

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA



Fifty-fifth meeting of the Standing Committee
The Hague (Netherlands), 2 June 2007

Interpretation and implementation of the Convention

Species trade and conservation issues

Elephants

MIKE BASELINE INFORMATION

1. This document has been prepared by the Secretariat.
2. Information on the methodology, structure, preliminary findings, data analysis and funding of the MIKE programme was provided to the Parties at: the 11th meeting of the Conference of the Parties (Gigiri, 2000) in document Doc. 11.31.2; the 12th meeting (Santiago, 2002) in document CoP12 Doc. 34.2; and the 13th meeting (Bangkok, 2004) in document CoP13 Doc. 29.3. Reports of the MIKE and ETIS Subgroup of the Standing Committee were reviewed at the 45th (document SC45 Doc. 22), 49th [document SC49 Doc. 11.2 (Rev. 1)], 53rd (document SC53 Doc. 20.2) and 54th (document SC54 Doc. 26.4) meetings of the Standing Committee (held in Paris, June 2001; Geneva, April 2003; Geneva, June-July 2005; and Geneva, October 2006, respectively). Other documents relating to the MIKE programme and associated meetings are available on the CITES website.
3. At its 49th meeting, the Standing Committee adopted a baseline definition which was further clarified at its 53rd meeting. This definition is provided in Annex 1 to this document. The baseline information, in accordance with this definition, was presented to the Standing Committee at its 54th meeting in document SC54 Doc. 26.2 (Rev. 1). The Committee agreed that the baseline information was not yet complete and requested that the Secretariat present the complete baseline information at the present meeting.
4. This document presents the status of the availability of the baseline information, which is complete for 51 sites in Africa and 18 sites in Asia. Annex 2 presents a summary table for each sub-region indicating that the data necessary to meet the baseline definition are available for the required number of sites.
5. As provided for in the definition, when data could not be collected in certain sites because of civil strife, the situation was inferred from ETIS data and other expert sources.
6. The preliminary analysis of the data is presented in Annexes 3-5. The analysis includes the new data received for sites that were not complete at the time of the 54th meeting.
7. The Secretariat recommends that the Standing Committee accept the baseline information as meeting the definition adopted by the Committee.

MIKE BASELINE INFORMATION

Pursuant to Decision 12.33, the Standing Committee adopted at its 49th meeting and clarified at its 53rd meeting, the following definition of MIKE baseline information:

Geographical scope

1. For Africa, the geographical scope will cover 45 sites as set out below.
2. For Asia, the geographical scope will cover 18 sites as set out below.

In the circumstances that MIKE data can not be collected at some sites in countries such as Côte d'Ivoire or the eastern part of the Democratic Republic of the Congo, owing to civil strife, the situation will be inferred from ETIS data and other expert sources.

Nature of the data

For each reporting site, the following information would be presented:

1. At least one population survey, which must not predate the year 2000;
2. Levels of illegal killing derived from a minimum of 12-months' (Africa) / 6-months' (Asia) data obtained from patrol forms and carcass forms and summarized in monthly reports;
3. A descriptive report on the patterns of influencing factors;
4. An assessment of the effort made in providing the illegal killing information; and
5. A preliminary baseline analysis of paragraphs 1 to 4 above.

Geographical scope

<i>Alternates</i>		<i>Alternates</i>	
West Africa – 16 sites		Central Africa – 13 sites	
Pendjari (BJ)	Parc W (BJ)	Bangassou (CF)	Salonga (CD)
Parc W (BF)	Parc W (NE)	Dzangha-S. (CF)	Virunga (CD)
Nazinga (BF)		Sangba (CF)	
Comoe (CI)		Boumba Bek (CM)	
Tai (CI)		Waza (CM)	
Marahoue (CI)		Nouabable-N (CG)	
Kakum (GH)		Odzala (CG)	
Mole (GH)		Garamba (CD)	
Ziama (GN)		Kahuzi-B. (CD)	
Sapo (LR)		Okapi (CD)	
Gourma (ML)		Minkebe (GA)	
Babah Rafi (NE)		Lope (GA)	
Sambissa (NG)		Zakouma (TD)	
Yankari (NG)			
Niokolo Koba (SN)			
Keran (TG)			
East Africa – 8 sites		Southern Africa – 8 sites	
Gash Setit (ER)	Meru (KE)	Chobe (BW)	Etosha (NA)
Elgon (KE)	Tsavo (KE)	Cahora Bassa (MZ)	
Samburu/L. (KE)	Katavi (TZ)	Niassa (MZ)	
Akagera (RW)	Tarangire (TZ)	Caprivi (NA)	
Ruaha (TZ)	Elgon (UG)	Kruger (ZA)	
Selous (TZ)		S. Luangwa (ZM)	
Murchison F. (UG)		Chewore (ZW)	
Q. Elizabeth (UG)		Nyami N. (ZW)	
South Asia – 10 sites		South East Asia – 8 sites	
E. Dooers (IN)	Chirang-R. (IN)	Xishuangbanna (CN)	Cardoman (KH)
Garo Hills (IN)	Deomali (IN)	Mondulkire (KH)	Nam Phui (LA)
Mayurbhanj (IN)	Dehang P. (IN)	Bukit Barisan (ID)	Kluang District (MY)
Shivalik (IN)	Niligiris (IN)	Way Kambas (ID)	She U Daung (MM)
Mysore (IN)	Yala (LK)	Gua Musang (MY)	Kuibiri NP (TH)
Wyanad (IN)		Alaungdaw K. (MM)	
Wilpattu (LK)		Salakphra WS (TH)	
Suklaphanta (NP)		Cat Tien (VN)	
Samchi (BT)			
Chunauti (BD)			

STATUS OF SITES IN RELATION TO THE BASELINE REQUIREMENTS

This annex provides a summary indicating the baseline status of each site as of 21 May 2007. Data collection for these sites has been ongoing and will continue in the context of the MIKE monitoring programme.

Table A2.1. *Status of sites in relation to the baseline requirements*

- = Baseline achieved
- 1 = Baseline achieved using ETIS proxy data (for areas of civil strife)
- 2 = baseline achieved using expert sources (IUCN African Elephant Database) for areas of civil strife

	Country	Site	12 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information
WEST AFRICA SUB REGION						
1	Benin	Pendjari	●	●	●	●
2	Benin	Park W	●	●	●	●
3	Burkina Faso	Nazinga	●	●	●	●
4	Burkina Faso	Park W	●	●	●	●
5	Côte d'Ivoire	Comoe	●1	●1	●	●2
6	Côte d'Ivoire	Tai	●1	●1	●	●2
7	Côte d'Ivoire	Marahoue	●1	●1	●	●2
8	Ghana	Kakum	●	●	●	●
9	Ghana	Mole	●	●	●	●
10	Guinea	Ziama	●	●	●	●
11	Liberia	Sapo	●1	●1	●2	●2
12	Mali	Gourma	●	●	●	●
13	Niger	Babah Rafi	●	●	●	●
14	Nigeria	Sambissa	●	●	●	●
15	Nigeria	Yankari	●	●	●	●
16	Senegal	Niokolo Koba	●	●	●	●
17	Togo	Keran	●	●	●	●
CENTRAL AFRICA SUB REGION						
18	Cameroon	Boumba Bek	●	●	●	●
19	Cameroon	Waza	●	●	●	●
20	Central African Republic	Bangassou	●	●	●	●
21	Central African Republic.	Dzanga Sangha	●	●	●	●
22	Central African Republic	Sangba	●	●	●	●
23	Congo	Nouabale Ndoki	●	●	●	●
24	Congo	Odzala	●	●	●	●
25	Democratic Republic of Congo	Garamba	●	●	●	●

	Country	Site	12 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information
26	Democratic Republic of Congo	Kahuzi Biega	●	●	●	●
27	Democratic Republic of Congo	Okapi	●	●	●	●
28	Democratic Republic of Congo	Salonga	●	●	●	●
29	Gabon	Lope	●	●	●	●
30	Gabon	Minkebe	●	●	●	●
31	Chad	Zakouma	●	●	●	●
SOUTHERN AFRICA SUB REGION						
32	Namibia	Caprivi	●	●	●	●
33	Namibia	Etosha	●	●	●	●
34	Botswana	Chobe	●	●	●	●
35	South Africa	Kruger	●	●	●	●
36	Zimbabwe	Nyami Nyami	●	●	●	●
37	Zimbabwe	Chewore	●	●	●	●
38	Zambia	South Luanga	●	●	●	●
39	Mozambique	Niassa	●	●	●	●
40	Mozambique	Cahorra Basa	●	●	●	●
EAST AFRICA SUB REGION						
41	Eritrea	Gash Setit	●	●	●	●
42	Kenya	Mt Elgon	●	●	●	●
43	Kenya	Samburu/ Laikipia	●	●	●	●
44	Kenya	Tsavu	●	●	●	●
45	Rwanda	Akagera	●	●	●	●
46	United Republic of Tanzania	Ruaha	●	●	●	●
47	United Republic of Tanzania	Selous	●	●	●	●
48	United Republic of Tanzania	Tarangire	●	●	●	●
49	United Republic of Tanzania	Katavi	●	●	●	●
50	Uganda	Murchison Falls	●	●	●	●
51	Uganda	Queen Elizabeth	●	●	●	●
	Country	Site	6 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information
SOUTH ASIA SUB REGION						
1	Bangladesh	Chunati	●	●	●	●
2	Bhutan	Samtse	●	●	●	●
3	India	E. Dooers	●	●	●	●
4	India	Garo Hills	●	●	●	●

	Country	Site	12 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information
5	India	Mayurbhanj	●	●	●	●
6	India	Mysore	●	●	●	●
7	India	Shivalik	●	●	●	●
8	India	Wyanad	●	●	●	●
9	India	Deomali	●	●	●	●
10	Nepal	Suklaphanta	●	●	●	●
11	Sri Lanka	Wilpattu	●	●	●	●
SOUTH-EAST ASIA SUB REGION						
12	China	Xishuangbanna	●	●	●	●
13	Cambodia	Mondulkire	●	●	●	●
14	Indonesia	Bukit Barisan NP	●	●	●	●
15	Indonesia	Way Kambas NP	●	●	●	●
16	Malaysia	Gua Musang	●	●	●	●
17	Thailand	Selakphra	●	●	●	●
18	Thailand	Kuibiri	●	●	●	●
19	Myanmar	Alangdaw Katapa NP	●	●	●	●
20	Viet Nam	Cat Tien NP	●	●	●	●

Table A2.2. *Sites for which population surveys are not yet completed*

- = Baseline Achieved
- n/a = Information not yet available

	Country	Site	6 Months LEM Data	Carcass Data	Population Survey	Influencing Factor Information
SOUTH ASIA SUB REGION						
1	India	Chirang-Ripu	n/a	n/a	n/a	●

Summary and statistical analysis of baseline data

A3.1 *The Data*

The data consist of monthly carcass counts, including carcasses encountered by patrols as well as non-patrol encounters. Various law enforcement monitoring (LEM) statistics are also included in the data. The coverage of the data are shown in Table A3.1.1.

The LEM data include, for each month, numbers of man- hours spent on patrols on foot, vehicle, boat, observation posts and others; also recorded are the total number of patrols and total number of patrol hours. Data from the Samburu/Laikipia site in Kenya, having been collected by participatory methods rather than patrols, include a very different measure of LEM effort: number of community meetings.

In the preliminary analysis presented to CoP13 in 2004, differences between sites were accounted for by simply including Site as a factor in the analysis. When site differences were found, no attempt was made to causally ascribe those differences to any particular feature of sites. For the present analysis, a number of characteristics of sites (described below) have been compiled. Most of these are ordered categorical variables. They are referred to variously as site attributes or “influencing factors”. Representing site differences in terms of attributes moves a step closer to assigning particular causal patterns explaining elephant mortality.

A3.2 *Data Summaries*

Summaries of the data are presented in Tables A3.2.1 – A3.2.4 at the end of this annex.

A3.3 *Patterns of Influencing Factors*

The number of potential site attributes, or influencing factors, is quite large and it would be useful to seek some simpler representation in terms of fewer variables. The idea is to lay the foundations for future analysis which is as simple as possible. Two approaches to this simplification are:

- (1) Decide on thematic groupings of the variables according to their meaning and devise a combined score for each group. This exercise would be carried out independently of the actual data on the attributes, being based solely on prior knowledge of the variables.
- (2) Use statistical methods to detect grouping of similar variables.

An attempt at the prior approach (1) is summarized in Table A3.3.1.

Table A3.3.1: An *a priori* thematic grouping of attributes.

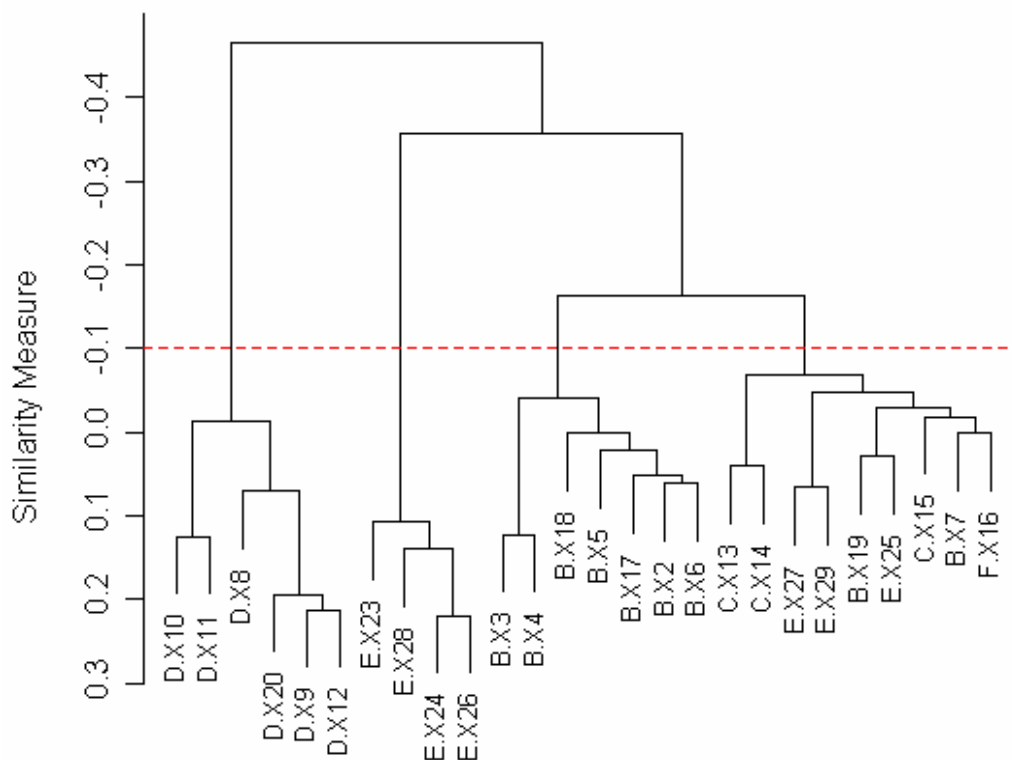
Group	Theme	Attribute variables
A	Ecosystem	X1
B	Human/elephant pressure	X2, X3, X4, X5, X6, X7, X17, X18, X19
C	Civil strife/conflict	X13, X14, X15
D	Degree of protection	X8, X9, X10, X11, X12, X20
E	Illegal trade pressures	X23, X24, X25, X26, X27, X28, X29
F	Elephant density	X16
G	CITES decisions	X30

The statistical approach used for grouping the attributes was *variable clustering* (Harrell, 2006; Sarle, 1990). A hierarchical clustering of the variables is shown in Fig. A3.3.1. Variable X1 is a classification variable and could not be utilized, and no data are currently available for X30, so it was also omitted from the analysis.

In the diagram, the groupings chosen in Table A3.3.1 are appended to the variable names. The broken line indicates a suitable level in the hierarchy to form the groups. This suggests that in broad terms there is strikingly good agreement between the *a priori* grouping and the variable clustering. The last group on the right is a residual group of variables with no clear associations with any others.

This offers hope that significant simplification will be possible in future analysis.

Fig. A3.3.1 Cluster analysis of site attributes



A3.4 Law Enforcement Effort

The MIKE process collects detailed information on law enforcement monitoring (LEM) effort. An important use for this information is to adjust for differential effort in making comparisons in measure of illegal killing between sites, or over time (Jachmann, 1998).

The variables on LEM effort that are available from most sites are, for each month:

- Total patrol hours
- Number of patrols
- Foot patrol man-hours
- Vehicle patrol man-hours
- Boat patrol man-hours
- Observation post man-hours
- Other patrol type man-hours

To be useful, a measure of effort should be reasonably well correlated with carcass counts. Two such measures were found to be the total patrol hours and the sum of all of the man-hours for the different patrol types. Carcass counts (excluding non-patrol counts) were found to be slightly better correlated with total man-hours than with total patrol hours. Furthermore, the data for total man-hours was slightly more complete and it was therefore chosen as the measure of effort used in subsequent analysis. No other combinations of the available variables afforded any improvement over this simple choice. Table A3.4.1 includes a summary of patrol total man-hours for each site. The table also presents carcass counts (recorded on patrol) adjusted for LEM effort.

Carcass counts from the MIKE database include observations from non-patrol sources. Given the likely diversity of these sources, there is no obvious measure of effort. Consequently, all catch-effort analysis has been based on patrol data only.

The method of data collection at Samburu, which was based on participatory methods with communities and informants, is completely different from the patrol approach used elsewhere. The “number of community meetings” has been used as a measure of effort in the analysis of the Samburu data. This is not compatible with the LEM effort measure used for the patrol data, so the Samburu data has been analysed separately.

A3.5 Analysis of the Data

The aims of the data analysis are:

- (1) To identify those site attributes which tend to influence the rate of illegal killing of elephants;
- (2) To use knowledge gained from (1) to enable a more refined assessment of the levels of illegal killing than could be obtained directly from the raw data.

Illegal killing must be assessed against the backdrop of elephant mortality from all possible causes. While direct estimates of overall mortality are not easy to obtain, an assumption of the present analysis is that the observed counts of carcasses derived from patrols will be a relative measure allowing comparisons, both spatial and temporal, to be estimated.

The present analysis is based on monthly totals of carcass counts. Future analyses may benefit from more detailed information at the level of individual patrols, when this information is collated. Such an analysis may be able to account for at least some of the likely bias in patrol data resulting from the strictly non-random nature of the data collection process.

A brief description of the statistical methods used in the analysis can be found in Annex 5.

There are important differences between the African and Asian sites, especially with regard to the nature of law enforcement patrols. The analysis was therefore done separately for each of the two regions.

A3.5.1 Analysis of African Sites

Overall carcass counts

Carcass counts must be adjusted for LEM effort, so this part of the analysis is restricted to carcasses encountered by patrols.

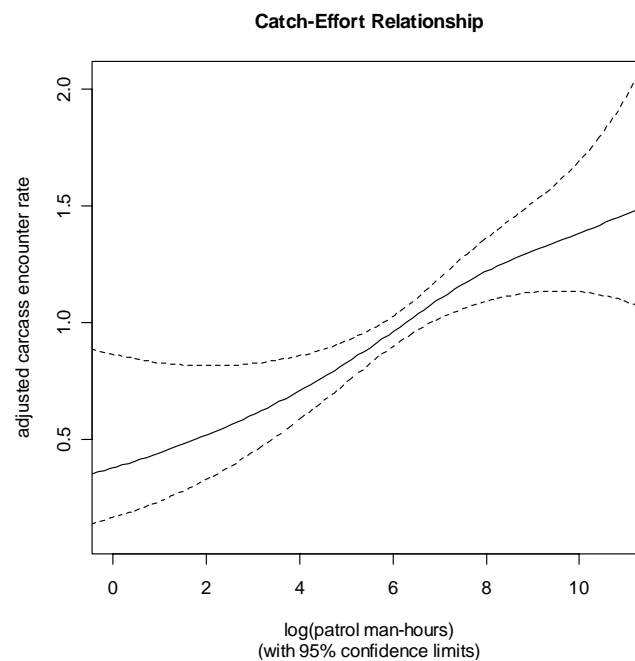
The factors that influence carcass counts are:

- patrol effort (total man-hours),
- elephant population size,
- area of the site,
- X3, type of land use within the site,
- X27, corruption index,
- X29, illegal arms.

All of these influencing factors were statistically highly significant (with a significance level < 0.0001).

The estimated relationship between number of carcasses (after adjusting for area and elephant population size) and effort (man-hours) is summarized in the graph below (Fig A.3.5.1.1).

Fig. A3.5.1.1. *Estimated relationship between number of carcasses (after adjusting for area and elephant population size) and effort (man-hours).*



Remarks on interpretation:

1. The effect of X3 on carcass counts was found to be mostly due to a large number in the group X3=1, which is the group of sites where the main land use is for wildlife. This probably simply reflects the fact that there tend to be more elephants in these sites, and hence more carcasses.
2. The correlation of carcass counts with X27 was found to be positive. The variable X27 is the "corruption perceptions index" from Transparency International, and is higher where corruption is less. So more carcasses are found where corruption is lower. A possible interpretation is that this variable is likely to be a proxy variable for a variety of other characteristics, some of which may tend to be associated with greater law enforcement efficiency. This in turn may be related to more effective patrols.
3. Numbers of carcasses were significantly greater in sites which where it was known that frequent illegal arms trafficking occurs.

Illegal killing

A preliminary analysis was restricted to patrol data so that the effect of patrol effort could be assessed. Also, the analysis was confined to cases where there were non-zero carcass counts. The method used (see Annex 5) models the *proportion* of all carcasses that were found to be illegally killed. LEM effort was found to be unrelated to the proportion illegally killed. Hence it is reasonable to use *all* carcass data (patrol and non-patrol) in the analysis of the proportion illegally killed.

Statistically significant effects were found to be:

- Sub-region,
- X5 - human access,
- X27 - corruption index,
- X9 - actual level of protection,
- X1 - ecosystem type.

There was no significant time trend apparent (except for the Samburu site which was analysed separately).

Illegal killing was found to be negatively correlated with the corruption index, indicating that higher levels of corruption are associated with more illegal killing.

Adjusted proportions of carcasses that were illegally killed:

<i>Sub-region</i>	<i>Proportion illegal</i>
Central Africa	0.63
East Africa	0.57
West Africa	0.33
Southern Africa	0.19

<i>Human access</i>	<i>Proportion illegal</i>
Difficult	0.28
Fairly difficult	0.36
Fairly easy	0.47
Easy	0.61

<i>Actual protection level</i>	<i>Proportion illegal</i>
Strong	0.31
Reasonably good	0.36
Moderate - none	0.49

<i>Ecosystem type</i>	<i>Proportion illegal</i>
Mainly forest	0.55
Mainly savannah	0.31

The data from Samburu/Laikipia in Kenya were analysed separately because of the fundamentally different mode of data collection noted above (Section A3.4). There was a significant year effect on the proportion of carcasses that were illegally killed, as can be seen from the following table.

Samburu: Proportion of carcasses illegally killed (unadjusted)

Year	2002	2003	2004	2005	Overall
No. of carcasses	159	195	128	160	642
Proportion illegal	0.38	0.18	0.31	0.17	0.25

A3.5.2 Analysis of Asian Sites

Overall carcass counts

Following the same analytical approach as for the Africa region, the factors that influence carcass counts were found to be

- patrol effort (total man-hours),
- area of the site,
- X24, ivory trade regulations.

Illegal killing

The only influencing factor found to be associated with the proportion of carcasses illegally killed was X27, the corruption index (significance level = 0.03). The association was negative, again indicating that higher levels of corruption are associated with more illegal killing.

Further analysis of data from Asian sites will be possible in due course when more data become available.

A3.6 Levels of illegal killing

The following are requirements of a measure of illegal killing elephants for the purposes of monitoring:

- (1) the measure needs to be robust with respect to changing conditions over time and between sites and countries;
- (2) it should represent the underlying average trend in illegal killing, without responding too much to random fluctuations.

In an attempt to meet these requirements, the measure adopted is derived from the second of the above statistical models. This has the effect of adjusting for the effects of influencing factors and smoothing out the “noise” in the data. Since there was no significant time effect, the data from all available years for each site were used in estimating the level of illegal killing. The results are in Table A3.6.1.

The level of illegal killing is defined as the percentage of the total carcass count that can be expected, other things being equal, to have arisen from illegal killing, according to the model with its underlying assumptions. A key assumption is that the probability of detection of a carcass remains constant within a site. It is important to understand that this measure is a *relative index* and not an absolute measure of the amount of illegal killing. It should be adequate for the purposes of making comparisons between sites or over time.

The level of illegal killing, as measured by this index, is subject to considerable uncertainty, reflecting the uncertainties inherent in the data. Some sites are represented by quite low total carcass counts, while others are high. For reference, these counts are included in the table. The table also includes 95% confidence limits (truncated to be in the range 0 – 100%).

Where the observed total carcass count is zero, the level of illegal killing is necessarily assumed to be zero.

A3.7 Use of ETIS information

Data gathering for four sites in West Africa was subjected to difficulties arising from civil strife in the region. These are Comoé, Marahoué and Tai in Côte d’Ivoire, and Sapo in Liberia. Data from ETIS on seizures of illegal ivory shipments have been used as a partial proxy for this missing information. However, the correspondence between ETIS and MIKE data is only meaningful at country level because ETIS contains no information at MIKE site level.

The table below presents summaries for the countries in the sub-region that have MIKE sites. The columns labelled RIE (kg) present the total weight of ivory, expressed as “raw ivory equivalent” arising from seizures where the country of origin was known to be the country in question. The number in the columns LE score are values of a statistic used by ETIS as a proxy measure for law enforcement effort and efficiency. This is a relative measure of the number of seizures reported by the country itself compared to the number of seizures reported elsewhere that implicate the country in question. The measure is on a logarithmic scale so that a negative score indicates poor enforcement effort.

Table A3.7.1 ETIS data for West Africa 2000 – 2006 used in the preliminary analysis

Country	2000		2001		2002		2003		2004		2005		2006	
	RIE (kg)	LE score	RIE (kg)	LE score	RIE (kg)	LE score	RIE (kg)	LE score	RIE (kg)	LE score	RIE (kg)	LE score	RIE (kg)	LE score
Benin	9	-3.0	11	-2.4	8	-2.9	3	-1.6		-1.1	12	-1.6		-1.1
Burkina Faso	5	-1.6	6	-1.6		0.0		0.0		0.0	3	-1.6	11	-1.1
Côte d'Ivoire	181	-4.3	33	-3.4	215	-0.6	46	-2.7	11	-2.7		-2.4		-2.2
Ghana	33	-2.6	5	-0.5	1420	-2.8	9	-2.2	2	0.0	31	-2.6	45	-2.8
Liberia		0.0	10	-1.1		0.0		0.0		-1.1		0.0	2	-1.1
Mali	6	-2.8	264	-3.8		-1.6		1.1		0.0		0.0	5	-1.1
Niger		-1.6		-1.6		-1.1	12	-1.1	5	-1.1		0.0		0.0
Nigeria	296	-4.6	4903	-4.5	164	-4.3	1528	-4.2	205	-4.1	181	-4.4	129	-3.4
Senegal	5	-3.1	7	-1.9	49	-3.1	43	-2.7		-1.1	6	-1.9		-2.2
Togo	1	-2.9	19	-2.2		-1.1		0.0	12	-1.1		-1.1		-1.1

Differences with the Preliminary report provided at SC 54

There are a number of differences in the results of this analysis when compared with the one provided at SC54. For example, in the United Republic of Tanzania sites in the table of levels of illegal killing (Table A3.6.1), the level for Rukwa Katavi has changed from 68 to 38. The reason is that the present analysis is based on a more complete dataset whereas the earlier one was provisional. With the data currently available, the preferred measure of LEM effort turns out to be total man-hours instead of total patrol hours. Different covariates emerge as being important partly because of this and partly because of additional records that have been supplied since the first analysis. This was anticipated and noted in the July 2006 report.

It can be anticipated that, as more information becomes available, further refinements to the analysis will become possible.

References

Harrell F.E. (2006). *Hmisc: Harrell Miscellaneous*. R package version 3.0-12. <http://biostat.mc.vanderbilt.edu/s/Hmisc>

Jachmann H. (1998). *Monitoring illegal wildlife use and law enforcement in African savanna rangeland*. Wildlife Resources Monitoring Unit, Environmental Council of Zambia.

McCullagh P., Nelder J.A. (1989). *Generalized Linear Models (2nd edition)*. Chapman & Hall.

Sarle W.S. (1990). The VARCLUS Procedure. *SAS/STAT User's Guide, 4th Edition*. Cary NC: SAS Institute, Inc.

Table A3.1.1 *Data coverage*

Subregion	Country	Site	Start	End	Months	
Central Africa	Cameroon	Boumba Bek	Jan 03	Dec 05	36	
		Waza	Mar 03	Jun 05	28	
	Central African Republic	Bangassou	Oct 03	Dec 04	15	
		Dzanga Sangha	Sep 03	Dec 05	28	
		Sangba	Jul 03	Dec 04	18	
	Chad	Zakouma	Jan 03	Dec 05	36	
	Congo	Nouabale Ndoki	Jan 03	Mar 05	27	
		Odzala	Jan 03	Dec 05	36	
	Democratic Republic of Congo	Garamba	Jan 03	Nov 06	47	
		Kahuzi Biega	Jan 04	Dec 06	36	
		Okapi	Apr 03	Jun 05	27	
		Salonga	Feb 03	Dec 05	35	
	Gabon	Lope	Jan 03	Dec 04	24	
		Minkebe	Jan 03	Dec 05	36	
	East Africa	Eritrea	Gash Setit	Jan 02	Dec 04	36
		Kenya	Mt. Elgon (Kenya)	Jan 03	Dec 05	36
Samburu Laikipia			Jan 02	Dec 05	48	
Tsavo East			Jan 03	Dec 05	36	
Tsavo West			Jan 03	Dec 05	36	
Rwanda		Akagera	Apr 04	May 06	26	
United Republic of Tanzania		Rukwa Katavi	Jul 03	Jul 05	25	
		Rungwa Ruaha	Jul 03	Jul 05	25	
		Selous Mikumi	[†] Oct 03	Sep 04	12	
		Tarangire Manyara	Jul 03	Dec 04	18	
Uganda		Murchison Falls	Jan 01	Aug 04	44	
		Queen Elizabeth	Jan 02	Mar 05	39	
Southern Africa	Botswana	Chobe National park	Apr 00	Aug 06	73	
	Mozambique	Cahora bossa	Jan 01	Dec 04	37	
		Niassa	Jan 04	Dec 04	12	
	Namibia	Caprivi Conservancy	Jan 03	Jun 04	18	
		Etosha National Park	Jan 00	May 04	53	
	South Africa	Kruger National Park	May 05	Jul 06	15	
	Zambia	South Luangwa	Oct 00	Dec 03	29	
	Zimbabwe	Chewore	Jan 00	Jul 03	27	
Nyami Nyami		Jan 00	Nov 03	35		
West Africa	Benin	Parc W	May 03	Dec 05	32	
		Pendjari	Apr 03	Sep 05	28	
	Burkina Faso	Nazinga	Jul 03	Mar 06	33	
		Parc W	Aug 03	Jul 06	13	
	Côte d'Ivoire	Comoé	*	*	*	
		Marahoué	*	*	*	
		Tai	*	*	*	

Subregion	Country	Site	Start	End	Months
	Ghana	Kakum	Jan 02	Dec 05	45
		Mole	Jan 03	Dec 05	36
	Guinea	Ziama	Jan 03	May 06	19
	Liberia	Sapo	*	*	*
	Mali	Gourma	Apr 02	Apr 05	12
	Niger	Babah Rafi	May 02	Dec 05	12
		Parc W	Jul 02	Jan 06	14
	Nigeria	Sambisa	Jan 03	Aug 04	19
		Yankari	Feb 03	Dec 04	15
	Senegal	Niokolo Koba	Jul 03	Dec 04	16
	Togo	Keran	Apr 02	Dec 04	15
South Asia	Bangladesh	Chunati Wildlife Reserve	Jan 05	May 06	17
	Bhutan	Samtse Forest Division	Jan 05	Jan 06	13
	India	Deomali E.R.	Apr 05	Mar 06	12
		Eastern Dooars E.R.	Feb 05	Mar 06	14
		Garo Hills E.R.	Feb 05	Dec 05	11
		Mayurbhanj E.R.	Apr 04	Jan 06	22
		Mysore E.R.	Jul 05	Mar 06	9
		Shivalik E.R.	Jan 05	Dec 05	11
		Waynad E.R.	Jul 04	Mar 06	21
	Nepal	Royal Suklaphanta W.R.	Jan 04	Dec 05	24
	Sri Lanka	Wilpattu N.P.	Jan 06	Jul 06	7
South-East Asia	Cambodia	Mondulkiri	Jan 06	Jul 06	7
	China	Xishuangbanna	Nov 05	Jun 06	8
	Indonesia	Bukit Barisan NP	Mar 06	Oct 06	8
		Way Kambas NP	Apr 06	Oct 06	7
	Malaysia	Gua Musang	Jul 05	Apr 06	10
	Myanmar	Alaungdaw Kathapa	Jan 06	Jun 06	6
	Thailand	Kuibiri	Dec 05	Sep 06	10
		Selakphra	Oct 05	Jul 06	9
	Vietnam	Cat Tien	Apr 06	Sep 06	6

† Selous Mikumi: Yearly totals are available for 2002-2006

* LEM and carcass data unavailable because of civil strife.

Table A3.2.1 Total carcass counts (patrol and non-patrol) by site and year and number of months for which data available

carc: number of carcasses found, *illegal*: number of illegally killed carcasses found, *months*: number of months that these totals are based on

Central Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Cameroon	Boumba Bek	<i>carc</i>				19	5	3	
		<i>illegal</i>				9	4	3	
		<i>months</i>				12	12	12	
	Waza	<i>carc</i>				3	2	2	
		<i>illegal</i>				1	1	1	
		<i>months</i>				10	12	6	
Central African Republic	Bangassou	<i>carc</i>				3	8		
		<i>illegal</i>				2	8		
		<i>months</i>				3	12		
	Dzanga Sangha	<i>carc</i>				10	9	6	
		<i>illegal</i>				10	4	6	
		<i>months</i>				4	12	12	
	Sangha	<i>carc</i>				5	1		
		<i>illegal</i>				4	1		
		<i>months</i>				6	12		
Chad	Zakouma	<i>carc</i>				28	29	11	
		<i>illegal</i>				17	24	4	
		<i>months</i>				12	12	12	
Congo	Nouabale Ndoki	<i>carc</i>				10	19	1	
		<i>illegal</i>				6	7	1	
		<i>months</i>				12	12	3	
	Odzala	<i>carc</i>				35	35	72	
		<i>illegal</i>				13	20	53	
		<i>months</i>				12	12	12	
Democratic Republic of Congo	Garamba	<i>carc</i>				114	197	86	34
		<i>illegal</i>				110	176	77	32
		<i>months</i>				12	12	12	11
	Kahuzi Biega	<i>carc</i>					0	0	0
		<i>illegal</i>					0	0	0
		<i>months</i>					12	12	12
	Okapi	<i>carc</i>				20	10	10	
		<i>illegal</i>				20	9	9	
		<i>months</i>				9	12	6	
	Salonga	<i>carc</i>				2	56	4	
		<i>illegal</i>				0	36	1	
		<i>months</i>				11	12	12	
Gabon	Lope	<i>carc</i>				6	4		
		<i>illegal</i>				4	1		
		<i>months</i>				12	12		
	Minkebe	<i>carc</i>				14	11	8	

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
		<i>illegal</i>				12	9	5	
		<i>months</i>				12	12	12	

East Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006	
Eritrea	Gash Setit	<i>carc</i>			3	3	1			
		<i>illegal</i>			0	1	0			
		<i>months</i>			12	12	12			
Kenya	Mt. Elgon (Kenya)	<i>carc</i>				7	7	1		
		<i>illegal</i>				6	5	0		
		<i>months</i>				12	12	12		
	Samburu Laikipia	<i>carc</i>			159	195	128	160		
		<i>illegal</i>			60	36	40	27		
		<i>months</i>			12	12	12	12		
	Tsavo East	<i>carc</i>				42	45	37		
		<i>illegal</i>				4	11	14		
		<i>months</i>				12	12	12		
	Tsavo West	<i>carc</i>				40	20	23		
		<i>illegal</i>				14	8	3		
		<i>months</i>				12	12	12		
Rwanda	Akagera	<i>carc</i>					0	0	0	
		<i>illegal</i>					0	0	0	
		<i>months</i>					9	12	5	
United Republic of Tanzania	Rukwa Katavi	<i>carc</i>				12	20	6		
		<i>illegal</i>				9	15	3		
		<i>months</i>				6	12	7		
	Rungwa Ruaha	<i>carc</i>				10	6	2		
		<i>illegal</i>				1	1	1		
		<i>months</i>				6	12	7		
	Selous Mikumi†	<i>carc</i>				9	11			
		<i>illegal</i>				2	2			
		<i>months</i>				3	9			
	Tarangire Manyara	<i>carc</i>				7	11			
		<i>illegal</i>				1	0			
		<i>months</i>				6	12			
Uganda	Murchison Falls	<i>carc</i>		3	0	10	2			
		<i>illegal</i>		2	0	10	1			
		<i>months</i>		12	12	12	8			
	Queen Elizabeth	<i>carc</i>			3	1	8	1		
		<i>illegal</i>			0	1	3	0		
		<i>months</i>			12	12	12	3		

† Data on annual totals for Selous Mikumi (no monthly data available)

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Kenya	Selous Mikumi	<i>carc</i>			43	42	28	28	13
		<i>illegal</i>			9	10	15	16	11
		<i>months</i>							

Southern Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Botswana	Chobe National park	<i>carc</i>	5	18	0	59	73	153	82
		<i>illegal</i>	0	0	0	0	5	7	6
		<i>months</i>	5	12	12	12	12	12	8
Mozambique	Cahora bossa	<i>carc</i>		7	1	3	2		
		<i>illegal</i>		4	0	1	2		
		<i>months</i>		12	1	12	12		
	Niassa	<i>carc</i>					14		
		<i>illegal</i>					0		
		<i>months</i>					12		
Namibia	Caprivi Conservancy	<i>carc</i>				8	6		
		<i>illegal</i>				2	0		
		<i>months</i>				12	6		
	Etosha National Park	<i>carc</i>	17	18	24	18	1		
		<i>illegal</i>	0	0	0	0	0		
		<i>months</i>	13	11	12	12	5		
South Africa	Kruger National Park	<i>carc</i>						35	27
		<i>illegal</i>						0	0
		<i>months</i>						8	7
Zambia	South Luangwa	<i>carc</i>	11	16	4	8			
		<i>illegal</i>	4	9	1	5			
		<i>months</i>	3	8	6	12			
Zimbabwe	Chewore	<i>carc</i>	2	14	2	5			
		<i>illegal</i>	0	0	0	0			
		<i>months</i>	11	12	2	2			
	Nyami Nyami	<i>carc</i>	13	10	3	7			
		<i>illegal</i>	8	7	2	2			
		<i>months</i>	11	12	6	6			

West Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Benin	Parc W	<i>carc</i>				0	4	0	
		<i>illegal</i>				0	2	0	
		<i>months</i>				8	12	12	

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
	Pendjari	<i>carc</i>				1	3	0	
		<i>illegal</i>				1	1	0	
		<i>months</i>				7	12	9	
Burkina Faso	Nazinga	<i>carc</i>				0	1	5	1
		<i>illegal</i>				0	0	0	0
		<i>months</i>				6	12	12	3
	Parc W	<i>carc</i>				1	0		0
		<i>illegal</i>				0	0		0
		<i>months</i>				4	6		3
Côte d'Ivoire	Comoé	<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
		<i>months</i>	*	*	*	*	*	*	*
	Marahoué	<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
		<i>months</i>	*	*	*	*	*	*	*
	Taï	<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
		<i>months</i>	*	*	*	*	*	*	*
Ghana	Kakum	<i>carc</i>			2	3	6	2	
		<i>illegal</i>			1	0	0	0	
		<i>months</i>			9	12	12	12	
	Mole	<i>carc</i>				1	4	4	
		<i>illegal</i>				1	2	2	
		<i>months</i>				12	12	12	
Guinea	Ziama	<i>carc</i>				1	2	0	0
		<i>illegal</i>				1	2	0	0
		<i>months</i>				10	6	2	1
Liberia	Sapo	<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
		<i>months</i>	*	*	*	*	*	*	*
Mali	Gourma	<i>carc</i>			3	1	1	2	
		<i>illegal</i>			0	0	0	0	
		<i>months</i>			3	3	2	4	
Niger	Babah Rafi	<i>carc</i>			0	0	0	0	
		<i>illegal</i>			0	0	0	0	
		<i>months</i>			3	3	3	3	
	Parc W	<i>carc</i>			0	3	3	0	0
		<i>illegal</i>			0	1	2	0	0
		<i>months</i>			1	4	4	4	1
Nigeria	Sambisa	<i>carc</i>				1	3		
		<i>illegal</i>				1	0		
		<i>months</i>				11	8		
	Yankari	<i>carc</i>				10	2		

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
		<i>illegal</i>				3	1		
		<i>months</i>				11	4		
Senegal	Niokolo Koba	<i>carc</i>				0	1		
		<i>illegal</i>				0	0		
		<i>months</i>				6	10		
Togo	Keran	<i>carc</i>			0	0	0		
		<i>illegal</i>			0	0	0		
		<i>months</i>			4	4	7		

South Asia

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Bangladesh	Chunati Wildlife Reserve	<i>carc</i>						0	1
		<i>illegal</i>						0	0
		<i>months</i>						12	5
Bhutan	Samtse Forest Division	<i>carc</i>						0	0
		<i>illegal</i>						0	0
		<i>months</i>						12	1
India	Deomali E.R.	<i>carc</i>						0	2
		<i>illegal</i>						0	0
		<i>months</i>						9	3
	Eastern Dooars E.R.	<i>carc</i>						8	0
		<i>illegal</i>						1	0
		<i>months</i>						11	3
	Garo Hills E.R.	<i>carc</i>						2	
		<i>illegal</i>						0	
		<i>months</i>						11	
	Mayurbhanj E.R.	<i>carc</i>					12	17	1
		<i>illegal</i>					0	2	0
		<i>months</i>					9	12	1
	Mysore E.R.	<i>carc</i>						30	3
		<i>illegal</i>						4	1
		<i>months</i>						6	3
	Shivalik E.R.	<i>carc</i>						2	
		<i>illegal</i>						0	
		<i>months</i>						11	
	Waynad E.R.	<i>carc</i>					2	8	0
		<i>illegal</i>					0	1	0
		<i>months</i>					6	12	3
Nepal	Royal Suklaphanta W.R.	<i>carc</i>					0	0	
		<i>illegal</i>					0	0	
		<i>months</i>					12	12	
Sri Lanka	Wilpattu N.P.	<i>carc</i>							30

<i>illegal</i>	1
<i>months</i>	7

South-East Asia

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006	
Cambodia	Mondulkiri	<i>carc</i>							0	
		<i>illegal</i>							0	
		<i>months</i>							7	
China	Xishuangbanna	<i>carc</i>						0	1	
		<i>illegal</i>						0	0	
		<i>months</i>						2	6	
Indonesia	Bukit Barisan NP	<i>carc</i>							0	
		<i>illegal</i>							0	
		<i>months</i>							8	
	Way Kambas NP	<i>carc</i>							1	
		<i>illegal</i>							0	
		<i>months</i>							7	
Malaysia	Gua Musang	<i>carc</i>						0	0	
		<i>illegal</i>						0	0	
		<i>months</i>						6	4	
Myanmar	Alaungdaw Kathapa	<i>carc</i>							2	
		<i>illegal</i>							2	
		<i>months</i>							6	
Thailand	Kuibiri	<i>carc</i>						0	0	
		<i>illegal</i>						0	0	
		<i>months</i>						1	9	
	Selakphra	<i>carc</i>							1	0
		<i>illegal</i>							0	0
		<i>months</i>							2	7
Vietnam	Cat Tien	<i>carc</i>							0	
		<i>illegal</i>							0	
		<i>months</i>							6	

* Carcass and LEM data unavailable because of civil strife.

Table A3.2.2 *Elephant population estimates and densities*

Subregion	Country	Site	Year	Method	Area	NumEI	Density
Central Africa	Cameroon	Boumba Bek	2004	DC	2485	318	0.13
		Waza	2002	GS	1700	475	0.28
	Central African Republic	Bangassou	2004	IE(DC)	12000	1000	0.08
		Dzanga Sangha	2004	DC	2554	869	0.34
		Sangba	2005	AS	167	3	0.02
	Chad	Zakouma	2005	AT	2987	4000	1.30
	Congo	Nouabale Ndoki	2003	DC	6660	3032	0.46
		Odzala	2005	DC	13545	13545	1.00
	Democratic Republic of Congo	Garamba	2005	AS	6354	4081	0.64
		Kahuzi Biega	2000	IE(DC)	6000	771	0.13
		Okapi	2000	DC	6209	3808	0.61
		Salonga	2004	DC	22100	1186	0.05
	Gabon	Lopé	2005	DC	4486	2350	0.52
		Minkébé	2004	DC	7338	21070	2.87
	East Africa	Eritrea	Gash Setit	2003	IE (AT)	5275	96
Kenya	Mt. Elgon (Kenya)		2002	IE (IR)	899	139	0.15
		Samburu Laikipia	2002	AT	30093	5447	0.18
		Tsavo East	2005	AT	11747	6395	0.54
		Tsavo West	2005	AT	15949	3918	0.25
	Rwanda	Akagera	2002	AT	3475	39	0.01
United Republic of Tanzania	Rukwa Katavi	2002	AS	13365	5732	0.43	
	Rungwa Ruaha	2002	AS	36071	24685	0.68	
	Selous Mikumi	2002	AS	89417	63039	0.71	
	Tarangire Manyara	2004	AT	12000	1890	0.16	
Uganda	Murchison Falls	2002	AT	5044	692	0.14	
	Queen Elizabeth	2002	AT	2499	998	0.40	
Southern Africa	Botswana	Chobe National park	2004	AS	12672	35359	2.79
	Mozambique	Cahora bossa	2003	AS	2621	1628	0.62
		Niassa	2004	AS	42612	12477	0.29
	Namibia	Caprivi Conservancy	2004	AS	2274	2803	1.23
		Etosha National Park	2004	AS	18551	2057	0.11
	South Africa	Kruger National Park	2005	AT	22990	14669	0.64
	Zambia	South Luangwa	2002	AS	8448	4459	0.53
	Zimbabwe	Chewore	2003	AS	1737	4111	2.37
		Nyami Nyami	2001	AS	4637	4089	0.88
West Africa	Benin	Parc W	2003	AT	5872	56	0.01
		Pendjari	2003	AT	2826	713	0.25
	Burkina Faso	Nazinga	2003	AT	940	548	0.58
		Parc W	2003	AT	3300	740	0.22
	Côte d'Ivoire	Comoé	2002	IE	11500	10	0.001

Subregion	Country	Site	Year	Method	Area	NumEI	Density
		Marahoué	2002	GD	1010	159	0.16
		Tai	2002	GD	6410	53	0.01
	Ghana	Kakum	2004	DC	366	164	0.45
		Mole	2002	AS	2839	368	0.13
	Guinea	Ziama	2004	DC	455	214	0.47
	Liberia	Sapo	2002	DC	1292	313	0.24
	Mali	Gourma	2002	AT	27750	322	0.01
	Niger	Babah Rafi	2005	IE(IR)	430	17	0.04
		Parc W	2003	AT	2200	85	0.04
	Nigeria	Sambisa	2006	AT	518	0	0.00
		Yankari	2006	AT	2244	348	0.16
	Senegal	Niokolo Koba	2006	IE(AS)	9130	2	0.00
	Togo	Keran	2003	AT	1402	0	0.00
South Asia	Bangladesh	Chunati Wildlife Reserve	2003	GT	77.64	16	0.21
	Bhutan	Samtse Forest Division	2006	IR	20.6	12	0.58
	India	Deomali E.R.	2005	IE(GS)	953	107	0.11
		Eastern Dooars E.R.	2005	DC	838	537	0.64
		Garo Hills E.R.	2005	GS	1319	360	0.27
		Mayurbhanj E.R.	2005	DC	1631	1305	0.80
		Mysore E.R.	2005	DC	6724	6320	0.94
		Shivalik E.R.	2005	IE(GS)	824	416	0.50
		Waynad E.R.	2005	DC	934	882	0.94
	Nepal	Royal Suklaphanta W.R.	2005	IR	305	23	0.08
	Sri Lanka	Wilpattu N.P.	2004	GT	1317	1076	0.82
South-East Asia	Cambodia	Mondulkiri	2006	GD	1312	116	0.09
	China	Xishuangbanna	2006	IE(GD)	2400	165	0.07
	Indonesia	Bukit Barisan NP	2001	DC	3568	498	0.14
		Way Kambas	2001	DC	1235	180	0.15
	Malaysia	Gua Musang	2007	DC	1397	132	0.10
	Myanmar	Alaungdaw Kathapa	2001	DC	1605	23	0.01
	Thailand	Kuiburi	2007	IE(GS)	969	120	0.12
		Selakphra	2007	GD	858	140	0.16
	Vietnam	Cat Tien	2001	DC	742	10	0.01

Legend:

AS = Aerial Sample Count	GT = Ground Total Count
AT = Aerial Total Count	GD = Genetic Dung Count
DC = Line Transect Dung Count	GS = Ground Sample Count
IR = Individual Registration	IE = Informed Estimate

Table A3.2.3
Site Attributes
(see Annex 4 for details of codings)

Country	Site	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
<i>Central Africa</i>																					
Cameroon	Boumba Bek	A	2	1	1	2	2	1	2	2	5	4	4	5	2	1	0.13	1	3	4	4
	Waza	D	2	1	1	4	2	3	1	2	1	3	3	1	1	1	0.28	2	2	4	3
C.A.R.	Bangassou	B	4	5	4	3	5	2	5	5	5	5	5	2	2	2	0.08	3	4	4	5
	Dzanga Sangha	A	3	1	1	2	4	1	1	3	4	3	4	5	2	1	0.34	4	3	4	2
	Sangba	D	2	5	2	4	2	2	2	2	4	4	3	5	2	1	0.02	2	2	4	2
Chad	Zakouma	D	3	1	1	4	3	3	1	2	3	4	2	1	2	1	1.30	3	2	4	2
Congo	Nouabale Ndoki	A	3	1	1	2	2	1	1	1	5	4	3	5	2	1	0.66	2	2	4	3
	Odzala	B	3	1	1	2	3	1	1	3	4	4	3	5	2	1	1.00	2	2	4	3
D.R. Congo	Okapi	A	3	4	1	3	4	1	1	4	4	4	2	1	2	4	1.90	2	4	4	4
	Salonga	A	3	1	1	1	4	1	1	4	5	4	4	1	1	4	0.05	2	4	4	4
Gabon	Lope	A	3	2	1	3	3	1	1	3	3	3	3	1	1	1	0.65	3	3	4	3
	Minkebe	A	2	3	1	2	3	1	1	2	5	4	3	5	4	1	3.10	2	2	4	2
<i>East Africa</i>																					
Eritrea	Gash Setit	D	3	5	3	3	4	2	5	5	5	4	5	5	2	2	0.02	2	2	1	5
Kenya	Mt. Elgon (Kenya)	A	2	1	1	1	4	3	1	3	4	3	1	5	3	1	0.15	1	2	1	1
	Samburu Laikipia	D	3	5	3	2	3	2	3	3	3	2	1	1	1	2	0.18	4	2	4	3
	Tsavo East	D	3	1	2	3	1	2	1	1	2	2	1	2	4	1	0.54	3	2	4	1
	Tsavo West	D	3	1	2	3	1	2	1	1	2	2	1	1	4	1	0.25	4	2	4	1
Rwanda	Akagera	D	3	1	2	1	5	2	4	4	4	4	3	5	3	2	0.01	2	2	1	3
Tanzania	Rukwa Katavi	D	2	1	2	2	1	2	1	2	2	3	1	2	3	1	0.43	2	2	3	2
	Rungwa Ruaha	D	2	1	1	2	1	2	1	2	3	3	1	1	1	1	0.68	2	2	1	3
	Selous Mikumi	D	2	1	2	2	1	2	1	2	2	3	1	2	3	1	0.71	2	2	3	2
	Tarangire Manyara	C	2	4	3	3	1	1	1	1	2	3	1	2	1	1	0.16	2	2	1	1
Uganda	Murchison Falls	C	2	2	1	3	1	1	1	1	2	3	1	3	1	4	0.14	1	2	1	2
	Queen Elizabeth	C	3	2	1	3	1	1	1	1	4	3	1	1	3	4	0.40	3	2	3	2
<i>Southern Africa</i>																					
Botswana	Chobe National park	D	2	1	1	2	2	2	1	1	1	2	1	5	3	1	2.79	4	2	1	2
Mozambique	Cahora bossa Niassa	D	3	5	3	4	5	1	2	4	2	5	4	5	4	1	0.62	4	3	3	4
Namibia	Caprivi Conservancy	D	4	5	3	3	5	2	3	2	2	5	2	5	2	2	1.23	5	3	2	3
	Etosha National Park	D	2	1	1	1	1	4	1	1	1	1	1	1	1	1	0.11	2	1	1	2
South Africa	Kruger National Park	D	3	1	1	1	2	2	1	1	1	1	1	5	4	1	0.64	2	1	1	1
Zambia	South Luangwa	D	3	5	3	4	5	2	2	3	1	3	2	1	2	1	0.53	4	3	2	4
Zimbabwe	Chewore	D	2	5	3	4	5	2	2	3	1	3	2	5	2	1	2.37	5	3	2	2
	Nyami Nyami	D	3	5	3	4	5	1	2	3	1	4	2	4	2	1	0.88	5	3	2	2
<i>West Africa</i>																					
Benin	Parc W Pendjari	D	2	1	1	3	3	2	3	3	4	4	4	5	2	1	0.01	2	2	2	4
	Nazinga	D	2	1	1	2	2	2	2	2	3	3	3	5	2	1	0.58	2	2	1	3
Burkina Faso	Parc W	D	2	1	1	3	2	2	3	3	3	3	3	5	2	1	0.22	2	2	1	4
Ghana	Kakum	A	3	1	1	2	4	1	2	2	3	2	2	1	2	1	0.45	3	2	1	2
	Mole	D	2	1	1	3	3	2	3	3	3	3	3	1	2	1	0.13	3	2	1	3
Guinea	Ziama	A	2	1	1	3	3	1	4	4	4	4	4	5	3	2	0.47	3	2	1	4
Mali	Gourma	D	2	5	2	4	4	3	4	4	4	3	4	1	2	1	0.01	3	2	1	4
Niger	Babah Rafi	D	2	5	2	4	4	3	4	4	5	3	4	5	2	1	0.04	3	2	1	4
	Parc W	D	2	1	1	3	2	2	3	3	3	3	3	5	2	1	0.04	2	2	1	3
Nigeria	Sambisa	C	2	1	1	3	3	2	4	4	4	4	4	1	2	1	0.00	4	2	3	4
	Yankari	C	2	1	1	3	2	2	4	4	3	3	3	1	2	1	0.16	2	2	1	2

Country	Site	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
Senegal	Niokolo Koba	C	2	1	1	3	2	2	4	4	3	3	4	5	2	1	0.00	2	2	1	3
Togo	Keran	C	1	4	2	4	3	2	4	4	5	4	4	1	2	1	0.00	2	2	3	4
<i>South Asia</i>																					
Bangladesh	Chunati Wildlife Reserve	C	4	4	2	4	5	2	2	2	3	3	1	1	1	2	0.21	4	2	1	3
Bhutan	Samtse Forest Division	A	3	5	2	4	2	2	2	3	5	5	4	5	5	2	0.58	3	2	1	4
India	Deomali E.R.	A	3	5	3	3	3	1	8	4	5	5	4	2	3	2	0.11	2	2	1	4
	Eastern Dooars E.R.	B	4	5	2	4	5	2	1	1	3	2	1	5	2	2	0.61	5	2	1	1
India	Garo Hills E.R.	A	4	5	4	4	4	2	1	4	5	5	4	2	4	2	0.27	4	3	3	4
	Mayurbhanj E.R.	A	4	4	2	3	3	2	1	1	3	3	1	1	1	2	0.80	4	2	1	1
India	Mysore E.R.	A	4	5	2	4	3	2	1	1	2	2	2	1	1	1	0.94	4	3	5	2
	Shivalik E.R.	A	4	5	2	4	4	2	1	1	1	2	1	1	1	1	0.51	4	3	4	1
India	Waynad E.R.	A	4	5	3	4	5	1	1	1	2	2	1	1	1	1	0.94	5	2	3	1
	Royal Suklaphanta W.R.	B	4	1	1	4	4	2	1	1	3	3	1	5	2	3	0.08	2	2	1	1
Sri Lanka	Wilpattu N.P.	B	4	5	4	4	4	1	3	3	2	3	3	1	1	2	0.82	5	3	5	2
<i>South East Asia</i>																					
Cambodia	Cardamom	B	2	4	2	4	4	2	4	5	4	4	4	5	5	1		3	3	1	4
	Mondulkiri	B	2	4	2	4	3	2	4	4	4	4	4	5	5	1		3	2	1	3
China	Xishuangbanna	A	3	1	1	3	4	2	1	2	3	2	2	5	3	1	0.07	2	2	2	2
Indonesia	Bukit Barisan Selatan	A	3	1	1	2	2	2	4	4	4	4	5	5	3	1	0.14	3	2	1	5
	Way Kambas	A	3	1	1	3	5	2	1	1	2	2	2	1	1	1	0.15	2	2	1	2
Lao	Nam Phui	A	3	1	1	3	5	2	1	1	2	2	2	1	1	1		2	2	1	2
Malaysia	Gua Musang	A	4	4	3	4	5	3	3	3	3	3	3	2	1	1		4	4	2	3
	Kluang	A	4	4	3	4	5	2	3	3	3	3	3	1	1	1		4	4	2	3
Myanmar	Alaungdaw Kathapa	A	2	1	1	2	2	2	1	3	5	4	4	2	1	1	0.01	2	2	1	3
	Shwe U Duang	A	2	1	1	2	2	2	1	3	5	4	4	2	1	1		2	2	1	3
Thailand	Kuiburi	A	3	1	1	4	5	1	2	2	2	3	2	5	2	1	0.64	3	3	1	2
	Selakpra	A	3	1	1	4	5	1	1	2	3	3	2	2	1	1		3	3	1	2
Viet Nam	Cat Tien	A	3	1	1	3	3	1	1	2	3	3	2	2	1	1	0.01	2	2	1	3

Table A3.2.4 *Country Attributes*

Subregion	Country	X23	X24	X25	X26	X27	X28	X29
Central Africa	Cameroon	4	5	4	5	2.2	4	3
	Central African Republic	3	6	5	6	2.5	5	3
	Chad	3	6	1	6	1.7	4	3
	Congo	4	5	4	5	2.3	4	3
	Democratic Republic of Congo	5	6	5	6	2.1	5	4
	Gabon	4	5	4	5	2.9	4	1
East Africa	Eritrea	1	5	1	1	2.6	5	2
	Kenya	2	2	1	1	2.1	3	3
	Rwanda	2	2	1	1	3.1	4	3
	United Republic of Tanzania	2	2	1	1	2.9	3	2
	Uganda	2	2	1	1	2.5	3	3
South Africa	Botswana	1	1	1	2	5.9	3	2
	Mozambique	3	3	3	3	2.8	4	2
	Namibia	1	1	1	1	4.3	2	1
	South Africa	1	1	1	1	4.5	2	2
	Zambia	2	3	3	3	2.6	4	1
	Zimbabwe	3	2	3	3	2.6	4	1
West Africa	Benin	2	2	1	2	2.9	4	2
	Burkina Faso	1	2	1	2	3.4	3	2
	Côte d'Ivoire	4	2	3	2	2.1	5	3
	Ghana	1	2	1	2	3.5	3	2
	Guinea	1	2	1	2	1.9	4	2
	Liberia	1	2	3	2	2.2	5	3
	Mali	2	2	1	2	3.0	4	2
	Niger	1	2	1	2	2.4	4	2
	Nigeria	5	2	4	2	1.9	4	2
	Senegal	4	2	1	2	3.2	4	2
	Togo	2	2	1	2	2.6	4	2
South Asia	Bangladesh	3	5	2	5	1.7	4	2
	Bhutan	2	4	1	1	2.7	3	2
	India	1	1	1	1	2.9	2	2
	Nepal	1	1	1	1	2.5	2	2
	Sri Lanka	1	1	1	1	3.2	3	2
South East Asia	Cambodia	3	4	1	3	2.3	4	3
	China	5	2	1	2	3.2	1	3
	Indonesia	3	2	1	5	2.2	5	3
	Malaysia	2	2	1	1	5.1	4	2
	Myanmar	4	5	3	5	1.8	5	4
	Thailand	5	5	1	3	3.8	4	2
	Vietnam	4	4	1	3	2.6	3	2

Table A3.4.1 *Carcass counts adjusted for LEM effort: no. of carcasses per 1000 man-hours on patrol* (patrol data from patrols with non-zero effort only).

MH: total number of man-hours spent on patrol, *carc*: number of carcasses found per 1,000 man-hours, *illegal*: number of illegally killed carcasses found per 1,000 man-hours.

Central Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Cameroon	Boumba Bek	<i>MH</i>				6121	15674	2847	
		<i>carc</i>				1.96	0	1.05	
		<i>illegal</i>				1.14	0	1.05	
	Waza	<i>MH</i>				2033	1369	1373	
		<i>carc</i>				1.48	1.46	1.46	
		<i>illegal</i>				0.49	0.73	0.73	
Central African Republic	Bangassou	<i>MH</i>				257	770		
		<i>carc</i>				11.67	10.38		
		<i>illegal</i>				7.78	10.38		
	Dzanga Sangha	<i>MH</i>				3720	9386	6778	
		<i>carc</i>				1.88	0.96	0.89	
		<i>illegal</i>				1.88	0.43	0.89	
	Sangha	<i>MH</i>				6032	4972		
		<i>carc</i>				0.83	0.20		
		<i>illegal</i>				0.66	0.20		
Chad	Zakouma	<i>MH</i>				7228	6622	3086	
		<i>carc</i>				3.32	4.38	3.56	
		<i>illegal</i>				1.94	3.62	1.30	
Congo	Nouabale Ndoki	<i>MH</i>				10964	29965	3696	
		<i>carc</i>				0.64	0.43	0.27	
		<i>illegal</i>				0.46	0.13	0.27	
	Odzala	<i>MH</i>				18633	11880	14608	
		<i>carc</i>				1.82	2.95	4.93	
		<i>illegal</i>				0.70	1.68	3.63	
Democratic Republic of Congo	Garamba	<i>MH</i>				69376	108503	60953	76222
		<i>carc</i>				1.64	1.82	1.41	0.45
		<i>illegal</i>				1.59	1.62	1.26	0.42
	Kahuzi Biega	<i>MH</i>					27266	12542	32746
		<i>carc</i>					0	0	0
		<i>illegal</i>					0	0	0
	Okapi	<i>MH</i>				101107	179395	82757	
		<i>carc</i>				0.19	0.06	0.12	
		<i>illegal</i>				0.19	0.05	0.11	
	Salonga	<i>MH</i>				89	3826	6749	
		<i>carc</i>				0	14.38	0.59	
		<i>illegal</i>				0	9.15	0.15	

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Gabon	Lope	<i>MH</i>				1244	2547		
		<i>carc</i>				4.02	0		
		<i>illegal</i>				3.22	0		
	Minkebe	<i>MH</i>				5315	6473	4439	
		<i>carc</i>				2.45	1.54	0.45	
		<i>illegal</i>				2.07	1.24	0.23	

East Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006	
Kenya	Mt. Elgon (Kenya)	<i>MH</i>				13885	12525	15668		
		<i>carc</i>				0.50	0.56	0.06		
		<i>illegal</i>				0.43	0.40	0		
	Samburu Laikipia [†]	<i>Mtgs</i>			57	92				
		<i>carc</i>			2.79	2.12				
		<i>illegal</i>			1.05	0.39				
	Tsavo East	<i>MH</i>				101064	108416	168128		
		<i>carc</i>				0.42	0.28	0.18		
		<i>illegal</i>				0.04	0.06	0.07		
	Tsavo West	<i>MH</i>				147231	176658	241644		
		<i>carc</i>				0.15	0.08	0.08		
		<i>illegal</i>				0.05	0.03	0.01		
	Rwanda	Akagera	<i>MH</i>					2833	12154	3307
			<i>carc</i>					0	0	0
			<i>illegal</i>					0	0	0
United Republic of Tanzania	Rukwa Katavi	<i>MH</i>				9229	26122	11334		
		<i>carc</i>				0.87	0.73	0.53		
		<i>illegal</i>				0.76	0.54	0.26		
	Rungwa Ruaha	<i>MH</i>				5084	12534	6139		
		<i>carc</i>				1.97	0.24	0.33		
		<i>illegal</i>				0.20	0.08	0.16		
	Selous Mikumi	<i>MH</i>				6406	11160			
		<i>carc</i>				1.40	0.90			
		<i>illegal</i>				0.31	0.18			
	Tarangire Manyara	<i>MH</i>				7828	16901			
		<i>carc</i>				0.26	0.24			
		<i>illegal</i>				0	0			
	Uganda	Murchison Falls	<i>MH</i>	24793	19245	44763	39820			
			<i>carc</i>	0.12	0	0.22	0.03			
			<i>illegal</i>	0.08	0	0.22	0.03			
Queen Elizabeth		<i>MH</i>			5716	3875	7901	2348		
		<i>carc</i>			0.35	0.26	0.63	0		
		<i>illegal</i>			0	0.26	0.25	0		

[†]Samburu Laikipia: Data are number of meetings held in the year (*Mtgs*) and the number of carcasses (*carc*) and the number illegally killed (*illegal*) found per meeting.

Southern Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Botswana	Chobe National park	<i>MH</i>		4673	138162	20477	3836	4010	5184
		<i>carc</i>		3.85	0	2.54	12.25	34.66	14.27
		<i>illegal</i>		0	0	0	0.26	1.75	0.77
Mozambique	Niassa	<i>MH</i>					37464		
		<i>carc</i>					0.37		
		<i>illegal</i>					0		
Namibia	Etosha National Park	<i>MH</i>	133518	29042	25408	12696	13678		
		<i>carc</i>	0.07	0.48	0.47	0	0.07		
		<i>illegal</i>	0	0	0	0	0		
South Africa	Kruger National Park	<i>MH</i>						491515	398524
		<i>carc</i>						0.07	0.07
		<i>illegal</i>						0	0
Zambia	South Luangwa	<i>MH</i>			32460	224365			
		<i>carc</i>			0	0.01			
		<i>illegal</i>			0	0.01			
Zimbabwe	Chewore	<i>MH</i>	5092	1776					
		<i>carc</i>	0	0					
		<i>illegal</i>	0	0					
	Nyami Nyami	<i>MH</i>	1762	3483	244				
		<i>carc</i>	0	0	0				
		<i>illegal</i>	0	0	0				

West Africa

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Benin	Parc W	<i>MH</i>				4582	4003	4306	
		<i>carc</i>				0	1.00	0	
		<i>illegal</i>				0	0.50	0	
	Pendjari	<i>MH</i>				6687	6940	784	
		<i>carc</i>				0.30	0.43	0	
		<i>illegal</i>				0	0.14	0	
Burkina Faso	Nazinga	<i>MH</i>				707	9005	27550	9781
		<i>carc</i>				0	0	0.18	0.10
		<i>illegal</i>				0	0	0	0
	Parc W	<i>MH</i>				168	119		28
		<i>carc</i>				5.96	0		0
		<i>illegal</i>				0	0		0

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Côte d'Ivoire	Comoé	<i>MH</i>	*	*	*	*	*	*	*
		<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
	Marahoué	<i>MH</i>	*	*	*	*	*	*	*
		<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
	Taï	<i>MH</i>	*	*	*	*	*	*	*
		<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
Ghana	Kakum	<i>MH</i>			8685	8522	10829	1626	
		<i>carc</i>			0.23	0.35	0.55	1.23	
		<i>illegal</i>			0.12	0	0	0	
	Mole	<i>MH</i>				2953	5092	29	
		<i>carc</i>				0.34	0.79	140.35	
		<i>illegal</i>				0.34	0.39	70.18	
Guinea	Ziama	<i>MH</i>				1066	1203	226	732
		<i>carc</i>				0.94	1.66	0	0
		<i>illegal</i>				0.94	1.66	0	0
Liberia	Sapo	<i>MH</i>	*	*	*	*	*	*	*
		<i>carc</i>	*	*	*	*	*	*	*
		<i>illegal</i>	*	*	*	*	*	*	*
Mali	Gourma	<i>MH</i>			608	187	64		
		<i>carc</i>			4.94	5.35	0		
		<i>illegal</i>			0	0	0		
Niger	Babah Rafi	<i>MH</i>			33			35	
		<i>carc</i>			0			0	
		<i>illegal</i>			0			0	
	Parc W	<i>MH</i>			270	600	503	2549	396
		<i>carc</i>			0	5.00	0	0	0
		<i>illegal</i>			0	1.67	0	0	0
Nigeria	Sambisa	<i>MH</i>				4725	4996		
		<i>carc</i>				0	0.60		
		<i>illegal</i>				0	0		
	Yankari	<i>MH</i>				14795	1956		
		<i>carc</i>				0.68	1.02		
		<i>illegal</i>				0.20	0.51		
Senegal	Niokolo Koba	<i>MH</i>				608	777		
		<i>carc</i>				0	1.29		
		<i>illegal</i>				0	0		
Togo	Keran	<i>MH</i>			339	107	507		
		<i>carc</i>			0	0	0		
		<i>illegal</i>			0	0	0		

* Carcass and LEM data unavailable because of civil strife.

South Asia

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006	
Bangladesh	Chunati Wildlife Reserve	<i>MH</i>						720	360	
		<i>carc</i>						0	2.778	
		<i>illegal</i>							0	0
Bhutan	Samtse Forest Division	<i>MH</i>						834	36	
		<i>carc</i>						0	0	
		<i>illegal</i>							0	0
India	Deomali E.R.	<i>MH</i>						62590	19535	
		<i>carc</i>						0	0.102	
		<i>illegal</i>							0	0
	Eastern Dooars E.R.	<i>MH</i>							611833	125764
		<i>carc</i>							0.013	0
		<i>illegal</i>							0.002	0
	Garo Hills E.R.	<i>MH</i>							21040	
		<i>carc</i>							0	
		<i>illegal</i>							0	
	Mayurbhanj E.R.	<i>MH</i>						84694	589107	40995
		<i>carc</i>						0.083	0.017	0.024
		<i>illegal</i>						0	0.002	0
	Mysore E.R.	<i>MH</i>							223759	150170
		<i>carc</i>							0.098	0.020
		<i>illegal</i>							0.018	0.007
	Shivalik E.R.	<i>MH</i>							257587	
		<i>carc</i>							0.004	
		<i>illegal</i>							0	
Waynad E.R.	<i>MH</i>						216217	395221	120034	
	<i>carc</i>						0.009	0.005	0	
	<i>illegal</i>						0	0	0	
Nepal	Royal Suklaphanta W.R.	<i>MH</i>						256645	178735	
		<i>carc</i>						0	0	
		<i>illegal</i>							0	0
Sri Lanka	Wilpattu N.P.	<i>MH</i>								34552
		<i>carc</i>								0
		<i>illegal</i>								0

South East Asia

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006
Cambodia	Mondulkire	<i>MH</i>						0	0
		<i>carc</i>						-	-
		<i>illegal</i>							-
China	Xishuangbanna	<i>MH</i>						1472	607
		<i>carc</i>						0	1.646
		<i>illegal</i>							0

Country	Site	Type	2000	2001	2002	2003	2004	2005	2006	
Indonesia	Bukit Barisan NP	MH							27558	
		carc							0	
		illegal							0	
	Way Kambas NP	MH							16142	
		carc							0.061	
		illegal							0	
Malaysia	Gua Musang	MH						185	237	
		carc						0	0	
		illegal						0	0	
Myanmar	Alaungdaw Kathapa	MH							69	
		carc							28.860	
		illegal							28.860	
Thailand	Kuibiri	MH						559	2662	
		carc						0	0	
		illegal						0	0	
	Selakpra	MH							27	393
		carc							37.453	0
		illegal							0	0
Vietnam	Cat Tien	MH							918	
		carc							0	
		illegal							0	

Table A3.6.1 Levels of Illegal Killing

Subregion	Country	Site	Level (%)	No. of carcasses	Lower 95% limit	Upper 95% limit	
Central Africa	Cameroon	Boumba Bek	55	27	30	80	
		Waza	60	7	29	92	
Central African Republic		Bangassou	100	11	71	100	
		Dzanga Sangha	71	25	45	98	
		Sangba	62	6	31	92	
		Chad	Zakouma	66	68	47	86
		Congo	Nouabale Ndoki	38	30	24	53
Democratic Republic of Congo		Odzala	62	142	50	75	
		Garamba	81	*	54	100	
		Kahuzi Biega	84	*	71	97	
		Okapi	78	40	55	100	
Gabon		Salonga	71	62	52	89	
		Lope	90	10	54	100	
		Minkebe	67	33	43	91	

Subregion	Country	Site	Level (%)	No. of carcasses	Lower 95% limit	Upper 95% limit
East Africa	Eritrea	Gash Setit	14	7	0	42
	Kenya	Mt. Elgon (Kenya)	42	15	22	62
		Samburu Laikipia†	24	642	20	28
		Tsavo East	28	124	21	35
		Tsavo West	28	83	21	35
		Rwanda	Akagera	0	0	0
	United Republic of Tanzania	Rukwa Katavi	39	38	26	51
		Rungwa Ruaha	39	18	26	51
		Selous Mikumi	39	20	26	51
		Tarangire Manyara	32	18	20	44
Uganda	Murchison Falls	61	15	32	90	
	Queen Elizabeth	61	13	32	90	
Southern Africa	Botswana	Chobe National park	5	390	2	7
	Mozambique	Cahora bossa	27	13	7	46
		Niassa	25	14	6	44
	Namibia	Caprivi Conservancy	6	14	0	11
		Etosha National Park	4	80	0	8
	South Africa	Kruger National Park	0	62	0	0
	Zambia	South Luangwa	49	39	27	71
	Zimbabwe	Chewore	34	23	19	49
Nyami Nyami		34	33	19	49	
West Africa	Benin	Parc W	57	4	1	100
		Pendjari	43	6	0	85
	Burkina Faso	Nazinga	0	7	0	0
		Parc W	0	1	0	0
	Côte d'Ivoire	Comoé	25	*	12	38
		Marahoué	23	*	9	37
		Taï	58	*	26	90
	Ghana	Kakum	24	13	5	43
		Mole	32	9	6	58
	Guinea	Ziama	100	3	0	100
	Liberia	Sapo	50	*	25	75
	Mali	Gourma	0	7	0	0
		Niger	Babah Rafi	67	0	0
	Nigeria	Parc W	50	6	0	100
		Sambisa	33	4	1	66
		Yankari	33	12	1	66
	Senegal	Niokolo Koba	0	1	0	0
Togo	Keran	0	0	0	0	

Subregion	Country	Site	Level (%)	No. of carcasses	Lower 95% limit	Upper 95% limit
South Asia	Bangladesh	Chunati Wildlife Reserve	0	1	0	0
	India	Deomali E.R.	0	2	0	0
	India	Eastern Dooars E.R.	13	8	0	37
	India	Garo Hills E.R.	0	2	0	0
	India	Mayurbhanj E.R.	7	30	0	16
	India	Mysore E.R.	15	33	2	28
	India	Shivalik E.R.	0	2	0	0
	India	Waynad E.R.	10	10	0	30
	Sri Lanka	Wilpattu N.P.	3	30	0	10
S.E. Asia	Cambodia	Mondulkire	0	0	0	0
	China	Xishuangbanna	0	1	0	0
	Indonesia	Bukit Barisan NP	0	0	0	0
	Indonesia	Way Kambas NP	0	1	0	0
	Malaysia	Gua Musang	0	0	0	0
	Myanmar	Alaungdaw Kathapa	100	2	0	100
	Thailand	Kuibiri	0	0	0	0
	Thailand	Selakphra	0	1	0	0
	Vietnam	Cat Tien NP	0	0	0	0

† The year effect was significant for Samburu. The estimated proportion of illegally killed is derived from a different model than the other sites.

* Levels estimated from earlier model and not based on the new data at these sites.

Site attributes/influencing factors

A descriptive report on the influencing factors for each site would be cumbersome to include in this baseline report. The information is therefore presented in the form of a value in accordance with the approach reflected below. Most of these attributes are provided as ordered categorical variables. By representing site differences in terms of attributes, the MIKE monitoring process moves a step closer to linking a change in an attribute (or attributes) to a change in elephant mortality.

Table A4.1 shows the site level attributes that have been compiled so far.

Table A4.1: Site level attributes

X1	Ecosystem/Habitat
X2	Adjacent Land Use
X3	Land Use within site – type
X4	Land Use within site – impact
X5	Human Access
X6	Human Population Pressure
X7	Water Availability
X8	Land Tenure System – legal
X9	Land Tenure System – actual
X10	Tourism Activities
X11	Research Activities
X12	Wildlife Management
X13	International Border Proximity
X14	Cross-border incursions
X15	Civil/Military Conflict
X16	Elephant Population Densities
X17	Elephant/Human Conflict
X18	Development Activities
X19	Illegal Killing History
X20	LEM Effort – cover

Table A4.2 shows Country level attributes that are thought to have a bearing on illegal activities at the site level.

Table A4.2: Country level attributes

X23	Ivory Trade Patterns – scale
X24	Ivory Trade Patterns – regulation
X25	Elephant Meat Trade Patterns – scale
X26	Elephant Meat Trade Patterns – regulation
X27	Corruption Levels
X28	Judicial Severity
X29	Illegal Arms/Drug Trafficking

Table A4.3 shows the scoring system used in providing attribute values

Table A4.3: Attribute scoring system

X1	A= Forest; B= Forest/Savanna; C= Savanna/Forest; D= Savanna
X2	1= Elephant friendly; 2= Relatively friendly; 3= Relatively unfriendly; 4= Unfriendly
X3	1= Wildlife; 2= Includes Forestry; 3= Includes mining; 4= Includes agriculture; 5= includes Settlement
X4	1= Elephant friendly; 2= Relatively friendly; 3= Relatively unfriendly; 4= Unfriendly
X5	1= Difficult; 2= fairly difficult; 3= fairly easy; 4= easy
X6	1= Very low; 2= Low; 3= Medium; 4= High; 5= Very high
X7	1= Plentiful; 2= Seasonally good; 3= Seasonally poor; 4= Scarce
X8	1= Strong legal protection; 2= Reasonably good legal protection; 3= Moderate legal protection; 4= Weak legal protection; 5= No legal protection
X9	1= Strong actual protection; 2= Reasonably good actual protection; 3= Moderate actual protection; 4= Weak actual protection; 5= No actual protection
X10	1= High activity; 2= Relatively high; 3= Relatively low; 4= Low; 5= None
X11	1= High activity; 2= Relatively high; 3= Relatively low; 4= Low; 5= None
X12	1= Uniformly well developed; 2= Patchily well developed; 3= Moderately developed; 4= Poorly developed; 5= None
X13	1= > 100km away; 2= < 100km away ; 3= < 50 km away; 4= < 20 km away; 5= Adjacent
X14	1= None; 2= Occasional; 3= Low regularity; 4= High regularity; 5= Frequently
X15	1= None; 2= Intermittent; 3= Frequent; 4= Constant
X16	Estimated population density from most recent survey
X17	1= None; 2= Small No. of incidences; 3= Moderate No. of incidences; 4= Frequent number of incidences; 5= High No. of incidence
X18	1= Elephant friendly; 2= Relatively friendly; 3= Relatively unfriendly; 4= Unfriendly
X19	1= Low regular offtake in last 5 years; 2= Declining offtake in last 5 years; 3= Moderate regular offtake in last 5 years; 4= Increasing offtake in last 5 years; 5= High regular offtake in last 5 years
X20	1= High uniform cover; 2= High but patchy cover; 3= Moderate cover; 4= Poor cover; 5= No cover
X23	1= No trade in country; 2= Country used for illegal transit; 3= active small scale market; 4= Active medium scale market; 5= Active large scale markets
X24	1= Fully regulated and implemented; 2= Fully regulated, partially implemented; 3= Fully regulated, no implementation 4= Partially regulated and implemented; 5= Partially regulated, no implementation; 6= No regulation
X25	1= No trade in country; 2= Country used for illegal transit; 3= active small scale market; 4= Active medium scale market; 5= Active large scale markets
X26	1= Fully regulated and implemented; 2= Fully regulated, partially implemented; 3= Fully regulated, no implementation; 4= Partially regulated and implemented; 5= Partially regulated, no implementation; 6= No regulation
X27	Corruption perception index values provided by Transparency International
X28	1= High; 2= Relatively Good; 3= Medium; 4= Relatively weak; 5= Poor
X29	1= None; 2= Intermittent; 3= Frequent; 4= Constant

The word 'friendly' is defined in terms of risk to an elephant being killed, i.e friendly is the low risk end and unfriendly is the high risk end. These values have been attributed by the Sub-regional Support Officers in order to optimize consistency, given that the SSOs know the sites well and are less likely to be defensive in regard to any attribute score. It is recognized that the list of attributes is large and it will be helpful, in due course, to seek some simpler representation in terms of fewer variables. This will become possible as the data set grows over time and the analysis becomes more comprehensive and robust. The site attribute list therefore will be reviewed after the first few rounds of analysis.

Notes on the statistical methods used in the analysis

A5.1 Variable clustering

The clustering of site attribute variables was done using Harrell's version of the hierarchical clustering algorithm (Harrell, 2006). The distance measure was Hoeffding's D-statistic and the clustering method was Ward's method.

A5.2 Analysis of carcass counts

Method: Poisson regression with overdispersion (McCullagh & Nelder, 1989), with patrol carcass counts as response.

Africa significant effects:

- log (el. pop.) (P < 0.0001)
- Log (total man-hours) (P < 0.0001)
- area of site (P < 0.0001)
- X3 (type of land use within the site) (P < 0.0001)
- X27 (corruption index) (P < 0.0001)
- X29 (illegal arms) (P < 0.0001)

Asia significant effects:

- log (total man-hours) (P = 0.003)
- area of site (P < 0.0001)
- X24 (ivory trade regulations) (P < 0.0001)

A5.3 Analysis of illegal killing

Method: Poisson regression with total number of carcasses as offset (so that the response is effectively the *proportion* of all carcasses that were illegally killed).

First model: investigated the effect of LEM effort and other variables on the proportion illegally killed from patrol data only. Overdispersion was not observed, and LEM effort was not significant. (Presumably this is because LEM effort would affect both numerator and denominator of the ratio of illegally killed to total carcass count)

Second model: based on all carcass data (patrol and non-patrol) together, to assess the importance of potential influencing factors. Analysis confined to cases (months) with non-zero total carcass counts; Samburu excluded.

Africa significant effects:

- Sub-region (P = 0.04)
- X5 (human access) (P = 0.0007)
- X27 (corruption index) (P = 0.0009)
- X9 (actual level of protection) (P = 0.005)
- X1 (ecosystem type) (P = 0.007)

Asia Significant effects: X27 (corruption index) (P = 0.03)

A5.4 Defining Levels of illegal killing

The level of illegal killing (defined in Annex 3) was obtained from the fitted values from the second model above. These were calculated for each site by setting the total number of carcasses to 100.