of a veterinary (wildlife) doctor, Bas van Luijk, who would give demonstrations on biopsy darting and lion immobilisation. The same three EdF teachers were intended to be participants of this part of the course, but unfortunately only Mr. Kwabong could attend – the most important person since he is course coordinator for future lion conservation courses at EdF.

Benoue NP is a 1,800 km^2 park bordered by the main North-South National Road to the west and by the Benoue river to the east. It is surrounded by hunting zones (see Fig 1), of which zone 1 and 4 have not been attributed to a professional hunter; the eastern part of those zones can functionally be considered as part of the park (see Fig 8). Several institutions have done research here, e.g. CEDC, EdF, GEF, WWF. Several publications give background information and area descriptions, here we use the dissertation of Mayaka (2002) to document prey density (figures are optimistic and must be interpreted as maximum values, Mayaka pers. comm. 2004) (see Table 5). Benoue NP has only 3 permanent operational game guards, assisted periodically by several locally recruited guides and eco-guards. Only a fraction of the road system is regularly maintained. The road from the tarmac to the main camp and the area around the main camp (including the guides' village and the office of the game warden) is relatively well patrolled but there is heavy poaching in the rest of the park. The proximity to an urban centre with high bushmeat demand (Garoua) and the easy access and bushmeat evacuation (bordered by a main road) explains the high human pressure.

Table 5: prey in Benoue NP, densities (d_) in km^{-2}, weight (w_) in $kg.km^{-2}$, loc=low-centre, upc= upper-centre, bel=bel eland east (see fig. 8). Source: Mayaka, 2002.

species	Weight	d_south	w_south	d_loc	w_loc	d_upc	w_upc	d_north	w_north	d_bel	w_bel
kob	70	5,6	392	19,4	1358	5,3	371	3,8	266	0,8	56
waterbuck	250	0,9	225	3,3	825	2,1	525	2,1	525	0,3	75
redunca	40	0,8	32	2,1	84	1,8	72	2,6	104	1,1	44
duikers	15	1,9	28,5	3,7	55,5	3,1	46,5	3,2	48	3,1	46,5
hartebeest	170	2,8	476	4,1	697	4,5	765	4	680	6,1	1037
roan	250	1,6	400	1,6	400	2,4	600	4,3	1075	3,5	875
oribi	15	1,6	24	5	75	3	45	3,5	52,5	4	60
eland	500	0	0	1,1	550	1,8	900	1,7	850	2,4	1200
warthog	50	1,3	65	1	50	1,7	85	1,8	90	1,3	65
total prey $kg.km^{-2}$			1642,5		4094,5		3409,5		3690,5		3458,5
total kg prey			824042		1528067		1784873		1586546		373518

Upon arrival, 17 April 14:00h., Bas van Luijk first gave a demonstration of darting (aiming at a cardboard box). He explained the conditions under which darting can take place and the pro's and con's of different types of darting materials. He also explained the materials and methods used for lion immobilisation. He was further present throughout the survey, ready to dart a lion if one responded to a call-up using a biopsy dart.

The survey consisted of a total of 22 calling stations, using the same materials and protocol as used in Bouba Ndjida NP and described in the previous section of the present report. There were no major practical problems, except some delay due to rains on 19 April between 17:00 and 21:00 hours. Originally we intended to cover sample areas distributed over the entire

park, but the inaccessibility of the north and south of the park limited fieldwork to the lower centre sector and, to a lesser extent, the upper centre and bel eland sectors (see Fig 8).

Not a single lion responded to our calling stations. A total of at least 6 hyenas responded; twice two adults and twice single adults, at various times of the night. In one case we were quite sure that there was only 1 hyena, in the other three cases sounds suggested that there were more than the 1 or 2 adults, respectively, leading to a likely number of 11 hyenas.

Here too, like in Bouba Ndjida NP, effective range and response rate were not determined empirically and are conservatively assumed to be 2.5 km and 100%, respectively. This gives a minimum hyena density of 0.014 km^{-2} and a likely density of 0.025 km^{-2} in the area covered by the call-ups. Extrapolation to the entire park should take into account that stations were mostly located around the main camp and the lower centre sector. Table 5 shows that this sector features a higher prey density than any other sector, and hyena density in the other sectors is therefore likely to be lower. On the other hand, the density estimate is conservative, since hyenas are extremely shy and may have been overlooked and since response rate is undoubtedly lower than the assumed 100%. We therefore speculate that the entire park has a hyena density of 0.025 km^{-2}, leading to a total speculative number of 45 hyenas.

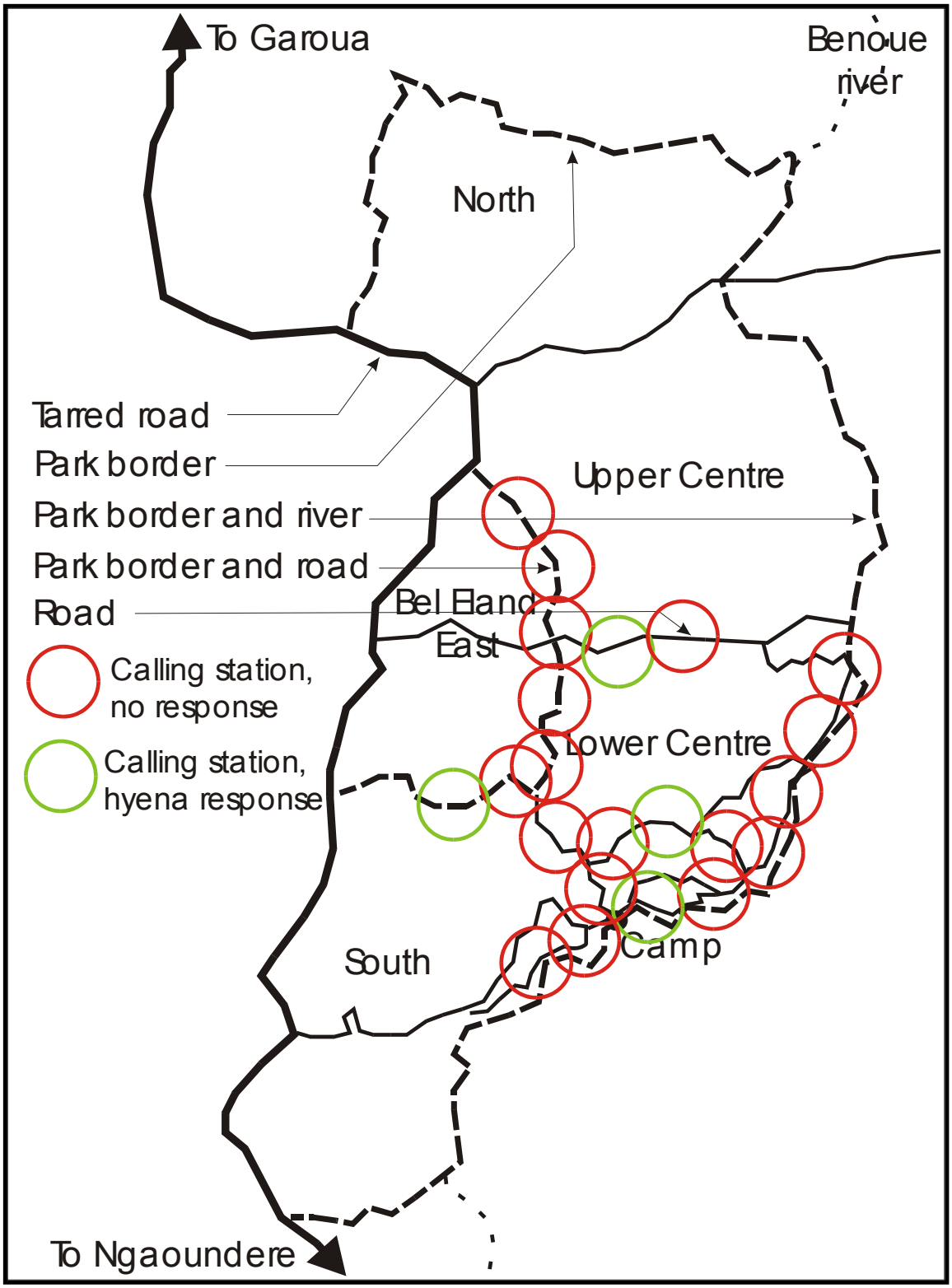
There was no lion response at the calling stations, we heard no lions throughout our stay in the park, and lion traces were found only once. Clearly, lion density is very low in the central part of the park at the end of the dry season. The survey covered 24% of the surface area of the park, a relatively high sampling effort and theoretically allowing extrapolation to the entire park. However, it is not true that there are no lions in Benoue NP. I observed lions on previous trips to the area, and resident researchers, students, guides and other informants regularly observe lions. The park warden estimates their population at around 20 (which equals 0.01 km^{-2}) excluding cubs (Assan Gomse, pers. comm. 2004). He also confirmed that herders frequently enter the park illegally, especially in the dry season when water is scarce, entering into conflict and sometimes poisoning predators (see Fig. 5), which partly explains this very low density. The results presented here suggest that these lions have large homeranges and were outside the central area of the park, or outside the park, during the survey period. The survey results are summarized in Table 6.

Table 6 : lion and hyena estimates for Benoue NP.

Species	Minimum density	Speculative number
Lion	0	20
Hyena	0.014 km^{-2}	45

Since we were unsuccessful in finding lions we could not exercise biopsy darting. This is very unfortunate both in terms of survey results and training effect, but it does not change the fact that the objective of the course was achieved; the participant can now easily take a cardboard box biopsy and can imagine what it would be like to dart a lion.

Fig 8: Map of Benoue NP, circles represent the surface covered by the calling stations



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Addresses

Institute of Environmental Sciences, Leiden University (CML)
P.O. Box 9518
2300 RA Leiden
The Netherlands
Oskam@cml.leidenuniv.nl

Wildlife Training College (Ecole de Faune - EdF)
P.O. Box 421
Garoua
Cameroon
Ecoledefaune@yahoo.fr

Centre for Environment and Development studies in Cameroon (CEDC)
P.O. Box 410
Maroua
Cameroon
Cedc@braouz.net