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Wildlife Research

Supplementary Material

Can conditioned taste aversion be deployed at a landscape level to mitigate the impact of invasive cane toads on northern quolls?

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Supplementary Materials 1: Decay of conditioned taste aversion in captivity

METHODS

We measured conditioned taste aversion decay in five male captive northern quolls. The quolls were captured from Mareeba, QLD and transported to the Territory Wildlife Park, NT six months prior to the commencement of the experiment. They were housed individually in 2x4m enclosures at the Territory Wildlife Park.

The experiment began by training each individual to avoid a novel bait using thiabendazole (TBZ) to elicit a conditioned taste aversion. We had two types of novel baits 1) pork mince laced with orange essence in a star shape and 2) kangaroo mince laced with vanilla essence in a heart shape. All baits were made from a single mix, were frozen, and thawed on the day of presentation. These meat, odour and visual cues were all novel to the quolls. They were randomly allocated a control and treatment bait from the two options. To begin with, we gave each quoll their allocated control bait (5g; not laced with TBZ) for three repeated nights or until the bait was eaten. Then, we presented each quoll with the treatment bait which was laced with chemical TBZ at a dose rate of 400 mg/kg quoll mass in a 5g bait. We repeated the dosed treatment bait until the bait was eaten or for up to three nights. Baits were given instead of the quoll's regular food.

Following the training period, we presented each individual with both a control and treatment bait (without TBZ) daily along with their regular food. Quolls were fed just before dusk and then checked the following morning, when we recorded if the referent bait was eaten or not. Referent, in this case, is the type of food- that the aversion refers or is referred to. This was repeated nightly following the initial training, until an animal left the study, or consumed the referent bait. The experiment was conducted as a pilot on post-breeding males, and the short monitoring period and disparity between individuals was due to the logistical difficulties.

One male died of natural causes during the experimental period, and another two were shipped to other zoos in order to make room in the captive breeding facility. These constraints, along with the difficulty of working with an endangered marsupial, have led to the uneven and small sample sizes.

Statistical Methods

The data are classical time to event data (where the event is consuming the referent food item), and they are right censored (animals left the study), so lend themselves to a survival analysis. We fit the simplest, one-parameter, survival model to these data: the exponential (constant hazard) model using the survival package in R (Therneau 2015).

RESULTS

Four of five individuals consumed the control bait throughout the experiment, bar one individual that did not consume control bait on one night (night six). Two quolls consumed the referent bait on the 15th night post training. The other three animals did not consume the referent bait, and left the study at 11, 13, and 18 nights post training. These animals were right censored, the effect of which will be to tighten the confidence interval on one side of the estimate. The estimated per day probability of losing aversion was estimated as 0.028 (95%CI: 0.0068, 0.11) yielding an expected decay function shown in Fig A1. This implies that at 120 days somewhere between 56-100% of trained animals will have lost their aversion.

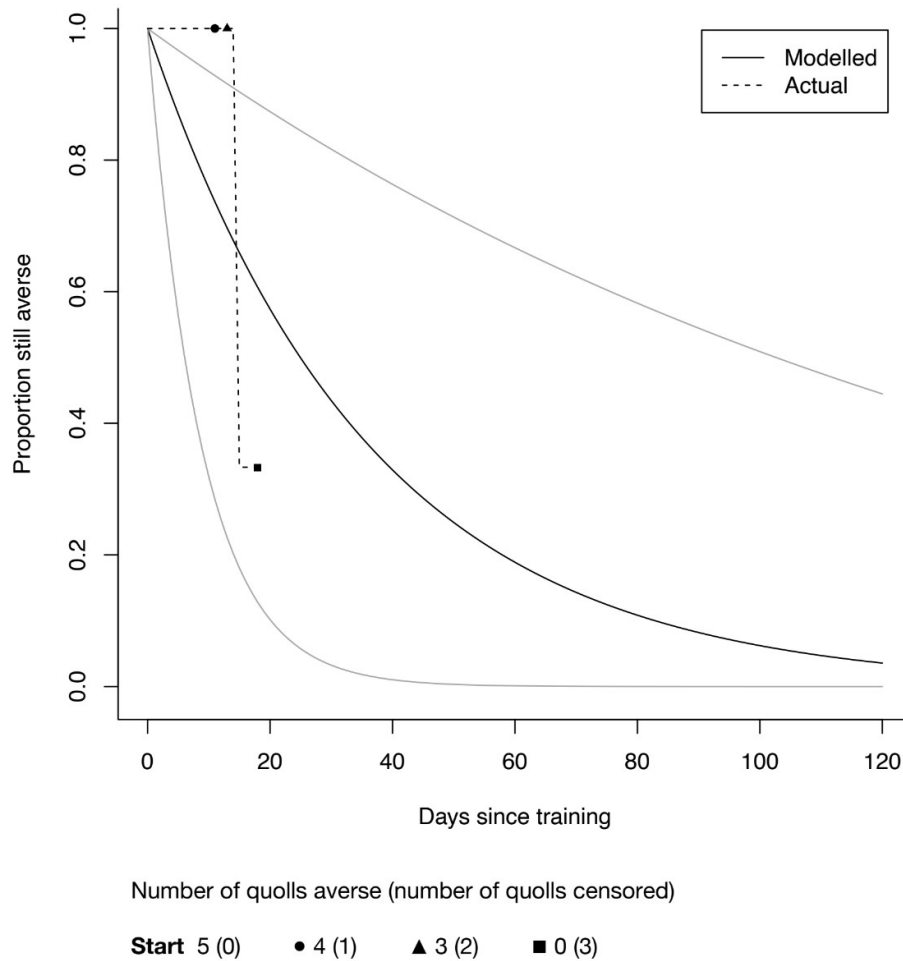


Figure A1: Decay of acquired CTA aversion (days since training) (expected value and associated prediction envelope light grey) within 120 days of training. The time taken for 80% loss of the lesson (with bounds) occurred around 60 days since training. Actual data is shown via Kaplan-Meier survival plot (dashed line), with the trial beginning with $n = 5$ individual male quolls and ending with $n = 2$ quolls. Times of each quoll censored during the course of the study are indicated with symbols.