

COMMENTARY

Counting the costs of white rhino poaching: We are likely underestimating the indirect and long-term impacts

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Overharvesting, especially illegal overharvesting, is one of the main threats to biodiversity worldwide and a key driver of extinction (Cardoso et al 2021; Morton et al. 2021). This is especially true when large mammalian herbivores are the target species (Ripple et al. 2015). For many iconic mammalian species, it is the hunting for specific body parts and not hunting for meat that is driving population declines (Ripple et al. 2015). For example, the poaching (i.e. illegal hunting) of elephants for ivory and rhinos for their horns has led to dramatic declines in their populations across many parts of their range (Vigne, et al. 1987, Douglas-Hamilton 2009).

The five extant rhino species (i.e. white rhino: *Ceratotherium simum*; black rhino: *Diceros bicornis*; greater one-horned rhino: *Rhinoceros unicornis*; Javan rhino: *Rhinoceros sondaicus*; and Sumatran rhino: *Dicerorhinus sumatrensis*) have been the target of illegal hunting and trade for decades, with demands coming primarily for ornaments (e.g. dagger handles) and traditional Chinese medicine (Vigne et al. 1987, Milliken & Shaw 2012, Cheung et al. 2021). Within South Africa, the average number of rhinos poached in a year from 1990-2007 was 14 individuals (Milliken and Shaw 2012). However, starting in 2008 the number of individuals poached increased to 83 and then continued to steadily climb for the next nine years, reaching a point where over 1000 individuals (i.e. an increase of two orders of

magnitude) were killed each year from 2013 to 2017 (Knight 2021). Thereafter, starting in 2018 there has been a gradual decline in poaching deaths with 394 rhinos being poached in 2020 (Knight 2021).

For many of us, the cost of poaching has been measured by the number of rhinos killed each year. Some consideration has been given to the number of orphans and youngsters that have died because of their mothers' deaths, but as pointed out by Nhleko et al. (2022), these values are likely greatly underestimated. Using population modelling, Nhleko et al. (2022) explored how poaching, rainfall, and indirect calf deaths due to the death of their mothers affected the white rhino population in the Kruger National Park, South Africa. What they found was that the interactions of all three of these variables best explained the observed white rhino population decline, indicating that both direct (poached adults and subadults) and indirect deaths (calf deaths due to the death of their mothers) influenced Kruger's white rhino population trend.

Projecting forward ten years to 2030, Nhleko et al. (2022) estimated that under the current poaching levels, the white rhino population in Kruger National Park would be reduced by 35%. This is concerning as Kruger is home to the largest population of white rhinos in Africa. Yet, poaching intensity can be higher on private lands which tend to have lower levels of security compared to Kruger. As these areas hold ca. 28% of South Africa's white rhino population (which is more white rhinos than in the rest of Africa combined; Emslie 2012), the long-term impacts of poaching of white rhinos may be even greater in private lands. However, this downward trend could be reversed. We all hope that poaching will stop completely and that the white rhino populations across Southern Africa will be allowed to recover. This is likely not going to happen. However, for the Kruger population, Nhleko et al. (2022) found that recovery does not require a complete halting of poaching. Rather, they calculated that if poaching is reduced by half (something more achievable than a

complete stop), the Kruger population could double over the next 10 years. A finding such as this provides hope for the future of white rhinos.

In addition to determining the impact of different factors on the white rhino population, Nhleko et al. (2022) also explored the impact of poaching on the lifetime reproductive success of adult female white rhinos. Something, to be honest, that I had not even considered. What they found, was that just using the deaths of adults and subadults as an indicator of the impact of poaching completely underestimated the true long-term reproductive impact on the population. Ultimately, poaching combined with calf deaths led to a drop in lifetime reproductive output of adult female white rhinos from six calves to a mere 0.7 calves. This is quite simply terrifying and results in a population that is neither stable nor viable.

Nevertheless, understanding that greater lifetime reproductive success of females is a key factor that needs to be improved, and that the reduction of poaching by 50% results in population growth, allows for better and more targeted conservation and management efforts. For example, this may be through providing greater protection for females, prioritising females for translocation operations where individuals are moved away from poaching hotspots, dehorning females, and initiating greater punishments (e.g. larger fines and/or jail times) for individuals found to have poached females. I, for one, hope that these findings are utilised and that we can make meaningful strides towards a better future for this iconic African mammal. Long live the white rhino.

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