

Scientists devise new method to give 'most robust' estimate of Maasai Mara lion numbers

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Scientists based at Oxford University have created a new method for counting lions that they say is the most robust yet devised. Using the Maasai Mara National Reserve and surrounding conservancies in Kenya as a case study, they estimate there to be 420 lions over the age of one in this key territory. At almost 17 lions per 100 square kilometres, that represents one of the highest densities anywhere in Africa.

Lion numbers are notoriously difficult to estimate, which is why there is heated debate over their true status throughout Africa, with some experts arguing that there are 20,000 lions left on the continent and others claiming the figure is more likely to be 30,000.

Lead author Dr Nic Elliot, Project Director of the Kenya Wildlife Trust's Mara Lion Project and a postdoctoral researcher with the Wildlife Conservation Research Unit (WildCRU) in Oxford University's Department of Zoology, said: 'Reliable estimates of [lion](#) density are critical to conservation: at a policy level, they inform regional strategies and are used by the International Union for Conservation of Nature (IUCN), the Endangered Species Act and CITES to classify lions; at a local level, they are used to advocate for management practices and to highlight conservation needs and successes. Yet our current methods of counting lions are too inaccurate and too imprecise.'

Population numbers are a critical measure of conservation success or

failure. To count lions, conservation biologists have traditionally used track surveys, which record lions' footprints, and/or call-up surveys, which broadcast sounds to attract lions for counting. This new study highlights how both methods can lead to inaccuracy and imprecision, thus providing misleading estimates of population trends. Despite such concerns, these two methods are currently the most commonly used to count lions. Additionally, other approaches tend to estimate lion numbers from observations of individual lions without including the amount of effort - such as distance covered in different areas - in the analysis.

The new survey, which circumvents these problems by using a 'spatially explicit' approach, involved five field teams systematically searching the Maasai Mara National Reserve and surrounding conservancies for lions. They carefully logged their search effort during the 90-day survey and drove just under 8,400 kilometres while searching for lions. By taking close-up, high-resolution photographs of individual lions, researchers were able to log their unique whisker spots. A total of 203 lions were identified within the 2,400-square-kilometre survey area. The data was then analysed with powerful computers, using a tailor-made 'Bayesian spatially explicit capture-recapture' model that corrects for the bias that some lions may not have been identified during the survey.

The study, published in the journal *Conservation Biology*, adapts methodologies that have successfully been used by scientists to count other big cats, such as tigers and cheetahs.

Dr Elliot said: 'A survey typically produces an estimate of density and an interval which gives the lower and upper possible true number. Say, for example, a survey estimates 300 lions but gives a lower bound of 100 lions and an upper bound of 500 lions. If the survey is repeated and an estimate of 200 lions is produced, is that telling us that the population has declined by 100 or increased by 100? A good survey, then, will

produce an accurate estimate with narrow intervals.'

He added: 'We estimate there to be 16.85 lions over the age of one year per 100 square kilometres in the Maasai Mara. This is extremely high compared with most places in Africa and reflects the incredibly productive ecosystem that the Maasai Mara is. We estimated the posterior standard deviation to be just 1.3, reflecting the excellent precision of our overall estimate. This survey will lay the foundation for accurate monitoring of the population over time.'

Co-author Dr Arjun Gopaldaswamy, from the Indian Statistical Institute and the Department of Zoology at Oxford University, said: 'Good estimates of big cat abundance can only be obtained when a rigorous field method is combined with a tailor-made statistical method. This study demonstrates the power of such a combined approach.'

'We should not underestimate the vital importance of obtaining accurate and precise estimates of wildlife numbers. When estimates are vague and non-transparent, we may fail to detect the direction of changes. As a result, we may end up supporting the most advertised rather than the most effective conservation strategy.'

He added: 'Think of it this way: a survey might reveal there are 200 identified lions, but it will tell you nothing about how many were missed and where. Our method crucially corrects for this problem that existed in previous methods by estimating density at a very fine scale so that we can produce a map to show which areas have high or low density. What's more, because we identify individuals, in time we will be able to estimate vital rates such as survival, additions to the population, and mortality for different demographics. As such, I can see this methodology being immediately applicable to count Asiatic lions in India.'

'In addition to big cat densities, our approach simultaneously estimates allied parameters such as sex ratios and sex-specific home range sizes, which provide important clues about the health of these populations. For example, you could have good densities, but if the population is composed only of males, and/or the home range sizes are very large, it could still be a sign of worry.'

The authors make the case for a unified framework to assess lion numbers across the animals' range.

Dr Elliot said: 'Conservation decisions have to be supported by robust science. Our method shows enormous promise in that it is more accurate and precise than traditional methods and provides valuable information on space use. Going forward, it will provide an accurate assessment of population trends.'

'Lions are too important for us to be vague about their numbers. Our methodology can accommodate sightings data, telemetry data and genetics data and is flexible enough to be used anywhere. As such, we recommend that spatially explicit capture-recapture methods are widely adopted to census African carnivores.'

More information: 'Towards Accurate and Precise Estimates of Lion Density' *Conservation Biology* 13 December 2016.

Provided by University of Oxford

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