

Elephant Partners

ElephantVoices conservation initiative Maasai Mara

Year End Report
December 2013



Introduction to Elephant Partners

Using web-based technology, ElephantVoices has developed a unique model for citizens to monitor and help protect elephants. The *Mara EleApp* (<http://elephantvoices.org/mara-eleapp.html>) permits the collection and upload via smart-phone of geospatial, group size and association data to the searchable, publicly available *Mara Elephant Who's Who & Whereabouts Databases* (<http://www.elephantvoices.org/maraelephants-whos-who.html>; <http://www.elephantvoices.org/maraelephants-whereabouts.html>) with Mapping functionality (<http://www.elephantvoices.org/maraelephants-mapping.html>). A registered user can submit the same type of data online with one or more photographs.

We are growing a community of guides, scouts, researchers, photographers, and tourists who are collecting data on, sharing information about, and working together to sustain the Mara elephants and to inform conservation management. ElephantVoices is mentoring and training these "citizen scientists" expanding their numbers via on-the-ground representation, word-of-mouth and social media.

All data uploaded are monitored, updated and corrected, where necessary, by ElephantVoices via the databases' backend. The online databases and the *Mara EleApp* were conceptualized and designed by ElephantVoices, and programmed by Verviant Consulting Services in Nairobi (<http://verviant.com>).

A presentation of the Mara elephant conservation initiative can be seen on "[The Elephant Network](#)" a talk by Joyce Poole during the National Geographic Explorers' Symposium in June 2012 for the session, *Envisioning a Better Tomorrow*.

The *Mara Elephant Who's Who and Whereabouts Databases* went online in October 2011. In November 2013 GIS specialist, Edward Ouko, began to work with us to improve our mapping capabilities.

This report represents what the project has revealed about the Mara elephants as of the end of 2013.

Cumulative Results

The participants

As of end 2013 195 different individuals had contributed data to the online databases (Figure 1). Participants include guides, tourists, volunteers, conservancy representatives, Kenya Wildlife Service representatives, veterinarians, researchers. The system is set up so that people can collect data via the *Mara EleApp* ([on the Android Market](#)) and, once registered, they can upload their observations from their smartphone directly to the [Mara Elephant Who's Who & Whereabouts Databases](#). Alternatively they can enter observations and photographs online via "My Observations".

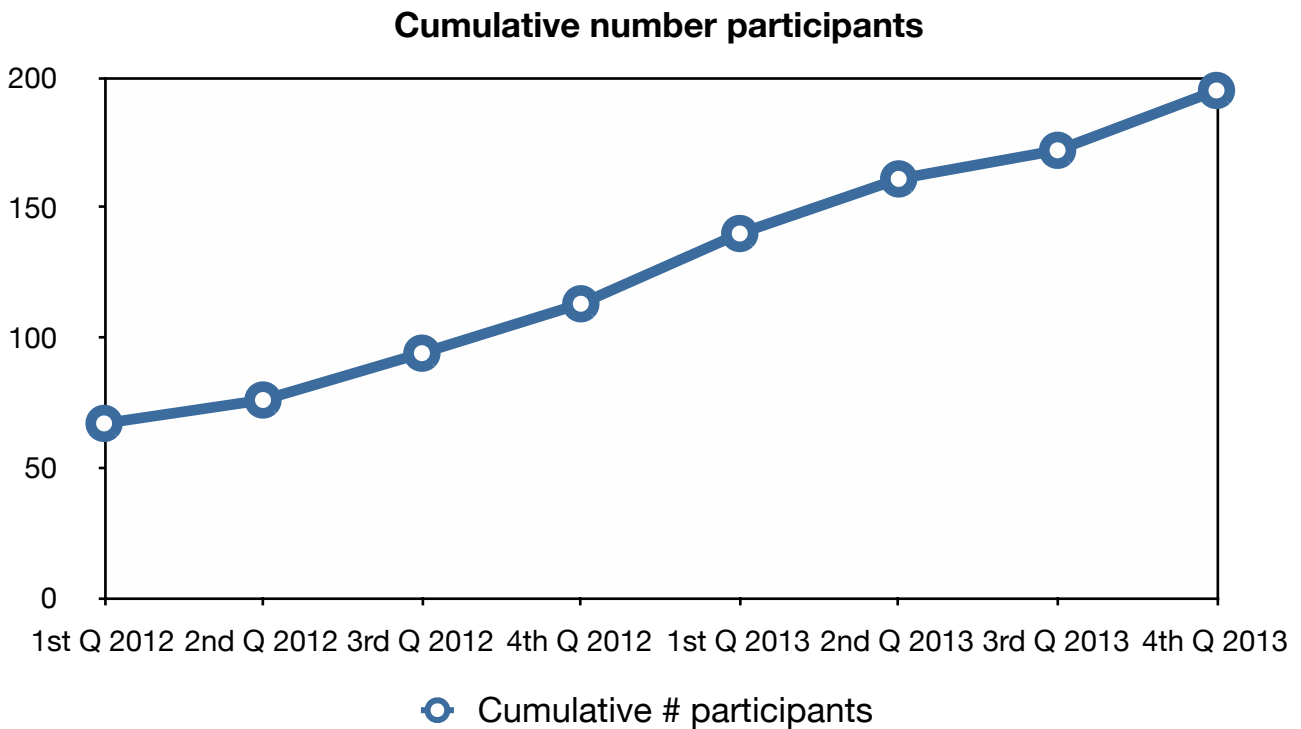
Thus far the bulk of observers have been short term African Impact volunteers based at Mara Naboisho Conservancy, under the guidance of Lincoln Njiru (Table 1). Our aim is to increase the number of Mara residents contributing to the databases and to continue to expand representation to outlying areas of the Mara ecosystem.

Two participants have been students who have carried out data collections as part of their degree program. One of these individuals is KWS Maasai Mara Research Scientist, David Kimutai, who is working toward a Masters degree at Moi University and the other is Alfred Mepukori, a student at Maasai Mara University. ElephantVoices offered field supervision and support to both individuals.

Table 1. Participants include volunteers from African Impact (AI), Conservancy Representatives (CR), ElephantVoices (EV), Elephant Aware (EA), Guides, Kenya Wildlife Service (KWS), Mara Elephant Project (MEP), Researchers (R), Tourism Operators (TO), Tourists, Veterinarians, and Other (Film makers, etc).

AI	CR	EV	EA	Guide	KWS	KGS	MEP	NCC	NGO	R	TO	Tourist	Vet	Other
132	11	2	1	17	1	0	3	0	1	4	2	13	1	7

Figure 1. The accumulated number of participants.



The observations

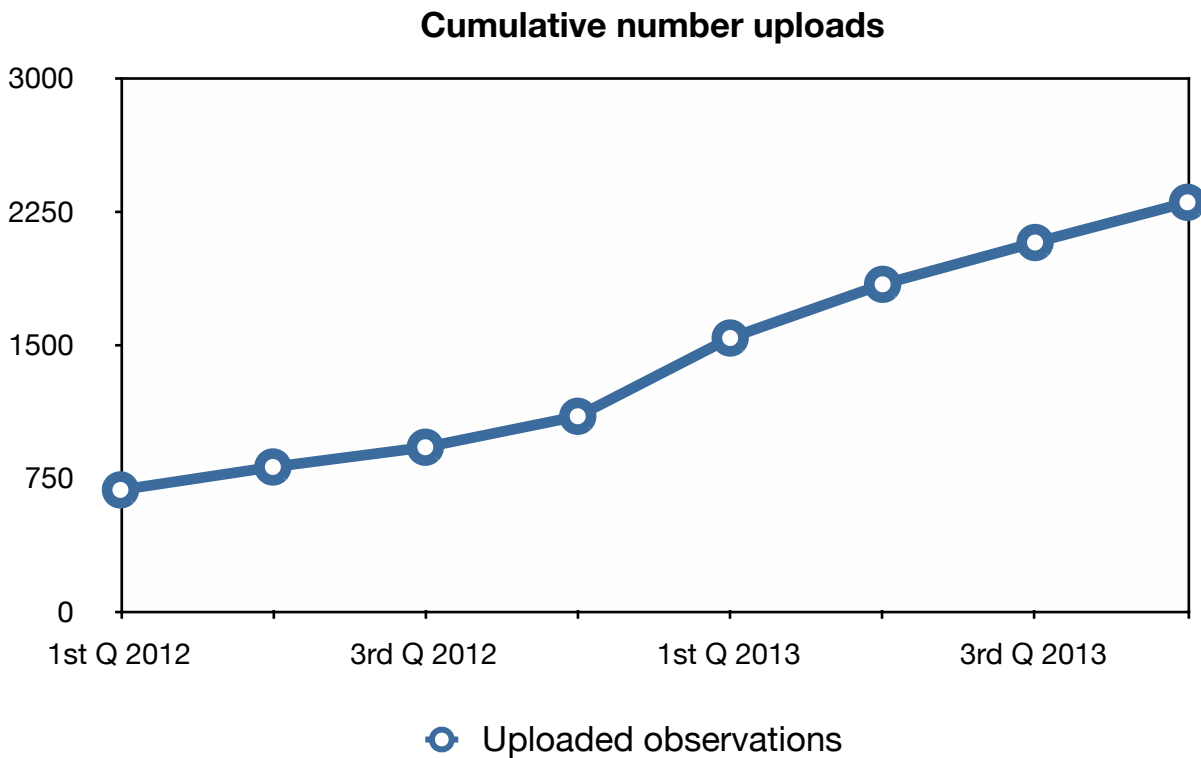
As of 31 December 2013, 2303 elephant sightings had been uploaded to the Whereabouts Database (Table 2). The sightings consist of lone males, bull groups of greater than one individual, family groups with or without associating males and groups of unknown type (n=57). In addition, 55 mortalities have been uploaded.

In November/December 2013 we redesigned the Mara EleApp to include the possibility of collecting signs (n=46; Table 2). Figure 2 shows the accumulated number of uploaded observations at each quarter.

Table 2 Number of elephant sightings, signs or mortalities uploaded as of 31/12/2013.

Group Type	Number of observations
Total	2,303
Elephant Sightings	2202
<i>Single males</i>	342
<i>Bull groups > 1 individual</i>	246
<i>Family groups with or without associating males</i>	1557
<i>Unknown type</i>	57
Elephant Mortalities	55
Elephant Signs	46

Figure 2. The accumulated number of uploaded observations through to end 2013.



The Mara elephants Who's Who: Numbers and sex ratio

The Who's Who Database is fully searchable. An elephant may be identified by selecting a number of traits (sex, age, home area, ear, tusk, tail and body characteristics) that best describe the elephant and which are defined and presented in a number of slideshows available through the [Features Guide](#).

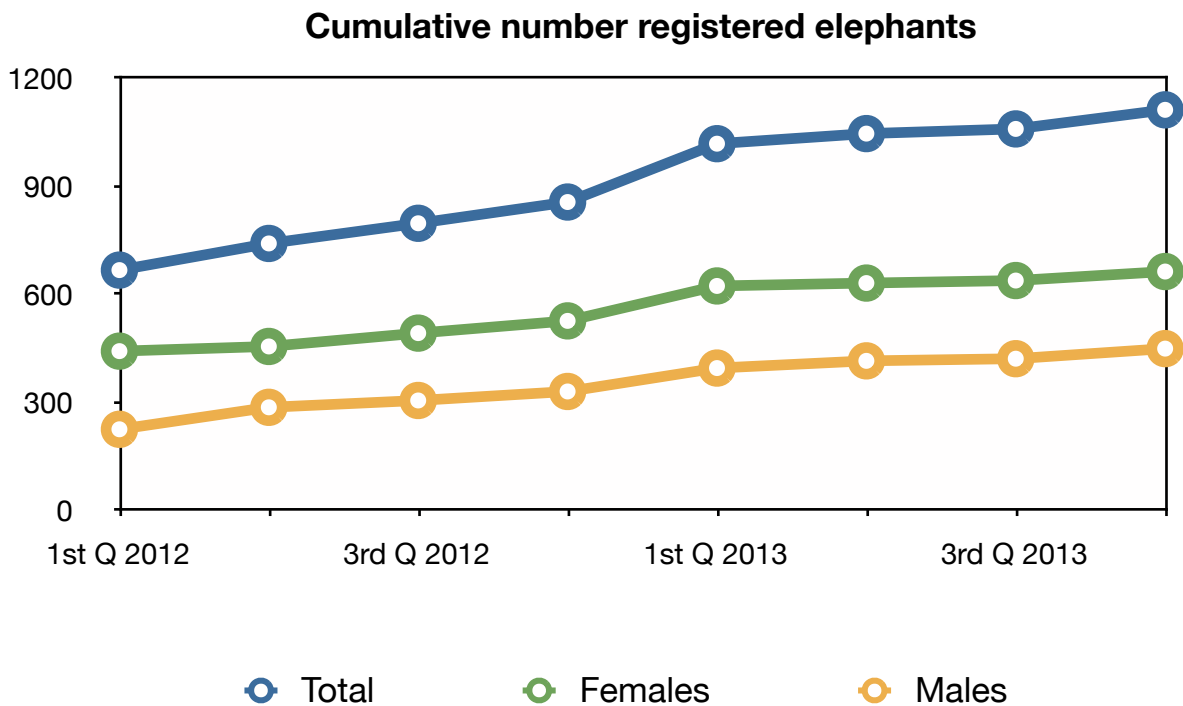
As of 31 December 2013 a total of 1112 elephants had been identified, individually characterised, given an age estimation and been registered on the [Mara Elephants Who's Who Database](#). Of these 1045 were adult elephants (≥ 15 years), with 607 (58%) being adult females and 438 (42%) being adult males (Table 3). While recent additions have increased the proportion of males, the sex ratio is still hovering around 60% female 40% male. The skew is caused by human-elephant conflict and ivory poaching which causes a greater attrition of males.

Figure 3 shows the number of individually registered adult elephants of both sexes at each quarter. What is clear from this graph is that, so far, there is no tapering off of the rate of acquisition of new individuals.

Table 3. Number of elephants individually recognised.

Mara adult elephants registered online 31 December 2012		
Total	1045	100%
Male	438	42%
Female	607	58%

Figure 3. The number of individually identified adult elephants registered.



The number and distribution of group sightings

Figures 4, 5, and 6 illustrate the number and distribution of elephant group sightings of different types: family groups and aggregations (with and without associating males), all-male groups and lone males.

The number and distribution of elephant groups is obviously influenced by the distribution and diligence of the different observers, and one can see clumping of sightings in areas with active participants (e.g. Alfred Bett based at Mara Bridge) or programs (e.g. African Impact Mara Project based in the center of Naboisho). This is typical of ground-based opportunistic data collection.

While there is certainly bias in the distribution of elephants, much information can be extracted. For example, as pointed out in previous reports, the distribution of family groups and aggregations (Figure 4) and that of lone males (Figure 5) tend to overlap, while groups of males are less likely to be seen inside the national reserve (Figure 6). Lone males may be either sexually inactive or sexually active, while groups of males are typically composed of sexually inactive individuals. Sexually active males roam in search of females and their distribution, therefore, overlaps with that of family groups. Sexually inactive males are more focused on bulking up for their next sexually active period and, in this phase of their cycle, they tend to occupy habitats with high biomass. These are areas with bush coverage (e.g. Mara Naboisho, Siana, Motorogi) or, in the case of Mara North, those providing easy access to crops.

The distribution of large groups

The location of large aggregations (Table 4) and large all male groups are not evenly distributed across the ecosystem (Figures 4, 5 and 7). Very few large aggregations have been recorded in Mara North, Olare Orok, Maasai Mara NR Central (between Sekenani and Musiara) and Mara Conservancy, while a higher percentage of groups observed on Motorogi, Mara Naboisho, South Eastern part of the National Reserve and Oldkeresi, Siana and Olarro Conservancies are large.

Siana and Olarro Conservancies stand out as having a very high proportion of large groups. A higher proportion (close to 50%) of large (six or more individuals) all male groups are also seen on Siana than elsewhere in the ecosystem.

Figure 4. Number and distribution of sightings of elephant family and aggregations with and without associating males.

Elephant Sightings Maasai Mara Ecosystem Family Groups and Aggregations

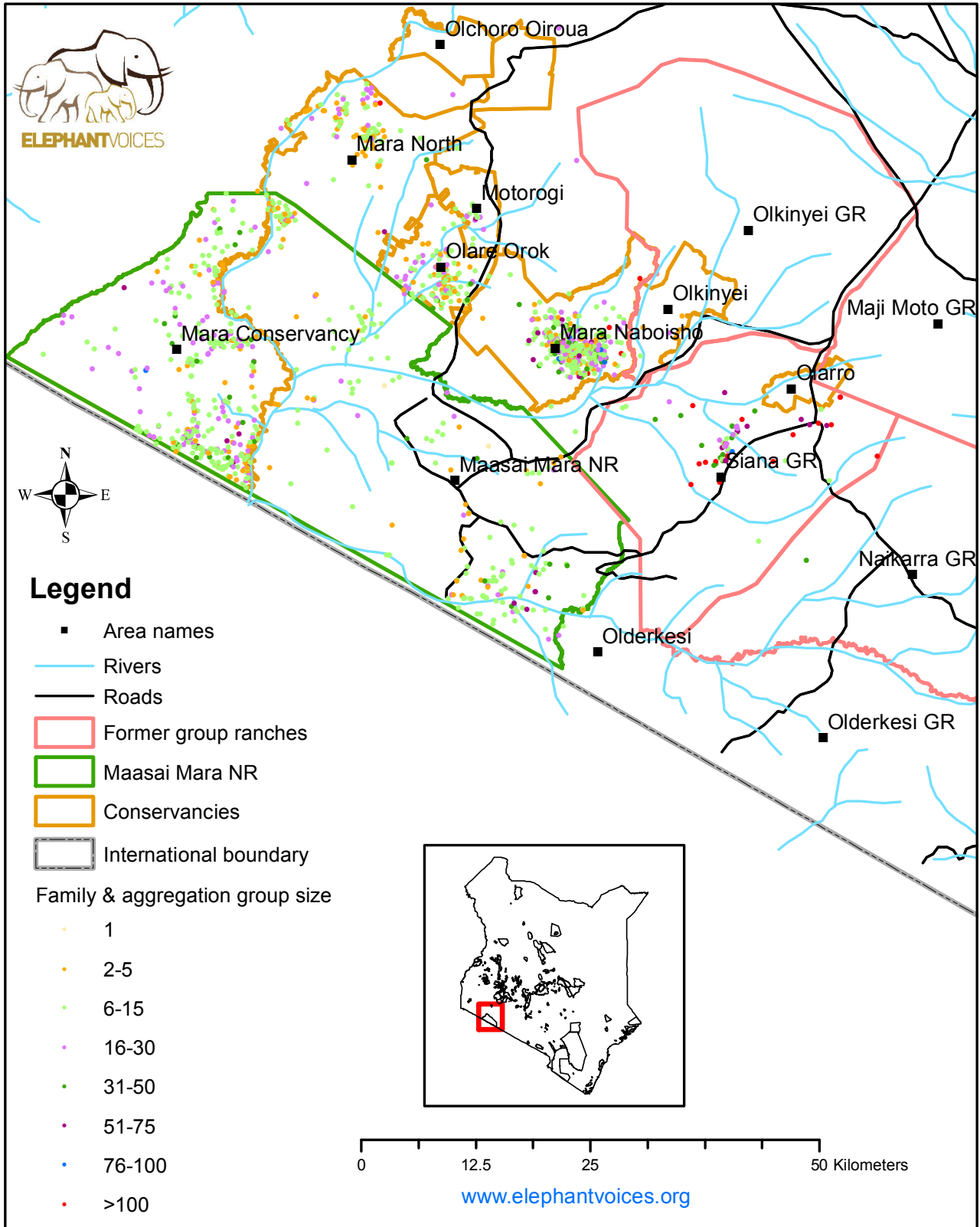


Figure 5. Number and distribution of sightings of lone males.

Elephant Sightings Maasai Mara Ecosystem Lone Males

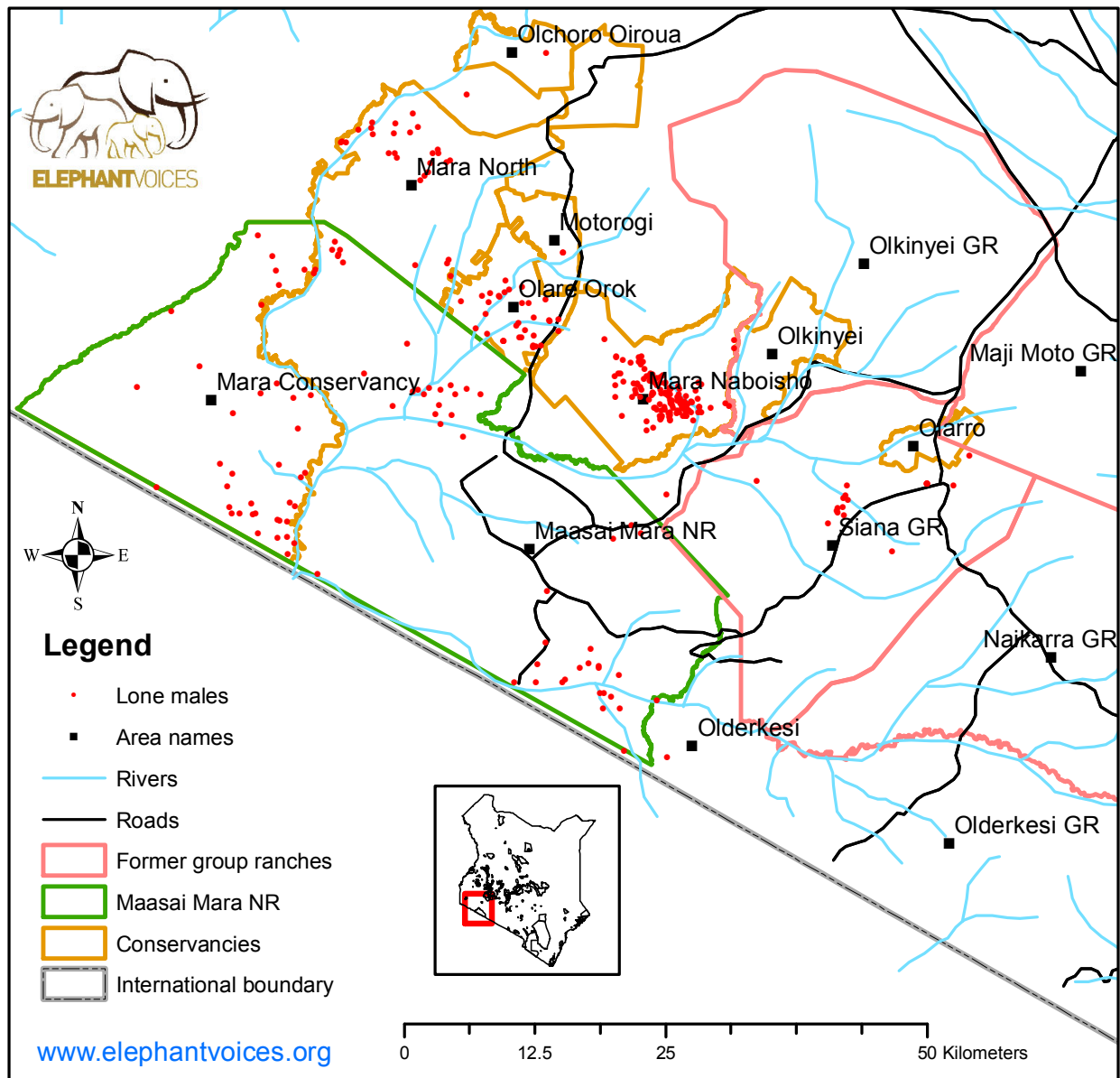


Figure 6. Number and distribution of sightings of male groups (≥ 2 individuals).

Elephant Sightings Maasai Mara Ecosystem Male Groups

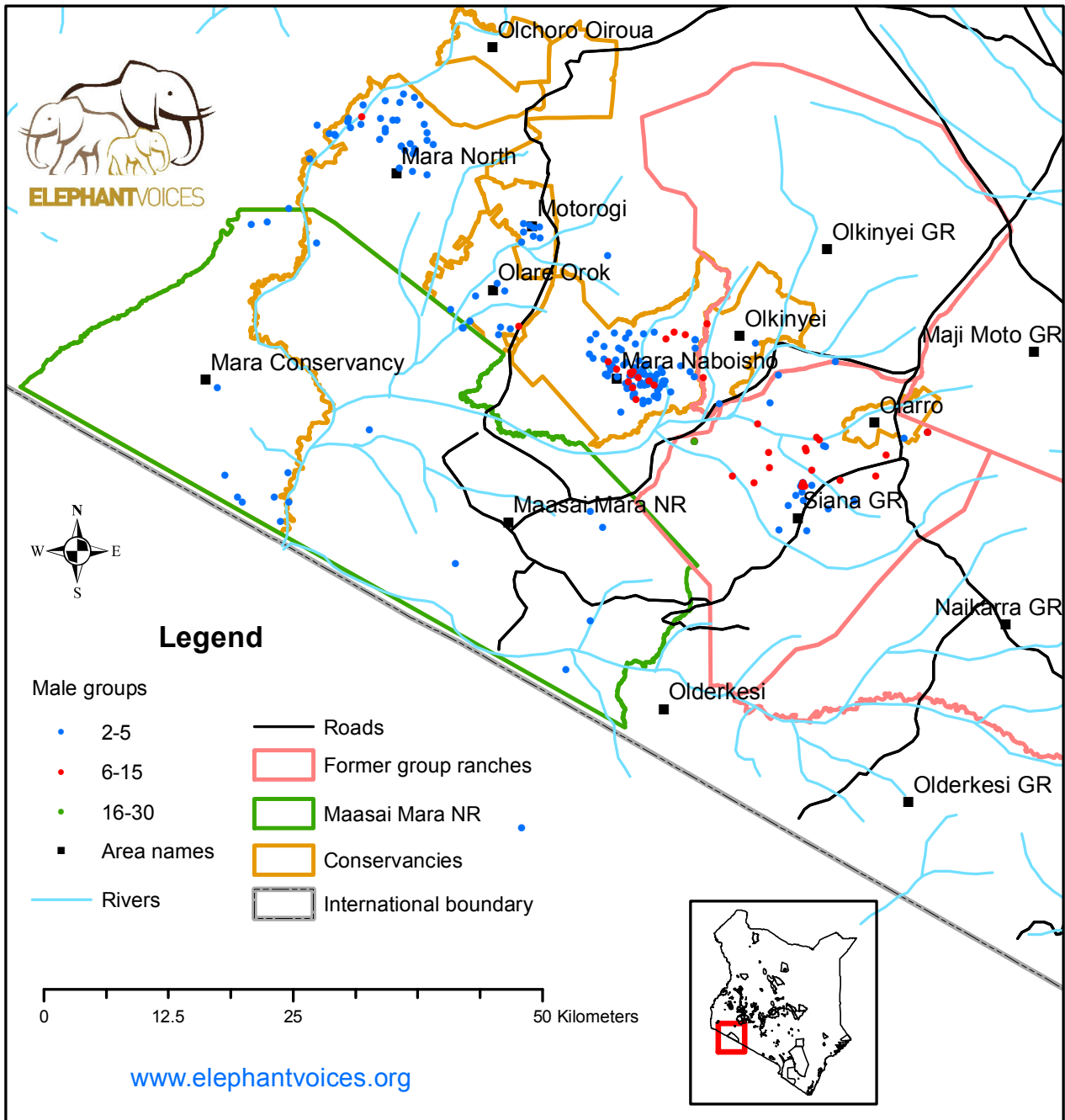


Table 4. Location of aggregations (>50 and >100) as of end 2013.

Location	Total No. groups (excluding all male)	No. groups > 100 individuals	% groups > 100 individuals	No. groups > 50 individuals	% groups > 50 individuals
Overall	1565	26	1.700%	95	6.100%
Mara North Conservancy	112	1	0.900%	1	0.900%
Maasai Mara NR Central	159	1	0.600%	2	1.200%
Olare Orok Conservancy	149	0	0.000%	2	1.300%
Mara Conservancy	413	1	0.200%	7	1.700%
Motorogi Conservancy	23	0	0.000%	1	4.300%
Mara Naboisho Conservancy	509	8	1.600%	36	7.100%
Maasai Mara NR SE/Olderkesi Conservancy	99	0	0.000%	8	8.100%
Siana Conservancy	92	14	15.200%	34	40.000%
Olarro Conservancy	4	2	50.000%	3	75.000%

Median group size

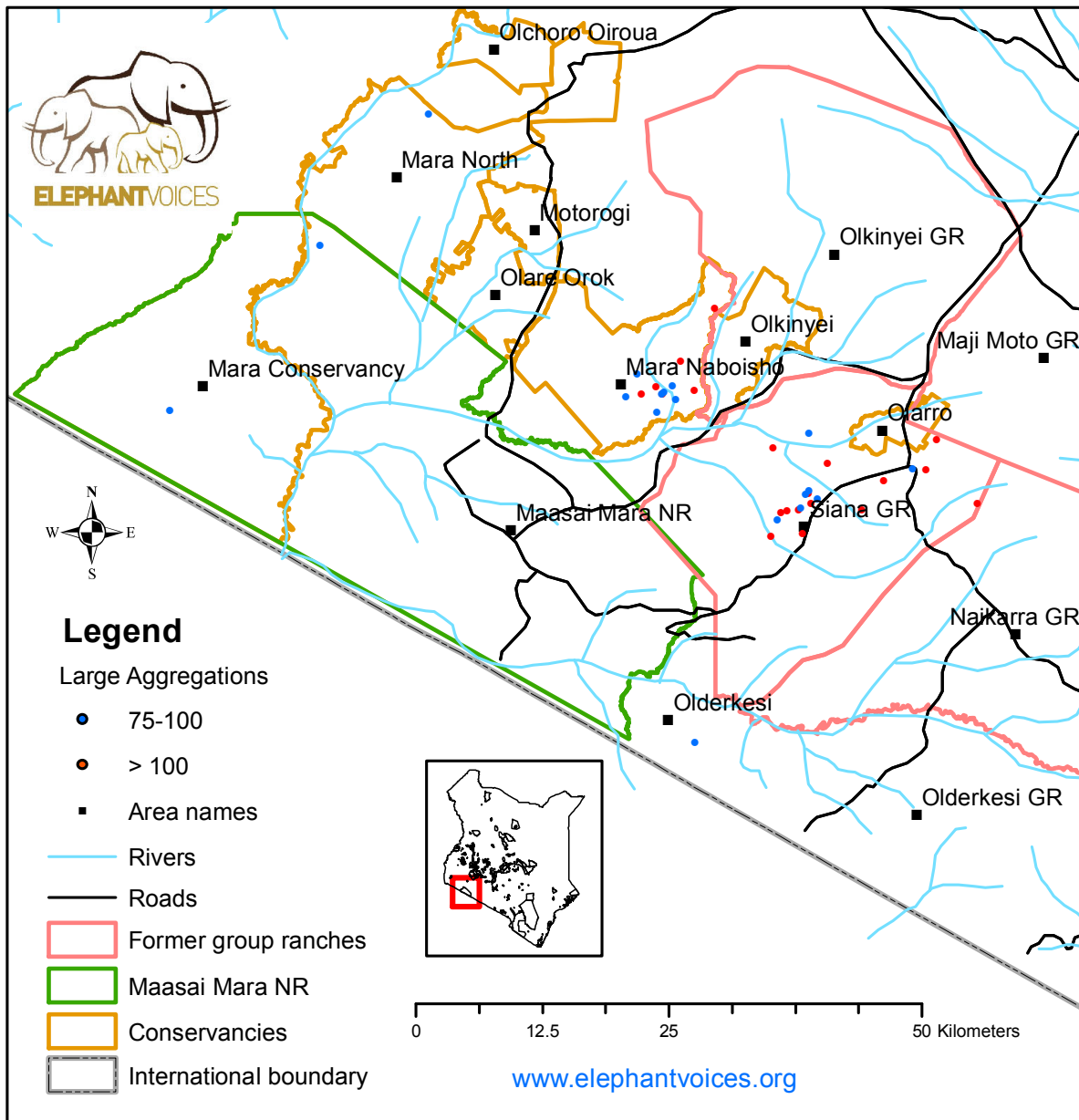
The median group size of family groups (with and without accompanying adult males) varies across different areas in the ecosystem as does the level of security and the degree of grazing competition from livestock (Table 5). High pressure from livestock will tend to increase competition for grazing and reduce elephant group size. Insecurity will be apt to cause elephant groups to coalesce to form larger aggregations. The MMNR and Mara North Conservancy have relatively high livestock grazing pressure and high security and small groups of elephants. By contrast, Siana and Maji Moto have high livestock pressure but low security and significantly larger groups of elephants. Groups seen on Olare Orok, Motorogi, Mara, and Mara Naboisho Conservancies are in the mid range and vary from very low to medium livestock pressure and from medium to very high security.

Table 5. Median family groups.

General Area	Livestock pressure	Security	Median	Min	Lower Q	Upper Q	Max	N
Mara North Conservancy	High	High	7	1	4	12	100	110
Maasai Mara NR	High	High	9	1	6	14	100	253
Olare Orok Conservancy	Low	High	10	2	5	15	51	148
Mara Conservancy	Very Low	Very High	11	2	7	17	80	407
Motorogi Conservancy	Medium	Medium	12	3	10	17	60	23
Mara Naboisho Conservancy	Medium	Medium	12	2	8	20	150	509
Siana & Maji-Moto Group Ranches	High	Low	35	6	21	65	335	94

Figure 7. Distribution of large aggregations ≥ 50 .

Elephant Sightings Maasai Mara Ecosystem Large Aggregations



Movement of individuals

Satellite tracking is a powerful tool for monitoring the movement of individual animals, defining habitat use and determining essential corridors. Drawbacks include animal welfare considerations and cost. Using citizen science, photographs and individual recognition one is able to monitor more course movement patterns of many more individuals. Table 6 lists the number of individually recognized male and female elephants who have been sighted in three areas: Mara Naboisho Conservancy, Olare Orok Conservancy and Siana Group Ranch and the number of these individuals who have been sighted on more than one, e.g. Naboisho-Olare Orok, Naboisho-Siana or Siana-OlareOrok. The percentage of individuals sighted in two areas was calculated by the formula, $\frac{a_1 + a_2 - k}{k}$, where a_1 =the number of individuals sighted in area one, and a_2 =the number of individuals sighted in area two, and k =the number of individuals sighted on both area one and area two.

As expected, the degree of movement between almost contiguous areas (e.g. Naboisho-Olare Orok; Naboisho-Siana) is higher than between non-contiguous areas (e.g. Siana-OlareOrok). The analysis confirms our observations that there

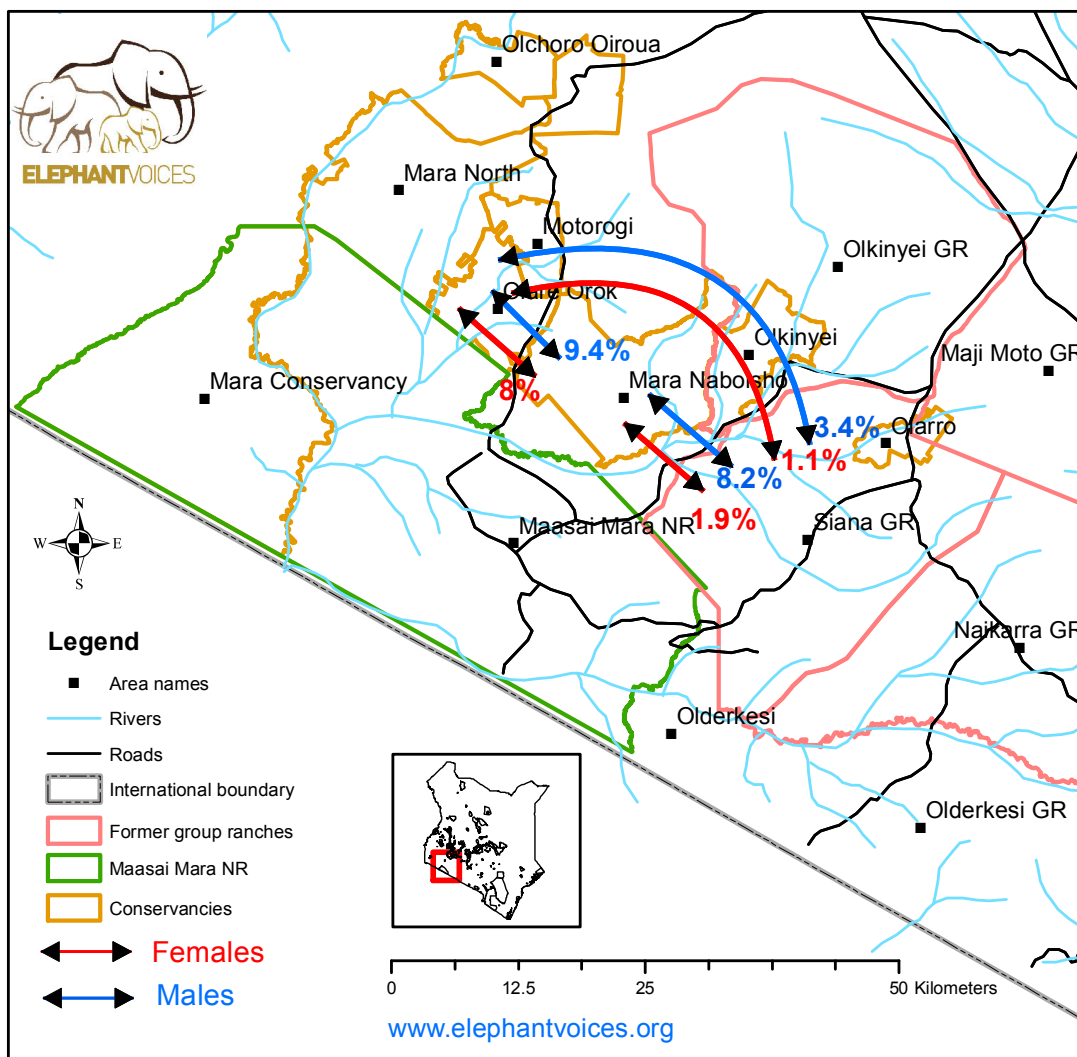
is much less movement by females between Siana and Mara Naboisho than by males; though this pattern does not hold between Mara Naboisho and Olare Orok (see also figure 8).

Table 6. The movement of elephants based on sightings of individually recognized elephants

Area	Individually recognized females sighted	% sighted on both	Individually recognized males sighted	% sighted on both
Naboisho	184		218	
Siana	32		84	
Olare Orok	59		37	
Naboisho & Siana	4	1.900%	23	8.200%
Naboisho & Olare Orok	18	8.000%	22	9.400%
Siana & Olare Orok	1	1.100%	4	3.400%

Figure 8. The movement of elephants based on sightings of individually recognised elephants.

Elephant Sightings Maasai Mara Ecosystem Percentage of Individuals Moving

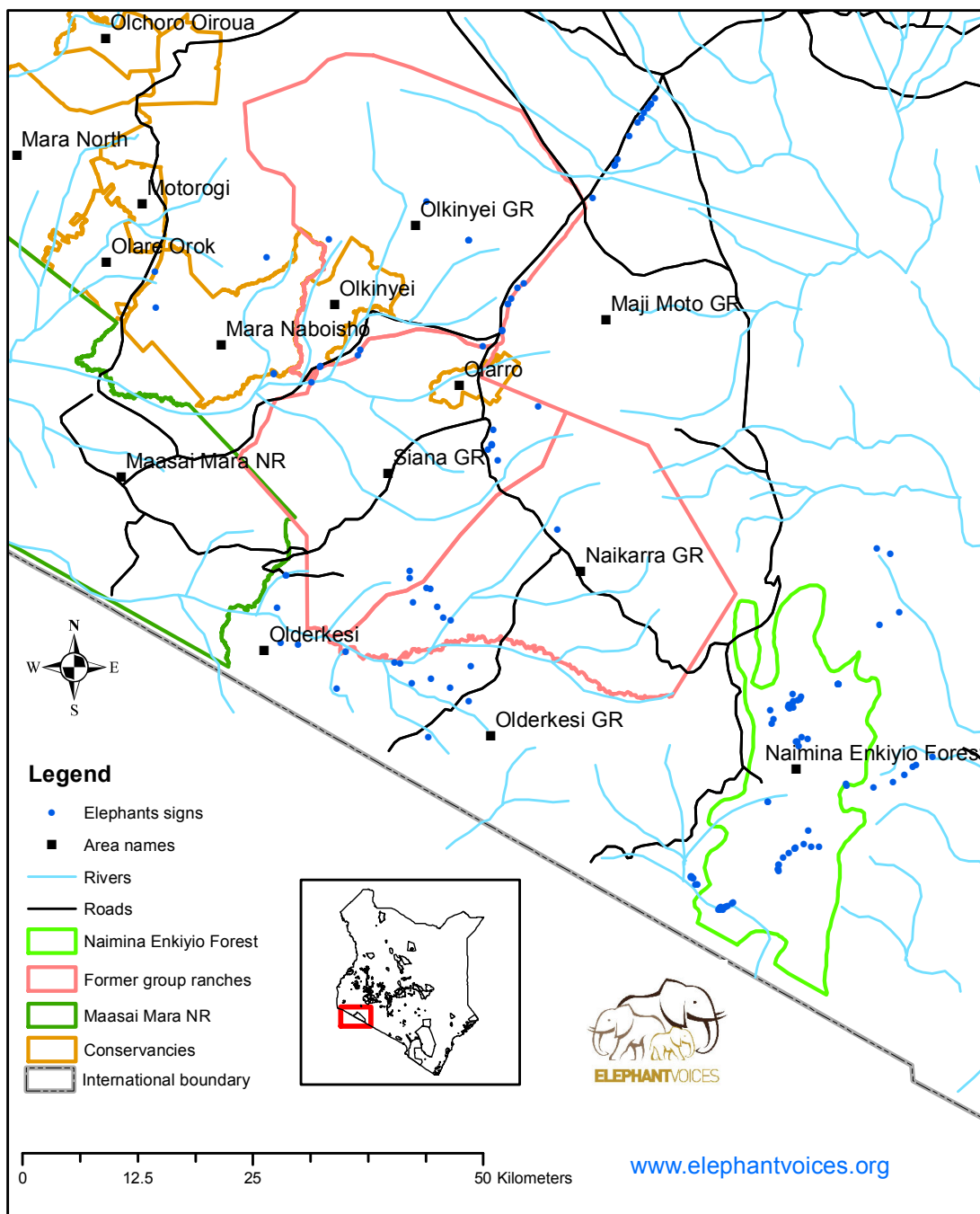


Elephant signs

To augment the sightings, sick/wounded and mortality data, we redesigned the Mara EleApp to allow for the collection of data on signs of elephants, including foraging sign, footprints, vocalizations, rub marks on trees. Data on signs are very useful for obtaining an idea of habitat use by elephants in areas where they are more elusive or at low densities. Since this update of the Mara EleApp was programmed and tested in the latter part of 2013 (published on Google Play 16 January 2014) very little data have been collected. Initial results show the potential for gathering data from areas such as between the Mara proper and the Naimina Enkiyo Forest and in the forest itself (Figure 9).

Figure 9. Initial data collected on signs of elephants.

**Elephant Sightings Maasai Mara Ecosystem
Elephant Signs**



The elephant population size

To estimate the total Mara ecosystem elephant population we used mark recapture methodology. Registered individuals on the database go back to 1998 and a good number of these are likely to have died since then. To reduce error due to mortality we limited the calculation to individuals observed since January 1st 2012. We assigned those adult elephants (≥ 15 years) of each sex who were “marked” (recorded as having been observed by any participant, but identified by ElephantVoices) in 2012 as Sample One (S^1) and the number of elephants (≥ 15) that ElephantVoices “marked” (recorded as having been observed and identified by ElephantVoices) in 2013 as Sample Two (S^2). Of this second sample we noted how many were already known individuals from the 2012 sample (k).

The estimated population size of adults is calculated by the formula $= S^1 \times S^2/k$ and gives a result of 1154 adult females and 670 adult males (Table 3). We estimated the number of calves per adult female by aging and sexing all individuals in a sample of 18 families including 154 individuals. Using 15 years as “adult,” the ratio of adult females to calves or juveniles in this sample was 1:2. Thus, we can estimate some 2308 calves and a total population size of 4,132 elephants (Table 3).

We wish to state that this calculation is still a rough estimate of the Mara elephant population. At the same time we caution that: a) *we do not know whether it includes any individuals who utilise the Naimina Enkiyio Forest*; b) *we do not know how many of these individuals are infrequent visitors from the Serengeti*; c) *we have not included any factor to adjust for losses due to mortality, which is much higher for males than for females*; d) *we have not included any factor to account for different levels of sampling in different areas*.

Considering the number of new elephants we encounter each time we are in the Mara, we believe that the population is at least this size. Our educated guess for some time has been at least 4,000 elephants. We wish to point out, however, that while this *figure is well above the 3,000 estimated in 2010 it does not represent an increase in the population over the last three and a half years, but rather a better representation of the population size*. Our reason for stating this is: a) the number of calves per adult female does NOT indicate a rapidly growing population - it is lower than the number calculated for Amboseli in 2010 (Lee, pers. comm.) which represented a period of lower than normal births following the drought of 2009; b) the high mortality caused by poaching in 2011 and 2012 (see below) means that the population will have decreased rather than increased.

Table 7. “Mark Recapture” methodology used to estimate the Mara elephant population size

	Sample 1	Sample 2	Known	Estimated total
Adult females	179	129	20	1154
Adult males	178	98	26	671
Calves	na	na	na	2308
Total				4,132

Mortalities

Up to the end of 2013 a total of 54 mortalities had been uploaded to the database (2 in 2011, 26 in 2012 and 27 in 2013). Of these 34 (63%) males and 11 (20%) females were determined to have been killed illegally for their tusks.

Table 8 shows the sex and cause of death for the 54 uploaded mortalities. Note that these mortalities represent a small portion of the total as the majority of elephant deaths are reported to the Mara Elephant Project or directly to KWS. These data, therefore, can only be used as a guide to the proportion of mortalities that represent illegal killings (or PIKE: 85%) and the bias of these illegal kills toward males with larger tusks (63%). It is not possible for us to say anything about trends based on these data.

Human Settlement

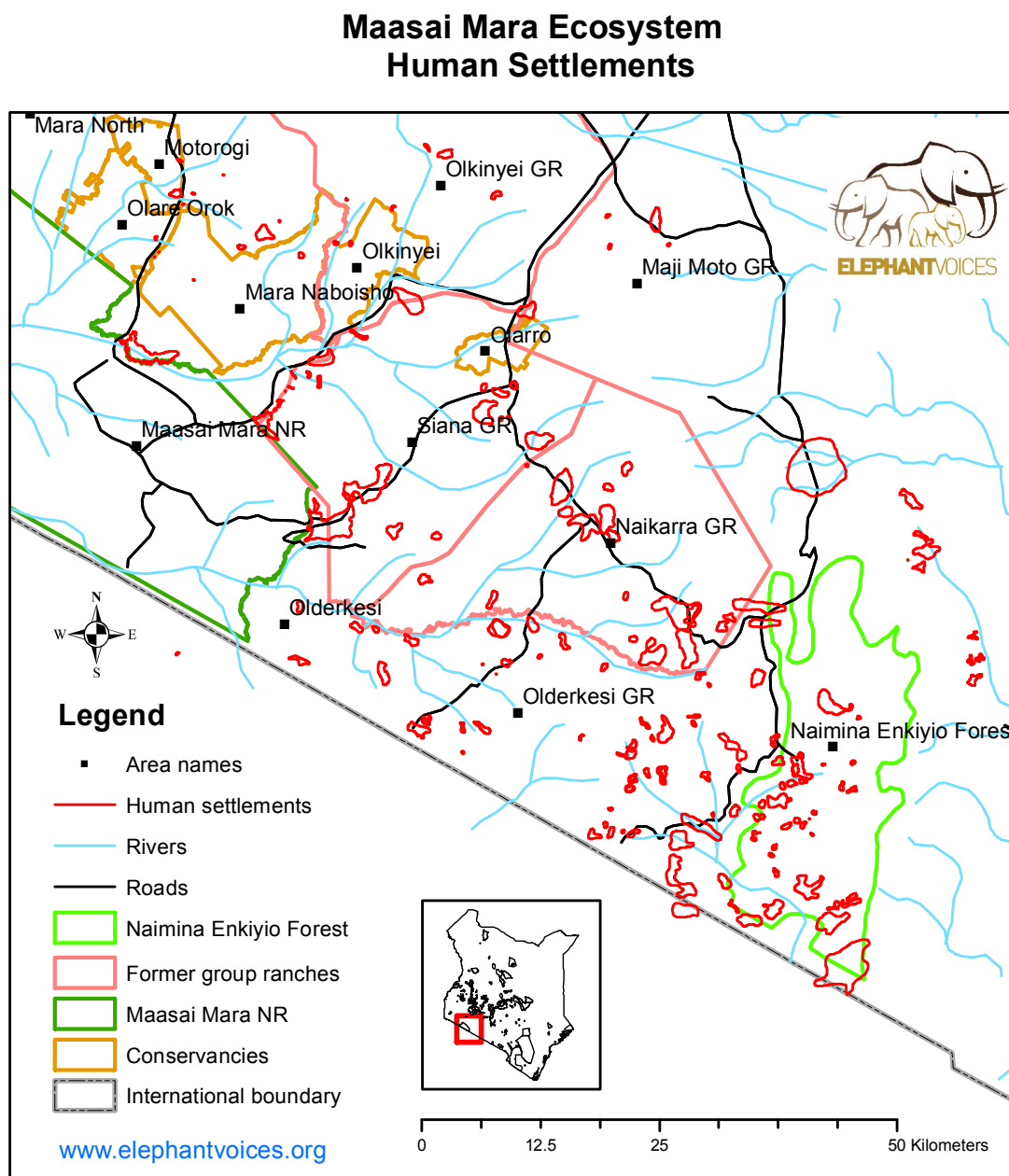
Using Google Earth Pro we have begun a process of mapping human settlement on the eastern part of the Mara ecosystem (Figure 10). We still have work to do, particularly in Maji Moto and north of the Naimina Enkiyio Forest. We

include the data here to show the degree of settlement flanking the western side of the Naimina Enkiyo Forest, and even within the forest, to illustrate the urgency of protecting a corridor for elephant movement.

Table 8. Elephant mortalities uploaded to the database up to end 2013

Cause	Male	Female	Unknown	Total
Illegal ivory	34	11	1	46
Natural mortality	1	2		3
Euthanized		1		1
Unknown	2	1	1	4

Figure 10. Human settlement. The areas of settlement are not as large as they appear on the map, as neighboring "bomas" have been amalgamated for display.



Implications of the data for elephant conservation and management

Estimating the size of the Mara elephant population

The June 2010 KWS aerial count estimated the size of the Mara elephant population to be 3162 elephants. This figure, represents an increase of 1000 elephants over the 2008 count, which cannot be accounted for by natality. As previously reported, it is likely that some of this apparent increase is caused by movement (temporary or otherwise) of elephants into the Mara from areas such as the Mau, Serengeti, Loliondo or the Loita Hills, which lie outside the area normally covered by the aerial count. Indeed, since the aerial count does not include the forested areas to the east of the Mara it is likely that the entire population (including the Naimina Enkiyio Forest and Loita Hills may be over 4000 individuals.

Since the Maasai Mara is contiguous with the Serengeti and elephants regularly move back and forth (see Save the Elephants tracking data), it is impossible to determine a unique "Maasai Mara elephant population" and a separate "Serengeti population." In February 2010, 2738 elephants were counted in Serengeti NP and Loliondo GCA, with about half of these elephants located in the southern portion of the national park. Combining KWS' 3,162 elephants and 1,400 of those from Serengeti, we estimate a population of perhaps 4,500 elephants who may use the Maasai Mara ecosystem. Our own data on individually recognized individuals and "capture-recapture" methodology indicates that some 4,132 elephants make use of the Maasai Mara Ecosystem. We will continue to reassess this number as we gather additional data.

Median group size and the location of aggregations and large all male groups

The median size of cow/calf groups varies quite a bit across the different parts of the Mara ecosystem, and is likely to be dependent, in part, on the degree of pressure from livestock and the level of security afforded to elephants. In the absence of competition for food, elephants have a tendency to aggregate (for social and reproductive reasons) beyond family units, while when experiencing competition they will fragment into subgroups. Likewise, when elephants feel threatened they tend to form larger aggregations for safety.

These dynamics appear to be playing out in the Mara ecosystem where elephants live under a mosaic of influences. For example, large parts of the Maasai Mara NR experience a massive nightly influx of livestock some 5-10 kilometers into the reserve, so that little grass remains accessible to elephants during the dry season. Elephants, therefore, tend to be in small groups and exhibit a large inter-individual distance, as they are forced to browse on widely dispersed seedlings and coppiced shrubs. The high security afforded them inside the reserve, however, means that they can move about in these small, spread out groups. On Siana livestock pressure is also high, and while the browse habitat would tend to cause elephant groups to further fragment into smaller units, the reverse is taking place. High levels of insecurity force elephants to aggregate such that elephant groups in this part of the Mara are significantly larger than anywhere else. The tendency to seek safety in numbers can also be seen among the males who also appear to form larger groups than in other parts of the Mara. We will attempt to gather data on livestock use and poaching incidents from the different areas so that we can put numbers to the different areas rather than relying on relative levels.

Sightings, signs, settlement and poaching

The data on sightings and signs gathered by this project, as well as the satellite tracking data collected by Save the Elephants and African Conservation Centre indicates a population of elephants that is continuous from Maasai Mara eastwards into the Rift Vally around Shompole and beyond. Settlement is taking place very rapidly, however, and combined with high levels of poaching outside the national reserve and the conservancies, there is the very real threat that such movement will be cut off. Every effort must be made to ensure that at least some movement continues between the Mara and the Naimina Enkiyio Forest.

Elephant Partners - priorities ahead

We aim to continue to focus on the eastern side of the Mara, including the Naimina Enkiyio Forest. Having added the capacity to collect data on signs we aim to expand the number of people collecting data in areas that elephants use but are not often sighted. We will work with Alfred Mepukori to increase coverage of this area, which will also make it possible for him to start on a three-year bachelor program in Wildlife Management at the Maasai Mara University.

Working with GIS specialist, Edward Ouko, we aim to continue improving the presentation of our data and share it with those who can use it to improve the conservation of elephants.

Other priorities are:

1. Continue to reach out to strategically placed individuals and entities that wish to participate, including internships by students of Maasai Mara University.
2. Ensure that participants monitor the key habitats in the Mara ecosystem that provide linkages between already protected areas.
3. Continue population of Mara Elephant Who's Who Database (identity, age, sex).
4. On the basis of 3. re-estimate size/structure of Mara elephant population.
5. Continue population of Whereabouts Database (who, where, with whom).
6. On the basis of 5. continue identification of areas preferred by elephants (all-male versus family groups) and those avoided.
7. Assess factors affecting elephant occupancy/movement.
8. Document elephant habitat use and movement patterns beyond the protected Maasai Mara NR and its neighboring conservancies and clarify habitats crucial to maintaining landscape linkages and identify important corridors for sustained elephant movement.
9. Work with KWS and other stakeholders to plan and carry out an elephant survey of the Loita Forest.
10. Develop educational material for schools/lodges.

Acknowledgements

The Mara Elephant Who's Who and Whereabouts has now been operative two years. During this period Elephant Partners was supported by the JRS Biodiversity Foundation, Conservation Trust of the National Geographic Society, the Northern Europe Global Exploration Fund of the National Geographic Society, Liz Claiborne Art Ortenberg Foundation (LCAOF), Fondation Franz Weber, A&K Philanthropy, IFAW, Friends of Conservation, Google, and many generous individuals. The success of this initiative depends upon the volunteer participation of many people whose names and affiliations appear online. We are grateful for the broad and enthusiastic support received.

ElephantVoices, Joyce Poole/Petter Granli, 24 January 2014,

info@elephantvoices.org

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