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SHORT COMMUNICATION

Commonly used funnel trap causes rostral damage in Lakes skink (*Oligosoma* aff. *chloronoton* 'West Otago')

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Abstract: Funnel trapping is recognised as a best practice method for lizard inventory and monitoring, and is considered safe for most lizard species when deployed correctly. However, we observed rostral damage to Lakes skinks (*Oligosoma* aff. *chloronoton* 'West Otago') following trapping using Gee's minnow traps with 1/8" mesh, a commonly used device for terrestrial lizards. Of 73 Lakes skinks captured over two distinct trapping sessions, 19 had damage (26.0%). One of two captured Mackenzie skinks (*Oligosoma prasinum*) also had damage. We suggest that damage was caused as interned lizards tried to escape through the mesh. No evidence of similar damage was seen for the smaller species caught, including McCann's skinks (*Oligosoma maccanni*), southern grass skinks (*Oligosoma* aff. *polychroma* Clade 5), and Southern Alps geckos (*Woodworthia* 'Southern Alps'). It may be that smaller lizards that can comfortably fit their snouts through the mesh were less affected, or that the behaviour causing the damage (i.e. ramming into the trap sides) was reduced for these species. In this instance, damaging behaviour may have been exacerbated by high within-trap temperatures, which can trigger escape responses in other lizards. In future, practitioners trapping for larger bodied skinks should consider using alternatives trap designs where possible (e.g. pitfall trapping), or test modified Gee's minnow traps. If unable to alter trap type, additional ethical justification should be required when using Gee's minnow traps for this species and potentially for other large skinks.

Keywords: animal ethics; behaviour; Gee's minnow traps; lizard; Mackenzie Basin

Introduction

Live animal trapping is a powerful methodology that can provide unique benefits to conservation monitoring. For Aotearoa | New Zealand's (NZ) lizards, live trapping can be used to detect presence (Bell & Patterson 2008; Patterson & Bell 2009; Lettink et al. 2013), estimate relative abundance and home range (e.g. Lettink et al. 2011), monitor population demography (e.g. McCoy et al. 2014), or capture individuals for translocation (e.g. Towns & Ferreira 2001). In comparison to visual surveying, trapping is easier to standardise, and devices can be left in the environment for extended periods of time, increasing relative effort. Trapping also captures animals, allowing for species and individual identification, in-hand measurements, and sexing. For these reasons, live trapping is a frequently used technique in conservation science and monitoring. Two commonly used live capture trap designs for lizards are pitfall traps and funnel traps (Lettink & Hare 2016; Lettink & Monks 2016). Generally, pitfall traps are installed where ongoing population monitoring is required, as they often involve a significant investment of time to install (Lettink & Hare 2016; Lettink & Monks 2016). Funnel traps are well suited to short-term trapping operations or to use where terrain is unsuitable for pitfall traps (e.g. changeable terrain) as they are easier to install and move. With both trap types, lizards remain trapped until released, potentially impacting the animal's welfare.

When animals are captured, they are interned in an unfamiliar space for an extended period (up to 24 hours). While they have access to food (e.g. bait or interned invertebrates) and shelter (e.g. shelter rocks in pitfall traps and grass bunches in funnel traps), how animals use these artificial systems and how that compares to natural behaviours is largely unknown. When captured, the animals may be exposed to unfavourable abiotic conditions (e.g. Jenkins et al. 2003; Read & Kearney 2016), negative intraspecific and interspecific interactions, or have positive interactions prevented (e.g. foraging, mating). For example, while pitfall trapping near the Upper Cass River, we trapped a scree skink (*Oligosoma waimatense*) which had likely eaten an interned roamatimati skink (*Oligosoma* aff. *longipes* 'southern'), evidenced by a clear bulge in the throat/stomach of the skink and a dropped tail found in the trap. Depredation by introduced mammals is also relatively common. Mice (*Mus musculus*) and weasels (*Mustela nivalis*) can enter and exit all types of lizard traps and are known to kill different species, though the risk to larger individuals is less clear (Newman 1994; Towns & Elliott 1996; Miskelly 1997; Woolley et al. 2022). Aside from predation, the stress of being

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in confined spaces with limited cover may alter behaviour and drive harmful physiological processes (Langkilde & Shine 2006). Generally, impacts on captured lizards are thought to be minimal, and efforts can be taken to reduce negative consequence (e.g. trapping during low mouse abundance).

To date, no direct damage to reptiles in NZ has been recorded from commonly used trapping devices. Here, we report rostral damage to Lakes skinks (*Oligosoma* aff. *chloronoton* 'West Otago'), a large bodied species (snout-to-vent length [SVL] up to 110 mm), following trapping using Gee's minnow traps. We discuss the likely cause of this damage and contextualise the implications and ethical considerations for use of this device in future.

Methods

Trapping occurred at a lowland site in the southern Mackenzie Basin, in a small gully system. The gully floor was heavily vegetated, comprising a mixture of invasive grass and scrub (e.g. *Rosa rubignosa*), with some native scrub plants (e.g. *Discaria toumatou*, *Comprosma propinqua*; Fig. 1a). The site is dominated by two large poplar trees (*Populus nigra*), which shaded the gully for long portions of the day (Fig. 1a).

We present records from two distinct trapping sessions: (1) carried out by the Department of Conservation in 2022 to determine relative abundance of known populations of Lakes and scree skinks using capture-recapture, and (2) performed by SB in 2025 to determine interaction rates of Lakes skinks with trapping devices and estimate daily movement using spatially explicit capture-recapture.

In 2022, 22 Gee's minnow traps (1/8" mesh; Tackle Factory, USA) were placed in habitat deemed suitable for target species (Lakes and scree skinks). Traps were open from 22/02/2022 until 28/02/2022 (132 trap nights). Notably, effort in 2022 was spread over four gully systems, while in 2025 effort was focused on a single gully with the highest apparent population of Lakes skinks (Fig. 1). In 2025, 36 traps were placed on the gully bottom in two grids (three by three and nine by three) at 2 m spacings. Traps were open from 02/02/2025 to 08/02/2025 (216 trap nights), though grid configuration was altered slightly in the first two days. Both grids transversed changing habitat, including dense introduced grass, native scrub, and the margins of rocky terraces (Fig. 1b).

When placed, traps were nestled into surrounding grasses, or under native scrub where possible. Grass bunches arranged perpendicular to the trap openings were stuffed against the trap roof and sides to provide a continuous area of shade within all traps. Dense grass and other detritus was provided in the base of the trap to give additional cover. Traps were baited with a single piece of canned pear (Pams brand, in juice). A wetted sponge (Value brand, cellulose) was added to each trap to prevent desiccation of interned animals. Traps were left in situ overnight for approximately 24 hours. Each day lizards were removed, measured, and marked for recapture. Pear was replaced, sponges rewet, and cover rebuilt after animals were removed.

While measuring and marking lizards, practitioners have time to actively check the lizards' condition and for identifiable features (e.g. toe loss, scars); this is when rostral damage was noted. Specific attention is not usually given to the snout of the animal, however, prior to the 2025 effort, we were made aware of the damage recorded in 2022, so were specifically checking each individual.

In 2025, Browning Dark Ops Pro X 1080 (Browning, USA) trail cameras were positioned above some traps from 03/02/2025 to 06/02/2025, approximately 1.8 m above the ground. Browning trail cameras have an internal temperature reader which records when each photo is taken. Photos were set to be taken from sunrise to sunset (approximately 6:30 a.m.

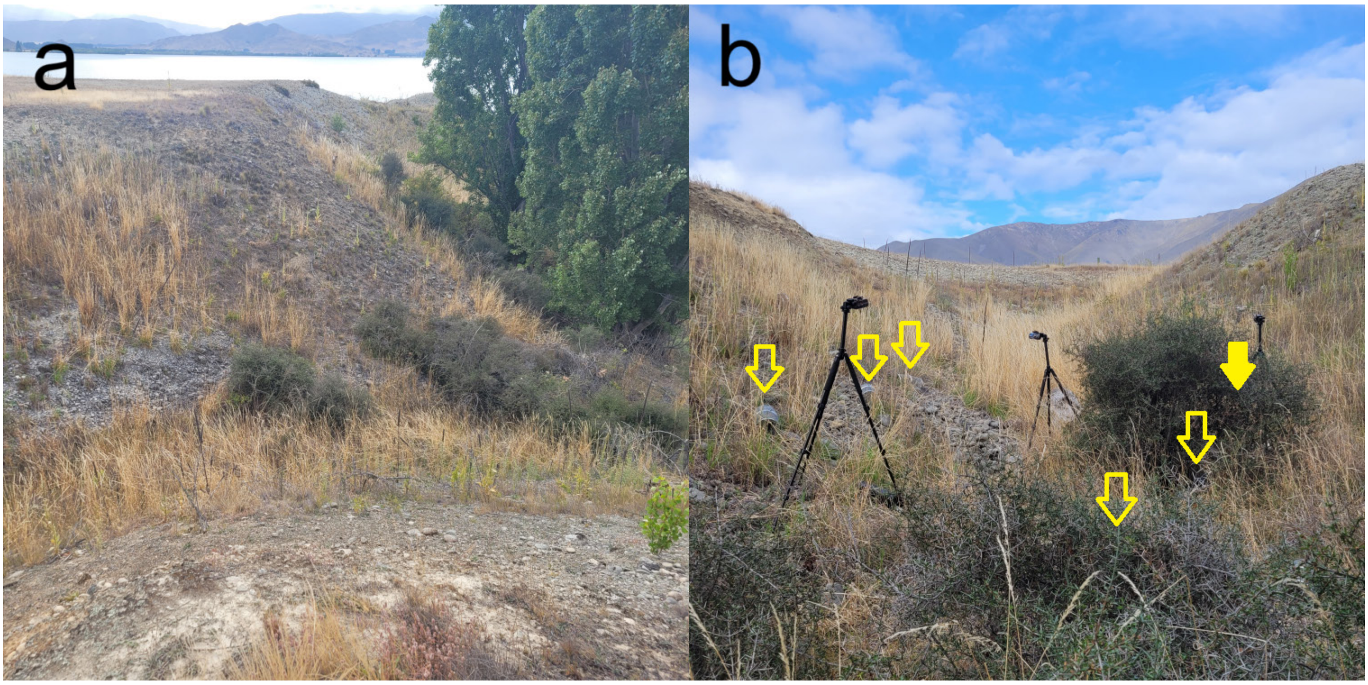

Fig. 1. Example of the habitat present at the trapping site, Mackenzie Basin. (a) A view down into the gully from the top of the terrace, showing the large poplar trees (*Populus nigra*), and some native scrub (*Discaria toumatou*) amongst introduced grasses. (b) Habitat on the gully floor where Gee's minnow traps were set (yellow arrows). The solid arrow indicates a trap which caught a lizard with snout damage.

to 9:00 p.m.). A subset of these recordings is presented here to represent the temperature at the site during trapping effort. These data are preferred to ambient temperatures measured upon arrival and departure from site, as the latter only provide a snapshot of temperature conditions and are heavily biased towards the morning, when traps are normally serviced. However, trail camera data are not ambient temperatures, as the camera casing can heat rapidly in direct sunlight. Ambient temperatures, recorded at the Pukaki Aerodome (c. 20 km from the site) are also provided for both trapping periods, for additional context.

Results

In 2022, 43 unique Lakes skink captures were made, 12 (27.9%) of which had some degree of rostral damage (Table 1). Eleven of these damaged skinks were newly captured individuals, and one was a recapture. Fifteen other lizards, from four species (McCann's, southern grass, and scree skinks, and Southern Alps gecko), were captured during this period, none of which had any noticeable damage (Table 1). In 2025, 30 unique Lakes skinks were captured, of which seven had rostral damage (23.3%). Two instances of damage were associated with recapture, as one skink was captured three times and had fresh rostral damage on all occasions. Damage included bleeding from the nostrils (Fig. 2a), dried blood and recent wounds (Fig. 2b), and scale loss forward of or including the frontonasal scale (Fig. 2a). Fifty-one other lizards (McCann's and southern grass skinks, and Southern Alps geckos) were captured in 2025; none had damage. Lakes skinks with rostral damage were similar in size (SVL) to those without; 80.1 mm on average (min. 75 mm, max. 85 mm), versus 80.4 mm (Table 1).

In 2025, lizards were more commonly caught in traps near more dense vegetation and larger substrate (cobbles), though captures in exposed traps were not rare. There was no clear pattern in terms of which traps caught lizards with snout damage. Two injured animals were caught in a single trap which was partially situated under *D. toumatou*. Another trap was completely covered by *D. toumatou* canopy. One trap was directly adjacent to a small *Melicytus alpinus* on large rocky cobbles, but otherwise exposed. One trap was covered on all sides by tall introduced grasses, and two were in the open, with minimal external cover (Fig. 1).

Additionally, one of two Mackenzie skinks (*O. prasinum*) captured during one night of trapping ($n = 24$; using the same methodology as 2025) at an alternate site (Simons Pass), also displayed clear rostral damage. Trapping was immediately discontinued following these captures.

When servicing Gee's minnow traps, we noted that Lakes skinks were ramming their snouts into the sidewall of the trap. Presumably, they were attempting to escape the trap directly through the mesh trap sides.

Maximum ambient temperatures recorded at the Pukaki Aerodome were between 16.7 °C and 23.9 °C (average 20.6 °C) for 2022, compared to between 22.3 °C and 30.7 °C (average 26.8 °C) for 2025. Temperatures recorded by trail cameras on site from 03/02/2025 to 06/02/2025 were consistently higher than the ambient temperatures (Fig. 3). Peaks in temperature occurred around 3:00 p.m. on all days, and exceeded 40 °C on three of the four days. Lower temperatures recorded by some devices (e.g. TRE7 and TRE4 on 03/02/2025; Fig. 3) were a result of the devices being shaded by the large poplar trees.

Discussion

We report a new impact of live trapping on Lakes skinks, rostral damage, which affected roughly one quarter of captured individuals.

Damage to trapped individuals could arise in a number of different ways. For metal Gee's minnow traps, unfastened mesh wire can produce sharp edges which may cause injury to animals interacting with the trap. These edges are usually only problematic around the trap entrances and can easily be dulled or removed if maintained regularly (which these traps were). It is unlikely that edges caused the damage reported, as we would not expect only Lakes skinks to be impacted, nor the damage be isolated to the snouts of animals. Alternatively, the animals may have injured themselves when falling into the trap. We consider this unlikely as our Gee's minnow traps were set with a liberal amount of cover on the bottom of the trap, cushioning any falls into the device. Instead, we suggest that the damage is directly caused by the observed behaviour of skinks ramming themselves into the trap wall. Whether this behaviour was occurring as a direct response to practitioners or happened regardless is unknown.

Rostral damage has previously been noted for Mackenzie skinks that injured themselves by ramming into the mesh sides of Gee's minnow traps, presumably when trying to escape (M. Lettink, Fauna Finders, pers. comm.). This behaviour was noted when trapping in rocky terrain, but not in grassy

Table 1. Captures (*N*) and recaptures (R) of all species caught at the gully site in the Mackenzie Basin for 2022 and 2025. Average snout-to-vent lengths (SVL, mm) and catch per trap night (Catch/TN) are also included. Species include Lakes skink (*Oligosoma* aff. *chloronoton* 'West Otago'), McCann's skink (*O. maccanni*), southern grass skink (*O.* aff. *polychroma* Clade 5), scree skink (*O. waimatense*), and Southern Alps gecko (*Woodworthia* 'Southern Alps'). Note that McCann's skinks, southern grass skinks, and Southern Alps geckos were not measured in 2022, nor was the latter measured in 2025.

Species	2022				2025			
	N	R	SVL	Catch/TN	*N*	R	SVL	Catch/TN
Lakes skink	43	8	80.4	0.39	32	12	72.4	0.20
McCann's skink	7	0	-	0.05	13	4	47.0	0.08
Southern grass skink	1	0	-	< 0.01	25	17	55.5	0.19
Scree skink	6	2	80.6	0.06	0	0	-	-
Southern Alps gecko	1	0	-	< 0.01	13	0	-	0.60

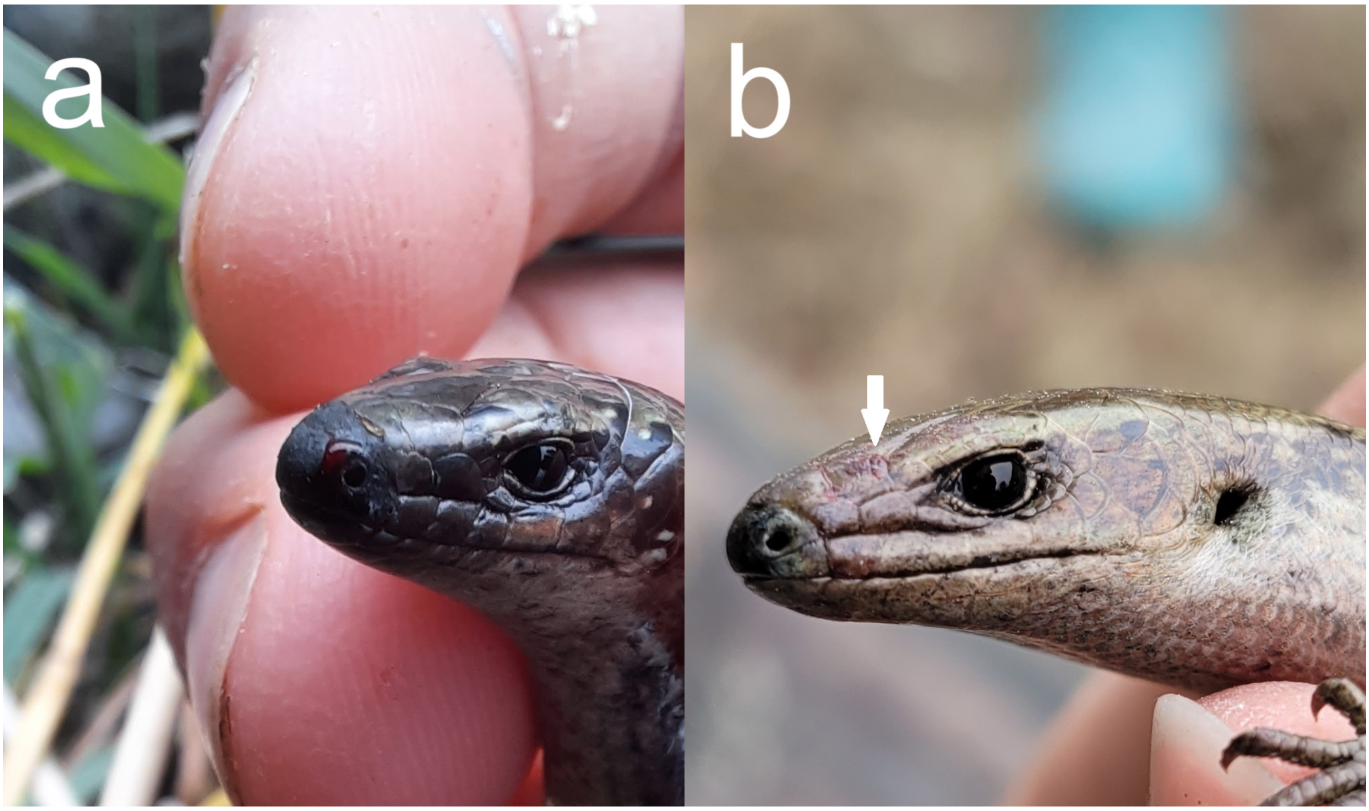

Fig. 2. Rostral damage on two Lakes skinks (*Oligosoma* aff. *chloronoton* 'West Otago'). (a) Fresh bleeding from the nose and loss of the rostral, nasal, and the frontonasal scales. (b) Dried blood on the snout (white arrow) and loss of the rostral scale.

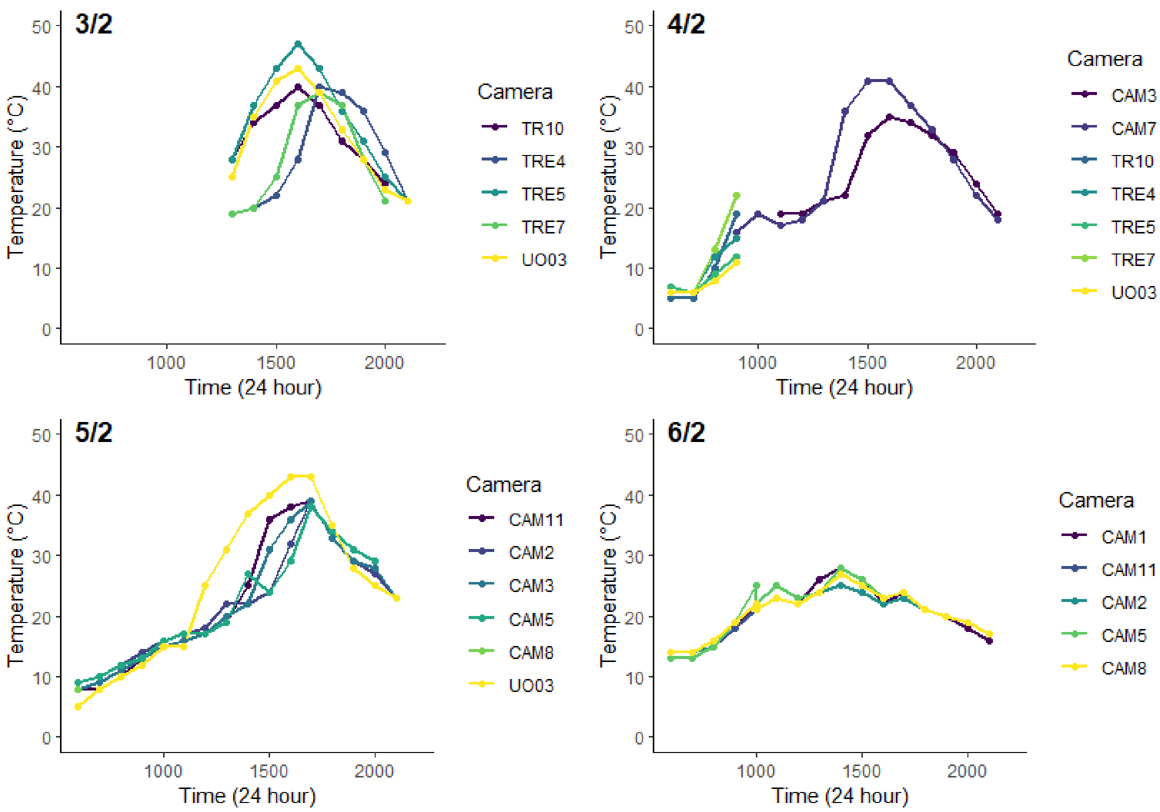

Fig. 3. Hourly temperature profiles of the trapping site through the day, from 03/02/2025 to 06/02/2025. Temperature readings were taken by Browning Dark Ops Pro X 1080 trail cameras positioned above Gee's minnow traps, approximately 1.8 m above the ground. Note that these data are not ambient temperatures, they are recorded by a temperature sensor within the plastic camera casing, which can heat rapidly in direct sunlight.

habitat (M. Lettink, Fauna Finders, pers. comm.). However, this phenomenon is not seen consistently when trapping large bodied skinks. The use of Gee's minnow traps in varied habitat within Mokomoko Dryland Sanctuary to capture Otago green skinks (*Oligosoma* aff. *chloronoton* 'eastern Otago'), a closely related species to Lakes skink, did not result in snout damage (Barry 2025). The inconsistent nature of this issue may be related to temperature. Similar ramming at the walls of containers is described by Morris (1974), who heated *Leiolopisma zelandica* (either *O.* aff. *polychroma* Clade 5 or *O. maccanni*) individuals to c. 40 °C during tests of thermophysiology.

Metal Gee's minnow traps can heat rapidly and to extreme levels when left in direct sunlight. Thompson and Thompson (2009), report that unshaded funnel traps were consistently one of the hottest among measured traps used to sample terrestrial fauna. Surface temperatures on the inside of the base of the traps could be 10 °C hotter than ambient temperatures in Australian conditions. Turner et al. (2023), report a similar difference between ambient and within-trap temperature for pitfall traps at Kaitorete Spit. For this study, daily maximum ambient temperatures recorded at a nearby weather station were, on average, 20.6 °C in 2022 and 26.8 °C in 2025. However, on-site trail cameras, which can heat rapidly in direct sunlight, reached temperatures of c. 40 °C on three of the four days measured in 2025 (Fig 3). For context, the voluntary thermal maximum of the smaller McCann's skink is between 35.0 °C ± 0.3 SE and 36.0 °C ± 0.4 SE (Virens & Cree 2019). While we do not believe that Gee's minnow traps reached the same temperatures as the trail cameras, we suggest that they may have been hot enough to trigger escape attempts by Lakes skinks and, in turn, cause rostral injury.

Neither snout damage or ramming behaviour was noted for smaller skinks caught in this study (McCanns and southern grass skinks; *O. maccanni* and *O.* aff. *polychroma* Clade 5), nor in previous work in similar habitats (c. 750 combined captures with the same Gee's minnow traps). If ramming is occurring, but not causing injury, it may be that smaller skinks can better fit their snouts through the mesh, resulting in a gentler interaction with the trap. However, snout damage was not noted for the scree skinks caught in 2022, which were very similar in weight and snout-to-vent length (average 11.1 g, 80.6 mm, $n = 6$) to Lakes skinks (average 10.9 g, 80.4 mm, $n = 43$), so the phenomenon is unlikely to be related to size alone. Anecdotally, in lowland systems, Lakes skinks are often found in habitats with higher moisture levels (e.g. vegetated terraces, gullies) indicating that the species may be prone to high rates of cutaneous water loss (as described by Neilson 2002). In contrast, scree skinks on the Mackenzie basin floor can inhabit some of the most exposed habitats available, including sparsely vegetated terraces with only shallow rocky refuges (Tekapo River). We suggest that Lakes skink may be particularly sensitive to high temperatures, though the thermal tolerance of this species has not been tested.

Hare (2012) recommended that metal funnel traps in the open are provided with additional shade (e.g. small rocks, nestling the trap within vegetation, or custom-made sheets/planks) that does not impede air flow to limit harm to interned animals. We have found that a generous amount of introduced grass stuffed into the roof of the trap provides uninterrupted shade to the base of the trap. Introduced grass is readily available in the lowlands of the Mackenzie Basin so this method also avoids additional burden. We believe that this internal shade, plus the additional material at the base of the trap is sufficient to protect lizards from the majority of direct radiative heat. However, we acknowledge that this method does not shade the top of the trap and that conduction from the exposed sections may increase in-trap temperatures above safe thresholds. Investigation into the effectiveness of this shading methodology is warranted going forward.

We suggest a precautionary approach to trapping until temperature can be ruled out as a catalyst of rostral damage. Where possible, pitfall traps should be used to trap Lakes skinks or other large-bodied skinks instead of Gee's minnow traps. For Lakes skinks, no comparative studies have been performed to suggest which trap design has higher capture rates, though disparities between devices are reported for other species (e.g. *Oligosoma homalonotum*; Department Of Conservation, unpubl. data, cited by Barr 2009). Where pitfall traps are untenable, trapping with Gee's minnow traps should be restricted to cooler temperatures (< 20 °C) or comprehensive trap shading should be used to lower in-trap temperatures. Investigation into modification of traps to reduce ramming behaviours or the harm to interned lizards could also be trialled as an alternative. In future, potential for rostral damage should be considered when trapping for Lakes and Mackenzie skinks, particularly in hot conditions.

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Additional information and declarations

Author contributions: Both SB and ST collected and collated the data presented here. SB led the writing of the short communication. All authors contributed to the conceptualisation and review of the work.

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Ethics: Work was carried out under the University of Otago's Animal Use Protocol 22-72.

Conflicts of interest: The authors declare no conflicts of interest.

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