

Responses of the native skink *Leiopisma maccanni* to two pest control baits

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1. Summary

1.1 PROJECT

This study investigated the attractiveness of two vertebrate pest baits (non-toxic RS5 and Pindone-impregnated AgTech) to captive skinks *Leiolopisma maccanni*. The trial was conducted in January 1995 by the Department of Entomology and Animal Ecology, Lincoln University, for the Department of Conservation.

1.2 OBJECTIVE

- To assess the relative attractiveness of RS5 and Pindone baits to captive skinks.

1.3 METHODS

- A total of 35 skinks from Kaitorete Spit were held in captivity for a 5-day palatability trial.
- The effect of bait type (RS5, Pindone), bait size (0.07g, 2.0g) and water content (wet, dry) on attractiveness was assessed by monitoring lizard behaviour using timelapse video.
- Following the palatability trial, each lizard's bait consumption was measured accurately over a 2-day period.

1.4 RESULTS

- Lizards were attracted to both bait types. When dry, Pindone baits were more palatable than RS5 baits. However, when wet the palatability of both baits increased and was similar. Bait size had no significant effect on palatability.
- Lizards ate an average 0.01g of RS5 and 0.02g of Pindone in 2 days.

1.5 CONCLUSION

Lizards may consume small amounts of toxic bait after some pest control operations. However, the amount eaten is unlikely to represent a lethal dose of either sodium monofluorocetate (1080) or Pindone.

2. Introduction

New Zealand currently has at least 65 extant species of lizards, a number of which are considered endangered or vulnerable (Daugherty *et al.*, 1994). Various lizard species, including the skink *Leiopisma maccanni*, are present in areas subject to poisoning operations for introduced rabbits (*Oryctolagus cuniculus*) and possums (*Trichosurus vulpecula*).

The risk that toxic baits used for vertebrate pest control poses to lizards is not clear (Spurr, 1993, 1994). New Zealand's lizards are predominantly insectivorous but may also eat soft fruit, honeydew and nectar (Whitaker, 1987; Patterson, 1992; Freeman, 1994). Vertebrate pest toxins are often incorporated into baits containing "sweeteners" (P Thompson, pers. comm.), which have the potential to attract lizards.

This study assessed the attractiveness of two commonly used vertebrate pest baits to the skink *L. maccanni*. RS5 is a cereal based bait that is often impregnated with sodium monofluoroacetate (1080). Pindone is a first generation anticoagulant used for rabbit control in New Zealand and Australia (Nelson and Hickling, 1994). The trial was conducted by the Department of Entomology and Animal Ecology at the request of Canterbury Conservancy, Department of Conservation.

3: Objective

- To assess the relative attractiveness of RS5 and Pindone baits to captive skinks *L. maccanni*.

4. Methods

L. maccanni were caught by hand at Kaitorete Spit, Canterbury during January and February 1995. All skinks used were adults with a snout vent length (SVL) greater than 49mm. These were housed in pairs in 23cm x 40cm x 40cm glass cages for 5 days in a climate-controlled room. A sequence of 16 hours light and 8 hours dark, at 25°C, was established. The cages were furnished with cardboard retreats and water was provided *ad lib.*, Coarse white paper was used as substrate so that lizard activity could be monitored with an overhead video camera. Each lizard was weighed (nearest 0.1 g), measured (SVL; nearest 1.0 mm), sexed and marked for individual identification.

4.1 ATTRACTION TRIALS

The first trial tested lizard responses to RS5 non toxic prefeed pellets dyed with Bayer V200 green dye. RS5 is a cereal-based bait with a relatively high sugar content, which for rabbit and possum control is commonly impregnated with sodium monofluoroacetate (1080) at concentrations ranging from 0.02-0.15% wt:wt. 1080 is thought to be relatively tasteless at these concentrations so lizard responses to non-toxic baits were assessed (these were assumed to approximate their response to toxic baits in the field).

The second trial tested the responses of a second group of lizards to AgTech Pindone rabbit pellets. These are an alternative cereal-based formulation, dyed with Bayer V200 green dye and containing the anticoagulant toxin Pindone. This toxin is impregnated in the baits at 0.025% wt:wt for rabbits and at 0.05% wt:wt for possums (P Thompson, pers. comm.). Pure Pindone has a distinct smell (P Thompson, pers. comm.), so this trial was conducted using toxin-impregnated bait.

Each lizard was presented with one or other bait type for 5 days, beginning on the day of capture. We assessed the effect of bait size by presenting two large (range: 1.6-2.4g) and two small (range: 0.05-0.9g) baits. We tested for an effect of moisture content by moistening one of the small and large baits twice daily. The four baits were presented simultaneously on the floor of the aquarium, together with similar-sized small and large pebbles (as an experimental control). Lizard responses to baits were monitored using a timelapse video recording at 3 frames per second. The duration of two categories of lizard response to the baits was estimated:

Investigating - obvious movement towards the bait and periods when the lizard's snout was close to or in contact with the bait (but without evident licking or biting);

Feeding - periods when licking or biting of the bait was apparent from the lizard's head movements.

4.2 CONSUMPTION TRIAL

At the end of the 5-day period each lizard was placed in a small individual container to accurately measure how much bait it was ingesting. Each container was provided with a cardboard retreat and water *ad lib*. At the start of each trial, a small piece of bait was placed on filter paper in a Petrie dish and dried to constant weight (nearest 0.01g) at 35°C. The bait was then moistened and presented in the petri dish to the lizard for 2 days. At the end of this period the bait was re-dried to constant weight and reweighed to estimate the amount consumed. During the trial all scats produced by lizards were collected and examined for any sign of bait. Any liquid faeces that could not be collected were scored for the presence or absence of the green dye contained in the baits.

5. Results

Lizards spent significantly more time investigating the two baits than the pebble (Fig 1). Only 3 of 35 lizards did not investigate baits at all (two for RS5 one for Pindone).

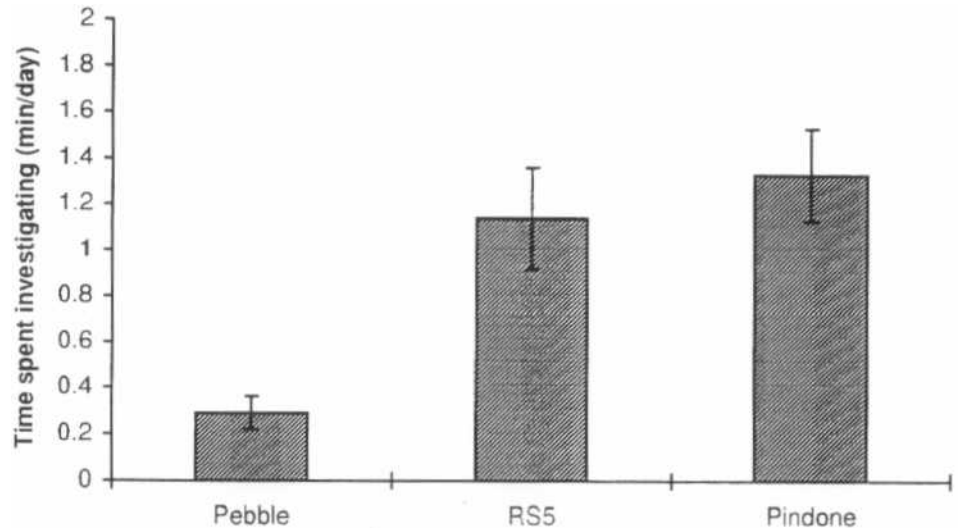


Figure 1: Mean times lizards spent investigating pebbles, and dry RS5 and Pindone baits. Investigation time was not influenced by bait size, so these data were pooled. Means presented + SE.

Lizards never attempted to feed on the control pebbles and almost never fed on dry RS5 baits (Fig. 2). They were much more likely to eat dry Pindone than dry RS5 (Paired t-test, $t=7.9$, $p<0.001$). However, when wet the consumption of both bait types increased markedly ($t=7.74$, $p<0.001$ for RS5 $t=2.86$, $p=0.006$ for Pindone) and there was then no significant difference in consumption of the two bait types ($t=1.18$, $p=0.24$).

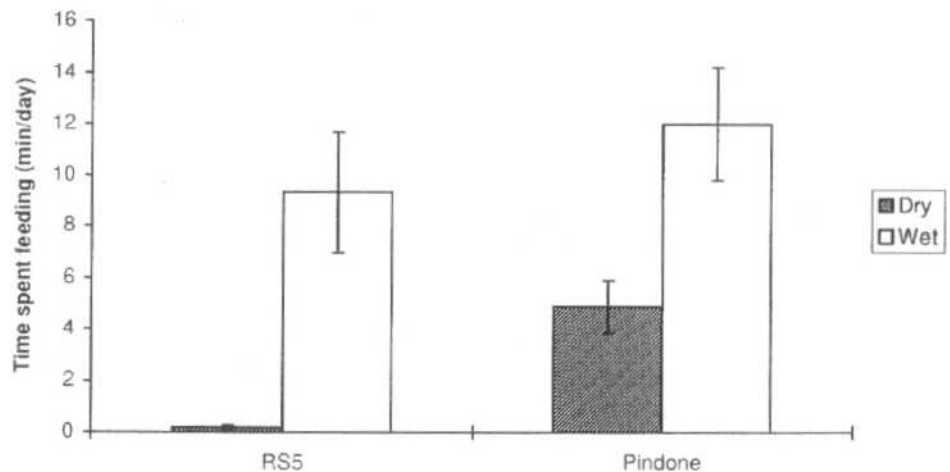


Figure 2: Mean times lizards spent feeding on dry and wet RS5 and Pindone baits. Feeding was not influenced by bait size, so these data were pooled. Means presented + SE.

Dye and/or bait was detected in 55% of faecal pellets from skinks fed RS5 and 97% of pellets from skinks fed Pindone (Table 1).

Table 1: Presence/absence of dye and bait in faecal pellets collected from skinks during consumption trial.

Bait type	No bait /dye detected	Dye detected	Bait and dye detected
RS5	10	7	5
Pindone	1	9	20
Total	11	16	25

Lizards ate very little bait during the consumption trials (Fig 3). Mean consumption of Pindone (0.020g) tended to be higher than that of RS5 (0.012g), although the difference was not statistically different ($t=1.12$, $P=0.3$).

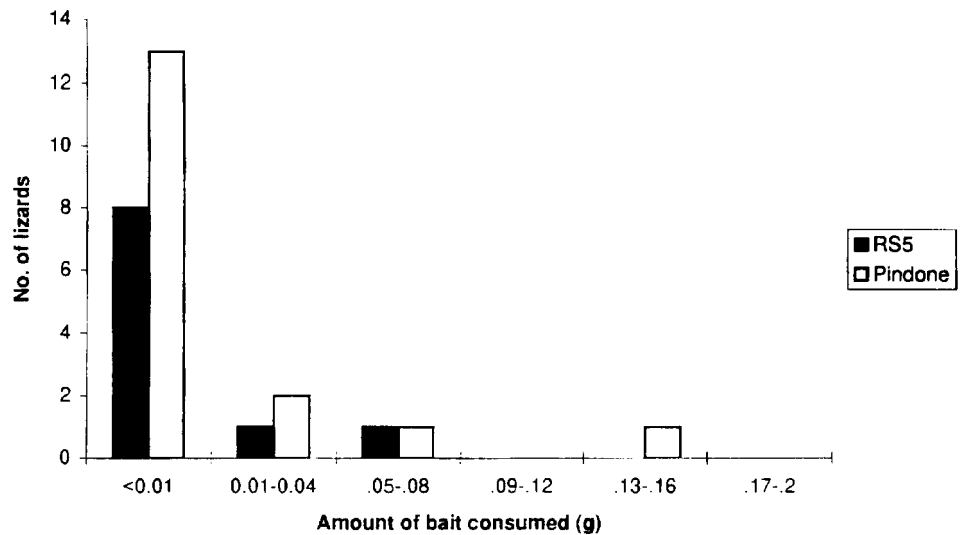


Figure 3: Quantities of bait eaten by lizards (N=27) during 2-day consumption trials.

The amounts of toxin that would be ingested at these levels of consumption are far below the likely lethal doses for these lizards (Table 2).

Table 2: Dose of toxin received by captive lizards feeding on wet Pindone and RS5 baits for two days. Data presented as mean (95 CI).

Bait	N		Bait Consumed	Bait Consumed	Toxin Consumed	LD ₅₀ for Toxin
			(g)	(g/kg body weight)	(mgr/kg body weight)	(mgr/kg body weight)
RS5	10	Mean	0.012 ± 0.015	3.8 (0.1-7.5)	6	205.9 (147.2-289.1) ³
		Max	0.042	15	23	
Pindone	17	Mean	0.02 ± 0.03	8.0 (0.8-15.1)	2	Unknown
		Max	0.14	59	15	

¹ Mean lizard weight 2.8g ± 0.6g

² Assuming that RS5 bait was loaded with 0.15% wt:wt 1080 and Pindone with 0.025% wt:wt Pindone.

³ For the Scincidae *Trachydosaurus rugosus* from South Australia (McIlroy et al., 1985).

6. Discussion

During the trials the lizards were given no alternative foods. In the field lizards may be less inclined to consume pellets because alternative food sources will be available. The results from this study are therefore likely to represent a "worse case" scenario.

Most of the skinks (89%) displayed some interest in the two types of bait. The most common response was licking and little bait was consumed. The effect of bait size on attraction was not significant, but there was a strong preference for wet baits over dry baits (Fig. 2). A similar preference has been documented in Telfer's skinks (*L. telfairii*) on Mauritius, which showed little interest in fresh pollard/bran baits but would eat rain softened ones (Merton, 1987). Moisture licked from damp baits is likely to be sweetened with dissolved sugars, and thus attractive to lizards.

In the consumption trial skinks tended to have a greater preference for Pindone baits than RS5 baits (Fig. 3). Commercial sensitivity meant that a direct comparison of the ingredients used in the two bait types could not be made, so the reason for this difference in palatability is uncertain.

The potential level of consumption of RS5 1080 bait that can be inferred from this trial is unlikely to be fatal, as lizards show a high tolerance to this poison. For example, the mean LD₅₀ for five species of Australian lizard (*Pogona barbatus*; *Varanus gouldi*; *V. varius*; *Tiliqua nigrolutea*, *Trachydosaurus rugosus*) varied from 27.5mg/kg for *V. gouldi* to 589.5 mg/kg of 1080 for *T. rugosus* (McIlroy et al., 1985.; McIlroy, 1986; McIlroy, 1992). The species most tolerant of 1080 in McIlroy's studies belongs to the family Scincidae of which *L. maccanni* is also a member. However, the innate tolerance of *T. rugosus* from Western Australia has probably been accentuated through feeding on species of *Gastolobium* and *Oxylobium* that contain high levels of fluoroacetate

in this part of Australia (McIlroy *et al.*, 1985). Therefore, for the purposes of this study, McIlroy's mean LD₅₀ of 205.9 mg/kg recorded for the Scincidae *T. rugosus* from South Australia was taken as a conservative estimate of *L. maccanni* tolerance to 1080.

In the present study the largest amount of RS5 bait eaten by a *L. maccanni* was 15g/kg of body weight (or 23mg/kg of toxin), which is an order of magnitude below the LD₅₀ discussed above.

The risk of Pindone baits to lizards is harder to quantify as the acute toxicity of anticoagulants to lizards is unknown (Spurr, 1993, 1994). However, anecdotal evidence suggests that widespread use of anticoagulants in areas where lizards are present has not led to any severe declines in populations (Mertens, 1987; Towns and McFadden, 1991). None of the lizards in the Pindone trials showed any signs of poisoning during the 5-day period they were held, although Pindone might take longer than this to have an effect.

Although lizards may feed on baits for more than two days in the field, it seems unlikely that the direct consumption of 1080 and Pindone poison baits would have a major impact on skink populations. It is also unlikely that lizards would be poisoned indirectly if they ate insects that had fed on toxic baits. Even if lizards fed entirely on insects poisoned with 1080 it is highly unlikely that they could ingest enough poison to receive a lethal dose (McIlroy, 1992).

The possibility that sublethal doses of Pindone and 1080 could affect lizard behaviour and reproduction remains uncertain. It has been suggested that sublethal quantities of 1080 may lead to physiological stress and a greater risk of predation (McIlroy *et al.*, 1985). Similarly, it has been suggested that sublethal doses of anticoagulants could inhibit the regulation of body temperature in lizards leading to an increased risk of overheating when high ambient temperatures are present (Merton, 1987).

However, to date there is no evidence that the use of toxic baits for vertebrate pest control has any long term negative impact on lizard populations (Merton, 1987; Towns and McFadden, 1991). While further research is required on the impacts of sublethal doses on behaviour and reproduction, it is likely that the benefits of decreased predation and habitat modification by introduced pests outweigh the minimal risk that the baits present to skinks.

7. Acknowledgements

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