Review of Draft Final Report, QA-2688: An assessment of the potential hazards of anticoagulant rodenticides to Plethodontid salamanders

A report to: U.S. Fish and Wildlife Service, Farallon Islands National Wildlife Refuge, Fremont, California through Interagency Agreement No. F16PG00129

This report addresses potential hazards posed to endemic plethodontid salamanders by a proposed mouse eradication project on the Farallon Islands National Wildlife Refuge. The study uses three suitable surrogate salamander species and realistic exposure routes. The results provide useful data on salamander mortality and sublethal effects, despite challenges related to working with difficult-to-obtain species.

Comments below are organized by report section

Introduction

Page 3: APHIS should be defined at first use

Page 3: It would be helpful to add a brief explanation of how ARs are typically applied (method and rates) in invasive rodent eradications, as well as a more explicit explanation of how salamanders would likely contact ARs under natural conditions.

Methods

Several elements of the study design/methods need additional detail:

The actual number of salamanders of each species exposed in each treatment or control group in Trials 1 and 2 should be specified in a table in the Methods section.

In addition to clarifying the experimental design, creating the table above would allow the information on *Batrachoseps* group sizes to be removed from the “oral exposure” and “dermal exposure” sections.

In oral exposures, what method was used to dust crickets with ARs, and at what rate were they dusted?

In dermal exposures, at what rate were pellets spread on the paper towels? Ideally, this rate should be linked to typical application rates used in the field, or a multiplier thereof (to simulate a worst-case scenario). Because the very high exposure rates are mentioned several times in the interpretation/conclusions of the study, it is critical to know how much higher the exposures might have been than realistic field levels.

In dermal exposures, was the procedure used to powder/crush pellets intended to replicate the size range of pellet pieces that salamanders might encounter in the field, or simply produce a wide range of pellet piece sizes?

How often was water applied to paper towel substrates (in all treatment and control chambers)?

What was the feeding procedure for crickets? More detail is needed here, because some values of cricket consumption reported in the results appear higher than what would be expected from feeding of 5-7 crickets per salamander twice weekly.

Please include a thorough description of all types of samples sent for rodenticide analysis. Appendix A lists many types of samples (particularly for crickets, but also placebo baits, etc.) that are not currently described. In particular, emphasize that crickets fed rodenticides were included in analytical samples for comparison, although they were not used in the trials.

More detail is needed on the statistical treatment of the data. Was the repeated measures design reflected in the analysis? See additional comment under Results, below.

Results

For Trial 1, it would be helpful to report the incidence of skin sloughing and sores by individual (and then summarized by species) to determine if individuals that developed skin problems were the same individuals that later died.

For Trial 1, it would be helpful to report mortality and weight change by species, given potential species-specific differences in rodenticide uptake/ingestion and sensitivity. Table 1 appears to show species-specific differences in weight change in both treatment and control groups.

In Trials 1 and 2, reporting cricket consumption by individual salamander (similar to weight change) would allow a better understanding of feeding patterns and potential changes between exposure and post-exposure periods.

Related to above, both weight change and cricket consumption should be analyzed with a paired samples t-test to account for the repeated measures design (with *Aneides* and *Ensatina* analyzed separately in Trial 1). This is especially important, given the wide variability among individuals in size and number of crickets consumed. The fact that weight and feeding were tracked for each individual is a strength of the study, and should be reflected in the statistical analysis.

In the results from the control group for Trial 2, is the higher end of the range given for cricket consumption (229 per salamander) correct?

For crickets fed rodenticides, are the residue values listed here from the initial batch of crickets that died shortly after feeding, or from a later batch?

Discussion

Was the “reduced skin sloughing and fewer sores during the post-exposure period” a qualitative or quantitative observation?

I agree that the rodenticide exposures in the current study clearly represent a worst-case scenario. As mentioned in the Introduction comments, adding information on typical field application rates would help readers understand how much higher exposure rates in the study might have been, compared to potential exposures in the field.

When “later batches of crickets [fed rodenticides] survived and were used in the study,” does this refer to being used for analytical samples, or being used in a different way?

It would be helpful to add more specific detail regarding the characteristics of 1) salamander physiology and behavior and 2) fate and transport of the two rodenticides that contribute to the determination of relatively low risk.

Additional points that may warrant mention in the Discussion:

Potential cause for apparent *Batrachoseps* sensitivity to dermal brodifacoum exposure?

Detection of low levels of brodifacoum in a control and a diphacinone-exposed *Batrachoseps* salamander. Also detection of low levels of diphacinone in crickets fed and dusted w/ brodifacoum.

Table 1

See suggestions for reporting in Results section, above.

Table 2

Salamander QS27 is missing a final weight value

Two salamanders in the control group are listed as “QO” rather than “QS”

Appendix A

Given the number of different treatments in Trial 2, it would be helpful to arrange the table of *Batrachoseps* residues by treatment. This would ease comparisons of residue concentrations in animals treated similarly.