Royal Zoological Society of New South Wales

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Paddy Pallin Science Grant – Progress Report

Assessing the impact of forestry plantation macropod culling programs on lead exposure in Tasmanian devils

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Project Description & Objectives

Summary

Culling programs are integral to wildlife management in Australia but there is a need to better understand their indirect impacts on wildlife. This includes the impact of lead from ammunition on scavengers. Lead is a potent neurotoxin and, where it is used extensively, negatively impacts on the health of scavenging wildlife, including mammalian carnivores such as the Tasmanian devil. Environment lead contamination is a major conservation problem in Australian systems, but has been under-recognised until recently. This project will assess lead exposure in Tasmanian devils inhabiting forestry plantations, a land use heavily reliant on culling.

Objectives

The project aims to assess the short-term role of forestry culling events in exposing Tasmanian devils to harmful levels of ingested lead, as well as long-term exposure. This will involve a two-pronged approach. Firstly, we will assess how lead levels in Tasmanian devil blood are affected by forestry culls. Blood reflects short-term lead exposure occurring over days-weeks. By focusing on a field site that has minimal background shooting activity outside of forestry culls, we will be able to compare two time periods: before and after a shooting program. Results will provide insight into the risk posed to native scavengers by forestry culling programs when using lead-based ammunition. Secondly, we will examine long-term lead exposure in devils by measuring lead concentrations in a tissue type that reflects changes over months-years: hair. This will allow us to infer how lead exposure may be affecting devil health and fitness in this landscape.

Project over duration of grant

Changes

There have been no major changes to the project.

Plans

The study aims to test two linked hypotheses:
1. Short-term lead exposure (blood study): Lead levels are higher in Tasmanian devils immediately after a forestry cull of macropods using lead-based ammunition than before the event, and isotopic lead signatures in animals with elevated lead exposure match ammunition used for culling.
2. Long-term lead exposure (hair study): Lead concentrations can be accurately measured in small hair samples from Tasmanian devils via X-ray fluorescence (XRF). Once validated, this method can be used to estimate long-term lead exposure in free-living Tasmanian devils.

We planned to conduct all fieldwork and collect all blood and hair samples over the period of the progress report, and to begin analysis of those samples.

Achievements

The project is proceeding as planned. Collection of all biological samples is complete. Laboratory analysis of samples for the blood study is underway and has just been completed for the hair study.

Blood study

- Blood samples were collected from 23 devils before and 15 devils after macropod culling.
- Blood samples are currently being shipped to the University of California for measurement of lead concentrations and characterisation of lead isotopes at by the world's leading lead isotope laboratory.
- Bullet samples have been collected from the shooting events to compare with lead isotopes in devil blood.
- A paper is planned for submission to *Environmental Science and Pollution Research*.

Hair study

- 102 hair samples were collected: 41 large (~1.0 g) and 61 small (~0.1 g).
- Portable XRF measurement was completed for all samples and validated by Aaron Specht at Purdue University, the world's leading expert on applying XRF to wildlife.
- ICP-MS (validated method for comparison with XRF) was completed for the 41 large samples.
- The regression relationship between XRF and ICP-MS values for this tissue type and species has been characterised and validated.
- A paper is in preparation for submission to *Science of the Total Environment*.

Difficulties

We were unable to capture and sample as many devils as we aimed for before and after macropod culling (we aimed for 25 animals from each time period, and achieved 23 and 15, respectively). However, this still provides an adequate sample size for a comparison of blood lead levels and isotope characterisation, without analysis of the influence of covariates.

Future Plans

In the next twelve months we intend to complete laboratory and data analysis for hair and blood samples, and publish two papers:

1. Blood lead levels and lead isotope characteristics before and after culling of macropods in a timber plantation.

2. Validation of the efficacy of portable XRF for elucidation of long-term lead exposure in a mammalian scavenger via measurement of lead concentration in devil hair.

Academic Outputs

Publications

A paper on the hair study is in preparation for submission to *Science of The Total Environment*.

Impact

We have not yet submitted publications so impact cannot yet be measured.

Outcomes

No completed outcomes as yet due to the fact that analysis of samples and data is still underway. However, once the study is complete, the management implications of the study are straightforward: if significant lead exposure is currently occurring in an iconic and threatened Australian mammal, there will be a strong impetus for land managers to transition to lead-free products, as has occurred in much of the world. If XRF is validated for non-invasive measurement of long-term heavy metal exposure in a threatened mammal species, it is likely to become a useful addition to the tool kit for conserving mammalian taxa vulnerable to the effects of anthropogenic pollution.