




Response to Darting Primates: Steps toward Procedural and Reporting Standards

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Abstract

The safety of primates which are captured and released in the wild is a topic of concern for many field primatologists. Our article and the recent commentary by Fernandez-Duque *et al.* contribute to the discussion. Although Fernandez-Duque *et al.* found a slightly higher rate of fatalities (2.5 %) than Cunningham *et al.* (2.0 %), their combined rate of fatal and serious injuries was lower (4.0 % vs 5.0 %). The differences in rate are not substantial, given limitations of the data. However, as Fernandez-Duque *et al.* highlight the need for standardizing methods of analysis, we believe the methods they suggest merit careful consideration. We agree that variation in size, habitat, and the experience of the darting team are important factors. Cunningham *et al.* reported the influence of these factors on injury and fatality rates. There are, however, some important differences in the methods of Cunningham *et al.* and Fernandez-Duque *et al.* We believe it is important to 1) acknowledge possible bias in the data, 2) report results of serious complications that arise during capture, 3) report results of capturing medically compromised primates, and 4) report rates of primates falling to the ground.

Keywords Best practices · Capture · Ethics · Methods · Risk

Little has been published about the safety of darting wild primates, although this is a concern for many primatologists. Our report on primate darting (Cunningham *et al.* 2015) consisted of a literature review examining trends in the reporting of darting methods and results, and the results of two anonymous surveys of primatologists that aimed to gather information on darting methods and their effect on the primates involved. Our study concluded with a call for more detailed reporting of darting methods given the wide range of challenges

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primates present to a darting program due to their variation in size, habitat, and behavior (Cunningham *et al.* 2015). We are grateful to Fernandez-Duque and colleagues for continuing the discussion of this important issue with a commentary on our article (Fernandez-Duque *et al.* 2017) and are pleased that they also recognize the need for detailed reporting, echo our call for greater openness, join us in bringing attention to the challenges the diversity of primates bring to darting, and share our ultimate goal of making the capture of primates safer.

Although the findings of the article and the commentary are broadly similar, and some of the differences in methods are due to differences in the aims of the reports, other differences merit careful and thoughtful evaluation. Our comments focus on 1) likely bias in the data, 2) reporting of serious complications that arise during capture, 3) reporting results of darting medically compromised primates, and 4) reporting rates of primates falling to the ground. We also explain additional differences between our analyses (Cunningham *et al.* 2015) and those in the commentary of Fernandez-Duque *et al.* (2017).

Likely Bias in Data

The primary goal of our literature review (Cunningham *et al.* 2015) was to analyze trends in the *reporting* of darting methods and results. We conducted a literature search of complete texts of articles from 1940 to 2013 with words related to darting (Cunningham *et al.* 2015). The analysis reveals the scarcity of published data: only 18 of 111 articles provide comprehensive information on darting methods and results. An additional 11 articles provide the rate of fatalities and serious injuries but do not provide details of darting methods. Eighty-two articles (74%) do not indicate whether fatalities or injuries occurred. In addition to this primary analysis, we summarize the causes of fatalities and serious injuries and complications reported in the 18 articles that provide comprehensive information. We state: “The results of our literature review and surveys cannot give an accurate rate of overall injury rates and death, but suggest a 5% rate of serious and fatal injuries and complications” (Cunningham *et al.* 2015, pp. 923–924), thus acknowledging the limitations of our analysis.

Fernandez-Duque *et al.* (2017) reanalyzed the 18 articles in the literature review that provided comprehensive information and, in addition, analyzed 11 articles that indicate whether fatalities or serious injuries occurred but offer no details of methods. They found a mortality of 2.5%, an injury rate of 1.5%, and a combined rate of 4.0%. Fernandez Duque *et al.* then compared their mortality estimate alone with the combined mortality and injuries rate in Cunningham *et al.* (2015), and concluded that their reanalysis yielded lower percentages than the earlier study. However, comparing mortality alone (i.e., comparing like with like) reveals no substantial difference between the two studies, given the limitations of the data (2% in Cunningham *et al.* 2015, 2.5% in Fernandez-Duque *et al.* 2017).

Although there is no way to know the rate of injury in the 74% of papers that did not provide information on fatal and serious injuries, people tend to provide information that will be viewed positively by others (Zuber and Kaptein 2014), and are likely to withhold negative information when self-reporting is voluntary (Friesena and

Gangadharan 2013). Extrinsic factors may also play a role in what information is reported (Sakamoto *et al.* 2013). For example, primatologists have spoken to us about their concern that revealing high rates of injury and mortality will make it more difficult for them to obtain the permits and approvals necessary to conduct their research. For these reasons, we believe that the rates reported in Fernandez-Duque *et al.* (2017) and Cunningham *et al.* (2015) are probably lower than the actual rates of serious injuries, complications, and mortality. Fernandez-Duque *et al.* (2017) do not discuss this likely bias in the data, but we believe acknowledging the limitations of the data is an important step in finding ways to encourage effective self-reporting.

Reporting of Serious Complications during Capture

Our analysis included fatalities, serious injuries, and serious darting-related complications. We considered serious complications and injuries those as that had the potential to affect survival or reproduction or required expert care (Cunningham *et al.* 2015). In contrast to our analyses, Fernandez-Duque *et al.* (2017) excluded darting-related complications, in particular 13 cases in which primates needed artificial respiration for up to 45 min (Scott *et al.* 1976). Neither did they include these cases in their calculation of the injury rate, although they referred to them in their discussion of the injury rate and they included two primates in the same report that died while under artificial respiration. We believe that analysis of serious complications will help us improve the safety of darting methods.

Reporting Results of Darting Medically Compromised Primates

Fernandez-Duque *et al.* (2017) excluded two papers (Hyeroba *et al.* 2011 and Sleeman *et al.* 2000) from their analysis because compromised health was a “conflicting factor in analyzing the injury and mortality risk of darting” (p. 5). As neither article reported injuries or fatalities *due* to darting, the health of the primates in these papers did not bias the data in Cunningham *et al.* (2015).

We agree, however, with Fernandez-Duque *et al.* (2017) that factors such as poor health, age, and reproductive status may increase complications, injuries, and mortality (Cunningham *et al.* 2015). One of the principal challenges of field anesthesia is the preanesthetic assessment of the animal. Conditions such as cardiac disease or liver disease, which are not readily observed in a free-ranging primate, can exacerbate stressors common to chemical immobilization (sites in Cunningham *et al.* 2015). Primates with unknown preexisting medical conditions should be included in calculations of injury and mortality, as they were in Cunningham *et al.* (2015) and Fernandez-Duque *et al.* (2017). We believe it is important that they continue to be included in calculations of serious complications and injuries and fatalities. Cases in which a primate is captured to provide help for a known preexisting injury or medical condition should also be reported. They could be treated, however, as a special circumstance and reported separately from darting in which the medical condition of a primate is unknown, or the primate is darted for reasons other than providing help.

Reporting Rates of Primates Falling to the Ground

Fernandez-Duque *et al.* (2017) included fall-related injuries in their rate of serious and fatal injuries. However, they stated: “We considered that the risk of darting is best assessed by quantifying the number of animals injured due to actual darting, rather than using falling as a metric for risk” (p. 4). In contrast, we believe information on the rates of catching falling animals can help primatologists assess risk associated with a darting protocol, as injuries from falls were the main cause of death in the results of our surveys and one of the leading causes of fatal and serious injury in our literature review (Cunningham *et al.* 2015). The risk of injuries from falls is greater for arboreal primates (Cunningham *et al.* 2015), and analysis of injuries from falls should distinguish between arboreal and terrestrial primates.

Reporting the Same Darting Events

The analysis of Fernandez-Duque *et al.* (2017) also differs from ours in that they excluded articles that reported on the same darting events. This is appropriate for their aim to calculate the rate of serious injuries and fatalities due to darting. Our primary aim was to identify trends in the reporting of darting methods and results, so we did not exclude papers that might describe the same darting events because we aimed to consider the level of detail offered in every paper. We stated, “As we are interested in general trends, rather than precise numbers, we did not attempt to exclude papers that might be describing the same darting events” (Cunningham *et al.* 2015, p. 213). We were aware that two articles included in our estimation of injury and death rates (Fernandez-Duque and Erkert 2006 and Fernandez-Duque and Rotundo 2003) reported the same darting events. Including data from both papers did not change the rate we reported, which was estimated to the nearest percent. Additional articles that Fernandez-Duque *et al.* (2017) excluded because they reported on the same events were not included in the Cunningham *et al.* (2015) estimates of serious and fatal injuries because we judged that they did not provide enough information. We agree with Fernandez-Duque *et al.* (2017) that calculations of injury and death rates should not include multiple reports of the same events.

Conclusion

We appreciate the opportunity presented by Fernandez-Duque *et al.* (2017) to further the discussion of issues related to primate capture. Such discussion is an essential step in refining methods. To further this goal, the International Primatological Society has created an ad hoc committee to address issues concerning the capture and release of wild primates (Setchell 2017). We serve with E. Fernandez-Duque on the committee and are working together to make primate capture safer.

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