Peer Community In Ecology

Unveiling the influence of carrion pulses on predator-prey dynamics

Esther Sebastián González *based on peer reviews by* ***Eli Strauss*** *and 1 anonymous reviewer*

Mellina Sidous; Sarah Cubaynes; Olivier Gimenez; Nolwenn Drouet-Hoguet; Stephane Dray; Loic Bollache; Daphine Madhlamoto; Nobesuthu Adelaide Ngwenya; Herve Fritz; Marion Valeix (2023) Insights on the effect of mega-carcass abundance on the population dynamics of a facultative scavenger predator and its prey. BioRixv, ver. 2, peer-reviewed and recommended by Peer Community in Ecology.
https://doi.org/10.1101/2023.11.08.566247

Submitted: 14 November 2023, Recommended: 18 April 2024

Cite this recommendation as:
Sebastián González, E. (2024) Unveiling the influence of carrion pulses on predator-prey dynamics. *Peer Community in Ecology*, 100594. 10.24072/pci.ecology.100594

Published: 18 April 2024

Most, if not all, predators consume carrion in some circumstances (Sebastián-Gonzalez et al. 2023). Consequently, significant fluctuations in carrion availability can impact predator-prey dynamics by altering the ratio of carrion to live prey in the predators' diet (Roth 2003). Changes in carrion availability may lead to reduced predation when carrion is more abundant (hypo-predation) and intensified predation if predator populations surge in response to carrion influxes but subsequently face scarcity (hyper-predation), (Moleón et al. 2014, Mellard et al. 2021). However, this relationship between predation and scavenging is often challenging because of the lack of empirical data. In the study conducted by Sidous et al. (2024), they used a large database on the abundance of spotted hyenas and their prey in Zimbabwe and Multivariate Autoregressive State-Space Models to calculate hyena and prey population densities and trends over a 60-year span. The researchers took advantage of abrupt fluctuations in elephant carcass availability that produced alternating periods of high and low carrion availability related to changing management strategies (i.e., elephant culling and water supply). Interestingly, their analyses reveal a coupling of predator and prey densities over time, but they do not detect an effect of carcass availability on predator and prey dynamics. However, the density of prey and hyena was partially driven by the different temporal periods, suggesting some subtle effects of carrion availability on population trends. While it is acknowledged that other variables likely impact the population dynamics of hyenas and their prey, this is the first attempt to understand the influence of carrion pulses on predator-prey interactions across an extensive temporal scale. I hope this helps to establish a new research line on the effect of large carrion pulses, as this is currently largely understudied, even though the occurrence of carrion pulses,

such as mass mortality events, is expected to increase over time (Fey et al. 2015).

References:

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Sidous, M. et al. 2024. Insights on the effect of mega-carcass abundance on 1 the population dynamics of a facultative scavenger predator and its prey. bioRxiv, ver. 2 peer-reviewed and recommended by PCI Ecology.
https://doi.org/10.1101/2023.11.08.566247

Reviews

Evaluation round #2

Reviewed by Eli Strauss, 08 April 2024

The authors have carefully addressed my comments from the last round of review, and I see no further changes needed to the current version of the manuscript. Congrats to the authors on this nice work.

Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.1101/2023.11.08.566247
Version of the preprint: 1

Authors' reply, 08 March 2024

Download author's reply

Decision by Esther Sebastián González, posted 30 January 2024, validated 30 January 2024

Please revise your preprint

Dear Mellina Sidous,

Thank you very much for sending your preprint to PCI Ecology. I have now received comments from two recognized reviewers and they both found your paper very interesting. None of the reviewers had major issues, but they included some comments and suggestions that may improve the quality of the study. Therefore I would like to invite you to revise your study accordingly and send me a revised version and a letter with a detailed description of the changes done.

I am looking forward to a revised version of your interesting study.

Best,
Esther Sebastián González

Reviewed by Eli Strauss, 21 December 2023

A major goal of wildlife conservation and management is to predict population changes of wild animals. This study investigates how pulses of large megaherbivore (elephant) carcasses modifies predator-prey population dynamics using a long-term study of spotted hyena and ungulate observations at waterholes. They find no evidence that hyena or ungulate population growth changes as a result of increases in elephant carcasses.

The paper uses an impressive ecological dataset and aims for an ambitious question of broad relevance. Although some aspects of the writing throughout the paper sometimes reduced clarity, I found that overall the ideas of the paper were well thought-out and communicated. The statistical approach was clearly explained, justified, and appropriate to the data. I have a few small suggestions for improvement.

Major comments

I would have liked to have learned more about the water supplementation policy. Given that the observation of hyena and prey animals occurs at watering holes, and some periods have more water availability than others, I'm left wondering if the trends presented in the results have more to do with varying attraction to watering holes over time rather than variation in population size. When there was active water supplementation, did data collectors count prey/hyenas at these new water sources?

Can the authors explain why the model with constant growth rate consistently predicted lower densities of both hyenas and prey than the other two models across the entire study period (Figure 3)? Does this make sense, or could this reflect an issue with one or more of these models?

Lastly, I found the interpretation of the results to be overly strong. In the discussion, the authors state "we do not detect patterns supporting effects of high carcass availability on the population dynamics of hyena and its prey" and I think this nicely summarizes what they found. However, elsewhere—including the title—the authors interpret this absence of evidence as evidence of absence. Given the messiness of the data and the sampling regime (one brief yearly count), it seems quite possible that these huge carcasses are influencing hyena predation rates, and thus prey demography, but that this effect is small or subtle enough not to be detected. In fact, it's hard to imagine how these carcasses could really have no effect on prey or predator demography. I recommend that the authors alter the title and amend parts of the discussion to soften the conclusions.

Minor comments

l. 49-51: These sentences are confusing. Don't the authors conclude that there is NO evidence of an effect of management measures on prey and hyena population dynamics? I think there may be a typo here, or at the very least, this needs to be clarified.

l. 50-52: These sentences seem very wishy washy and vague for the abstract. Can the authors streamline this to a more straightforward point?

l. 55 “on the long run” should be “in the long run”

Introduction: In this first paragraph, it would be helpful to clarify whether the work cited on lines 75-78 comes to some conclusion about the conditions under which carrion availability would reduce or increase predation pressure. These potential effects are mentioned in the paragraph, but it isn’t clear how they relate to the work cited.

l. 81 it would be clearer to just say what the consequences are instead of referring the reader back to the prior sentence

l. 138-139 I would like the authors to say more here about what this study found. What is the evidence that they reliably reflect actual population changes?

l. 250 - this parenthetical statement is confusing, so I recommend the authors spell out that this is not what they found.

Figure 3: What are the faint fluctuating lines in panels A and B? In C and D there are only confidence intervals for the constant model, despite statements in the figure caption that ribbons exist for each model type.

l.327-328 Could the authors explain what they mean by “mortality is likely to be compensatory?”

l. 334: I think “as we focused here” should be “as we observed here”

Reviewed by anonymous reviewer 1, 30 January 2024

This manuscript offers an interesting study of the numerical response of hyena and its common prey species in relation to availability of elephant carrion, using long-time data series from a national park in Zimbabwe. The manuscript is well written and was a pleasure to read. I only have very few minor suggestions of changes.

Line 50: Something is missing between those sentences.

Line 86: This sentence can be deleted.