

LOWER WAIMAKARIRI RIVER PEST MAMMAL CONTROL PLAN



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LOWER WAIMAKARIRI RIVER PEST MAMMAL CONTROL PLAN

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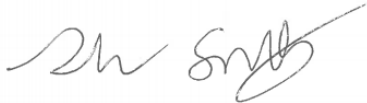
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ABSTRACT

The Waimakariri River is an important nesting ground for indigenous braided river birds, many species of which are threatened. Environment Canterbury (ECan) wishes to increase the predator control effort in Area 1, a section of the lower Waimakariri River.

Monitoring undertaken in October-November 2021 shows high numbers of cats, rats, hedgehogs, and mustelids in Area 1. The following plan recommends trap lines to cover both sides of the Waimakariri River, incorporating Sentinels and cage traps to catch possums and cats, in addition to DOC-series traps. Grids and lines of Philproof bait stations delivering pulses of pindone and Double Tap poison are suggested to knock rat and possum numbers down.

Ongoing monitoring is recommended using trail cameras, tracking tunnels, and wax tags.

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1. INTRODUCTION

Braided rivers and their associated gravel beds have been identified as a historically rare ecosystem type, and are naturally uncommon nationally (Williams *et al.* 2007). Braided river ecosystems are therefore classified as Threatened-Endangered (Holdaway *et al.* 2012). Sixty-four percent of New Zealand's braided rivers occur in Canterbury.

The Waimakariri River (a braided river) flows for 160 kilometres from its source in Arthurs Pass National Park to its mouth in Kaiapoi. Braided river birds known to nest on the Waimakariri River include tarapiroe/black-fronted tern (*Chlidonias albobriatus*; Threatened-Nationally Endangered; Robertson *et al.* 2021), tūturiwhatu/banded dotterel (*Charadrius bicinctus bicinctus*; At Risk-Declining), tarapuka/black-billed gull (*Larus bulleri*; At Risk-Declining), tōrea/South Island pied oystercatcher (*Haematopus finschi*; At Risk-Declining), poaka/pied stilt (*Himantopus himantopus leucocephalus*; Not Threatened), and ngutu-pare/wrybill (*Anarhynchus frontalis*; Threatened-Nationally Increasing) (Robertson *et al.* 2021). A major threat to braided river birds is predation by introduced mammals (Spurr and Ledgard, 2016).

Environment Canterbury (ECan) has, for several years, run a temporary location-reactive trapping programme around braided river bird breeding colonies along the Waimakariri River. The programme is focused on Area 1, running for approximately 11 kilometres from Poynters Wetland to Hars Road on the north bank, and 14.5 kilometres from Te Rauakaaka to Haul Road on the south bank. A separate trapping operation is also in effect, with an area of intensive trapping and three traplines either side of the river within part Area 1 (Figure 1).

ECan would like to improve its predator trapping programme in Area 1, and make a meaningful reduction in the numbers of mammalian predators present in the riverbed. This will gradually be achieved by building up permanent trap lines on the river berms, to supplement short-term temporary trapping around bird colonies.

Environment Canterbury commissioned Wildland Consultants Ltd to monitor predator species and numbers on the Waimakariri riverbed over three months, and use the results to inform the preparation of this predator control plan.

2. KEY PREDATORS AND THE THREATS THEY POSE

Braided river birds nest on the ground and have little ability to defend their nests or young from small mammalian predators. Table 1 describes the introduced predator species likely to threaten braided river bird populations on the Waimakariri River.

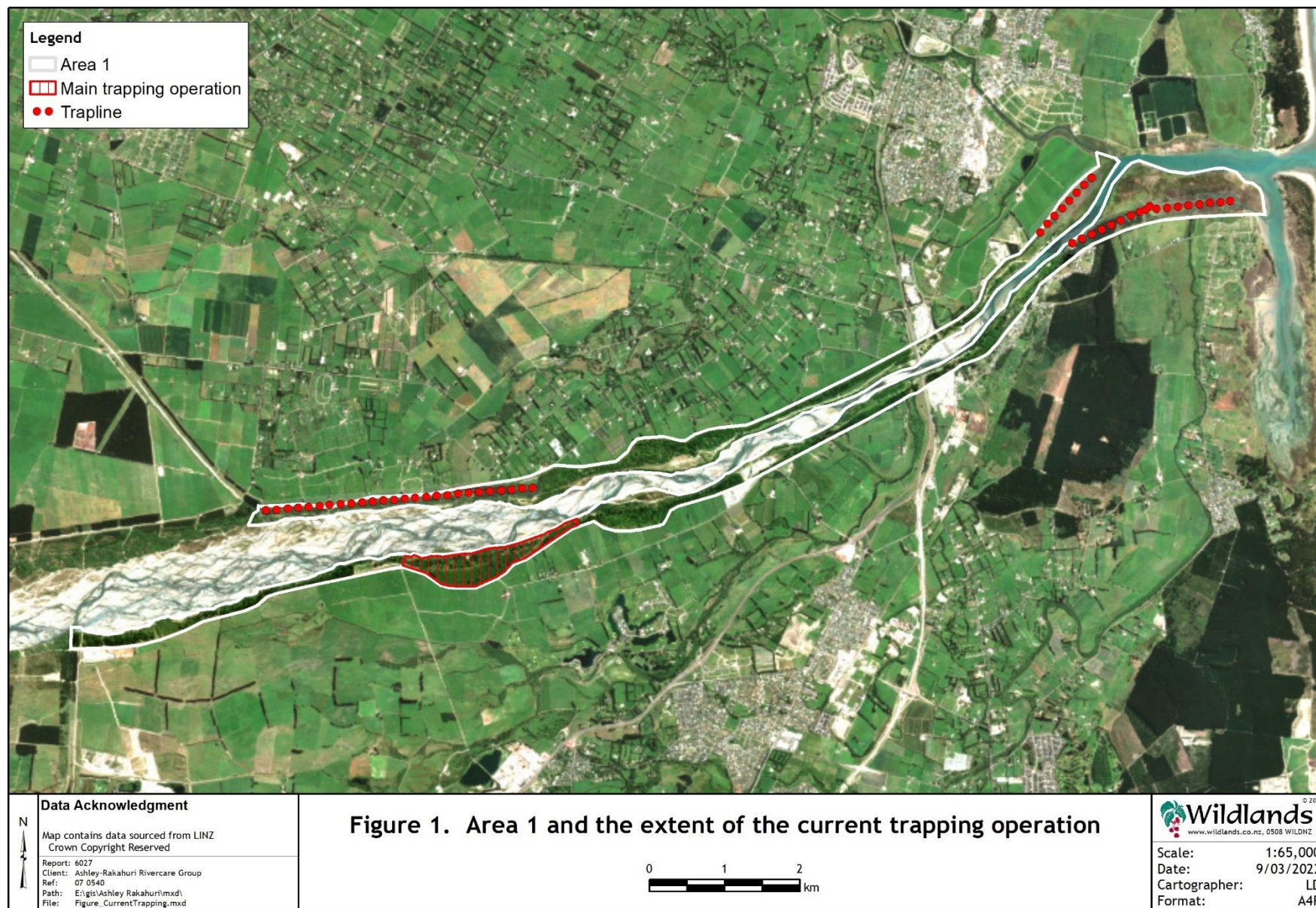


Table 1: Predators of braided river birds on the Waimakariri River.

Predator Species	Threats Posed
Feral cat (<i>Felis catus</i>)	Nocturnal predation of adults and chicks; predation of lizards and invertebrates (Murphy <i>et al.</i> 2004).
Ferret (<i>Mustela furo</i>)	Ferrets are known to kill ground-nesting shorebirds such as banded dotterel, wrybill and black-fronted terns (Clapperton and Byrom 2005).
Weasel (<i>Mustela nivalis</i>)	Predation of eggs and chicks. Diurnal and nocturnal predation. (Haworth 2018; Strang <i>et al.</i> 2018).
Stoat (<i>Mustela erminea</i>)	Significant bird predator, particularly of eggs and chicks but also adults (Steffens <i>et al.</i> 2012); major contributor to bird decline in braided rivers. (J. Dowding <i>et al.</i> 2015; Murphy <i>et al.</i> 2004).
Norway/brown rat (<i>Rattus norvegicus/ rattus</i>)	Egg and chick predation (J.E. Dowding and Murphy 2001).
Hedgehog (<i>Erinaceus europaeus</i>)	Major predator of eggs and chicks (Sanders and Maloney 2002).
Possum (<i>Trichosurus vulpecula</i>)	Opportunistic omnivores that will eat eggs, chicks, lizards, and invertebrates (Brown <i>et al.</i> 1993).

3. PREDATOR MONITORING

Predator monitoring took place between October and November 2021. Tracking tunnels were used to monitor rodents, mustelids, and hedgehogs. Wax tags were used to monitor brushtail possums and rats. Camera traps were used to monitor feral cats, but also recorded data on other predator species. Lines were spread throughout Area 1 to give the best possible coverage. Line direction was randomised where possible.

3.1 Tracking tunnels

Tracking tunnel deployment followed the methods described in Gillies and Williams (2013). Fifteen tracking tunnel lines were set up throughout Area 1 (Figure 2), with each line having 10 tracking tunnels spaced 50 metres apart. Tracking tunnels were set out unbaited three weeks before monitoring began in order to condition animals to their presence in the environment.

Tracking tunnel lines were run overnight from 18-19 October 2021, then again from 22-23 November 2021, baited with peanut butter to obtain a rodent index. Every second tunnel along ten of the lines (100 metre spacing between tunnels, one kilometre spacing between lines) was then baited with rabbit (19-22 October 2021, then 23-26 November 2021) for three nights to obtain a mustelid index.

Tracking tunnel cards were retrieved and footprints identified. Results were entered into a spreadsheet and the tracking tunnel index (TTI) calculated for rodents and mustelids. Where tracking tunnel cards were missing from tunnels (probably removed by possums) they were discounted from analysis. Some tunnels were crushed, destroyed, or removed and were also removed from the analysis. Tracking tunnel indices for other species (e.g. possum, hedgehog) were also calculated.

3.2 Wax tags

Possum monitoring using wax tags followed the best practice guidelines in NPCA (2020).

Ten wax tag monitoring lines were set up within Area 1 (Figure 2). Each line was run for three nights, once in October 2021 and once in November 2021, with 10 wax tags spaced 20 metres apart. Initially, six lines were run from 19-22 October and four lines were run from 26-29 October. During the second deployment wax tags were run from 23-26 November. Wax tag lines were placed along the 10 tracking tunnel lines used for mustelid monitoring.

Upon retrieval, tooth marks in wax tags were identified and the results entered into a spreadsheet, which was used to calculate a wax tag index (WTI) for possums. The WTI was also calculated for rats and mice.

From the monitoring results reported in Section 4, average indices were calculated for each species and each detection method. These were used to map areas of high predator activity (see Section 5).

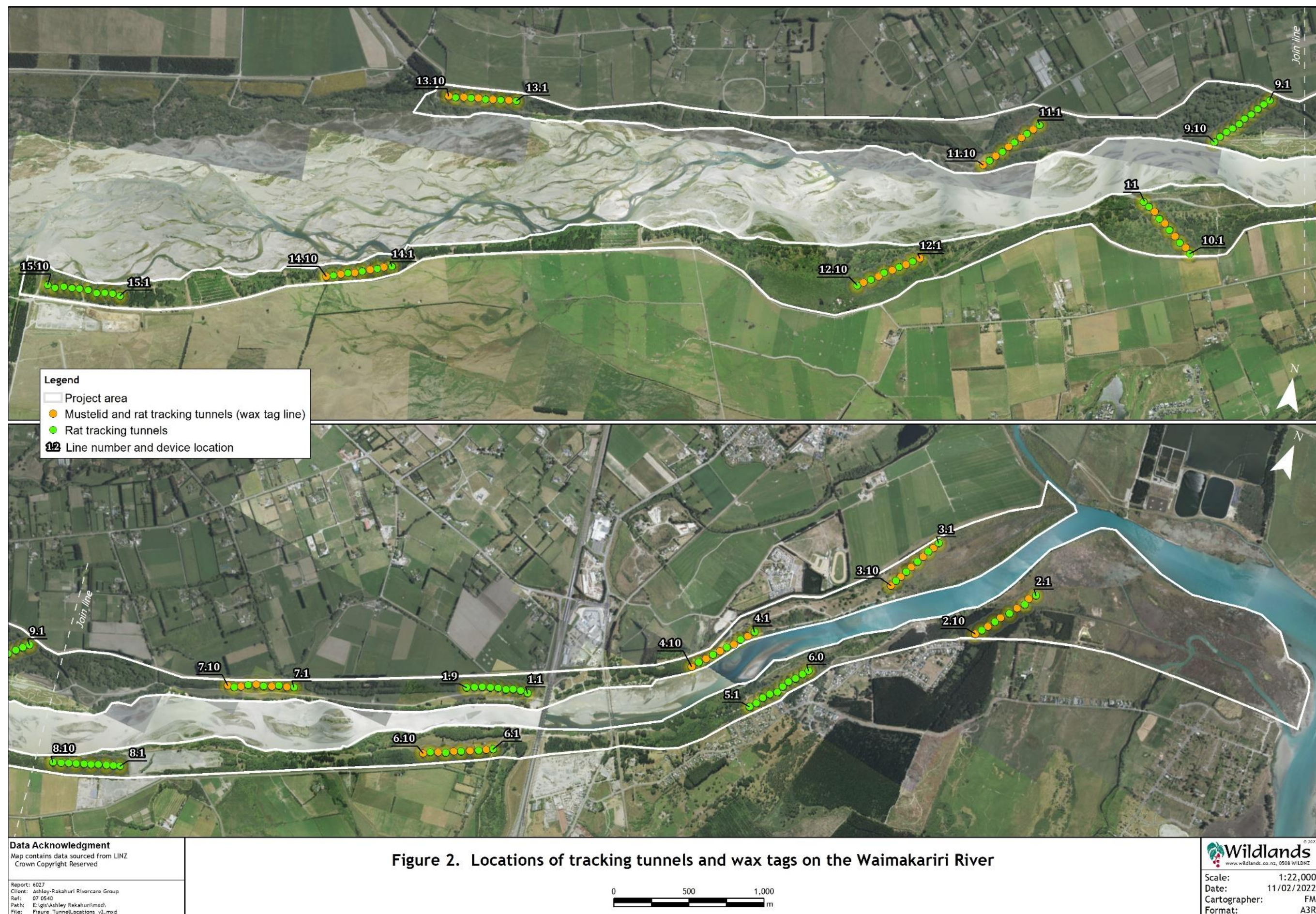
3.3 Camera traps

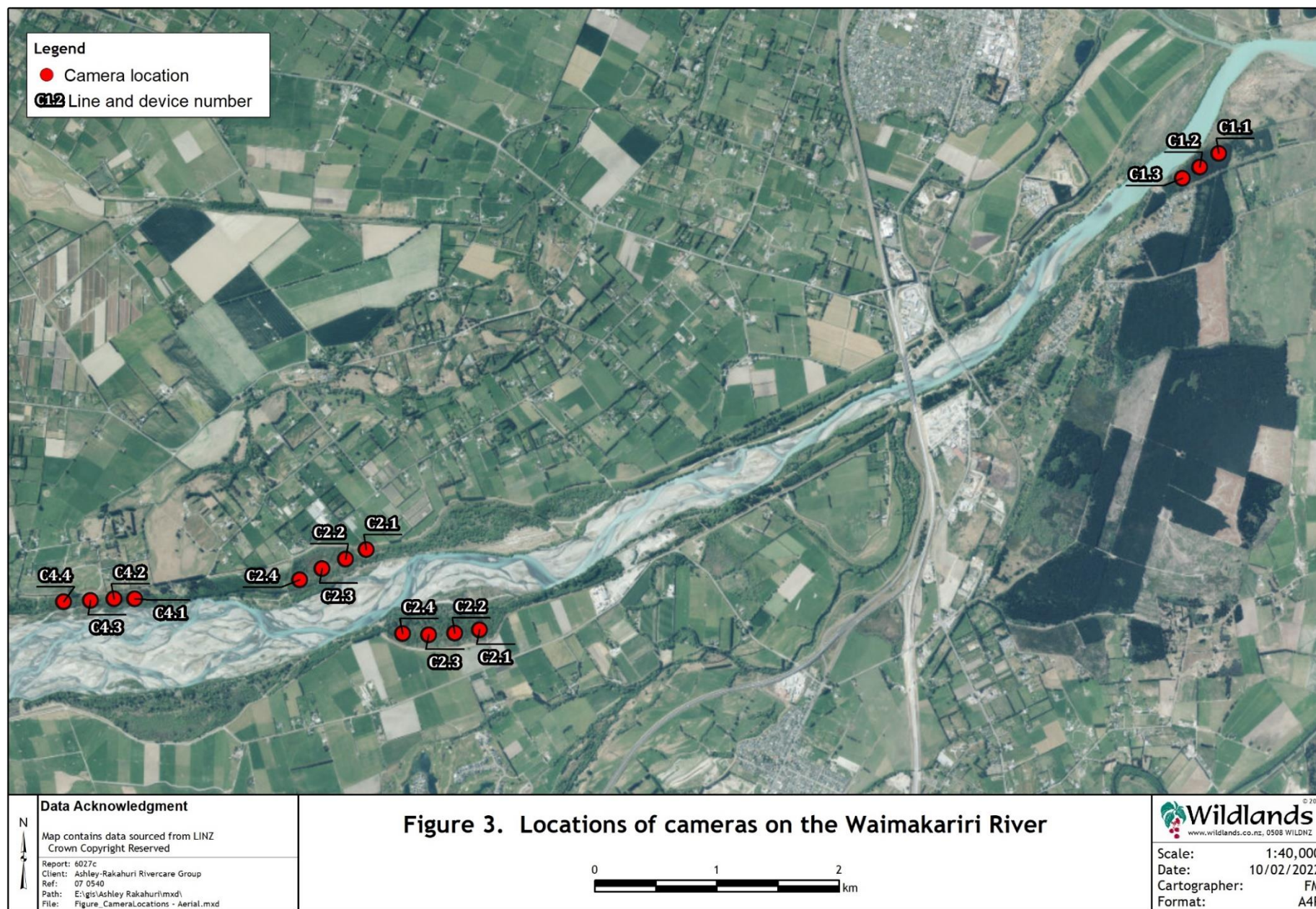
Feral cats were monitored using the DOC trail camera protocol that is currently under development (Gillies 2021). Wildlands staff used the 15 trail cameras provided by ECan.

Four camera trap lines were set (Figure 3), independent from tracking tunnel and wax tag lines. Four cameras were run per line, except for Line 1 which had three cameras. Camera settings and the lure basket setup were matched to the protocol (Gillies 2021). The cameras were run twice, once from 1-22 October 2021, and once from 2-23 November 2021 (21 nights per session). Cameras were retrieved between sessions.

After retrieving cameras, photographs were analysed for images of cats, and any other mammals captured. Animal captures were entered into a spreadsheet. As outlined in the protocol, an animal photographed one or more times within a three second burst was classed as one detection.

Camera data was used to calculate the relative abundance index (RAI), which is the mean number of detections per 2,000 camera hours. Localised RAI were calculated to give a separate indication of animal activity per line, and separate RAI were calculated for each species captured.





4. MONITORING RESULTS

Mice, rats, possums, cats, stoats, hedgehogs, weasels, and ferrets were all detected within Area 1 (Appendix 1).

Mouse and rat numbers are high throughout Area 1. Cats were frequently caught on camera, though in some incidences the same individual may have visited camera traps multiple times over the 21 day monitoring period, inflating the index. The cats seemed healthy and not overly-muscled, and some may have been pets.

Hedgehog and stoat activity is high throughout Area 1. Ferret numbers do not appear to be high, as they were only detected by tracking tunnels in few areas. A single weasel was detected in the tracking tunnel data, although weasel tracks and stoat tracks can overlap in size and therefore are not always easy to distinguish.

Individual TTI and RAI results for different lines and species are reported in Appendix 1, to give an indication of how predator abundance is spread throughout Area 1, and to aid in calculating where predator numbers might be highest.

5. PEST CONTROL PLAN

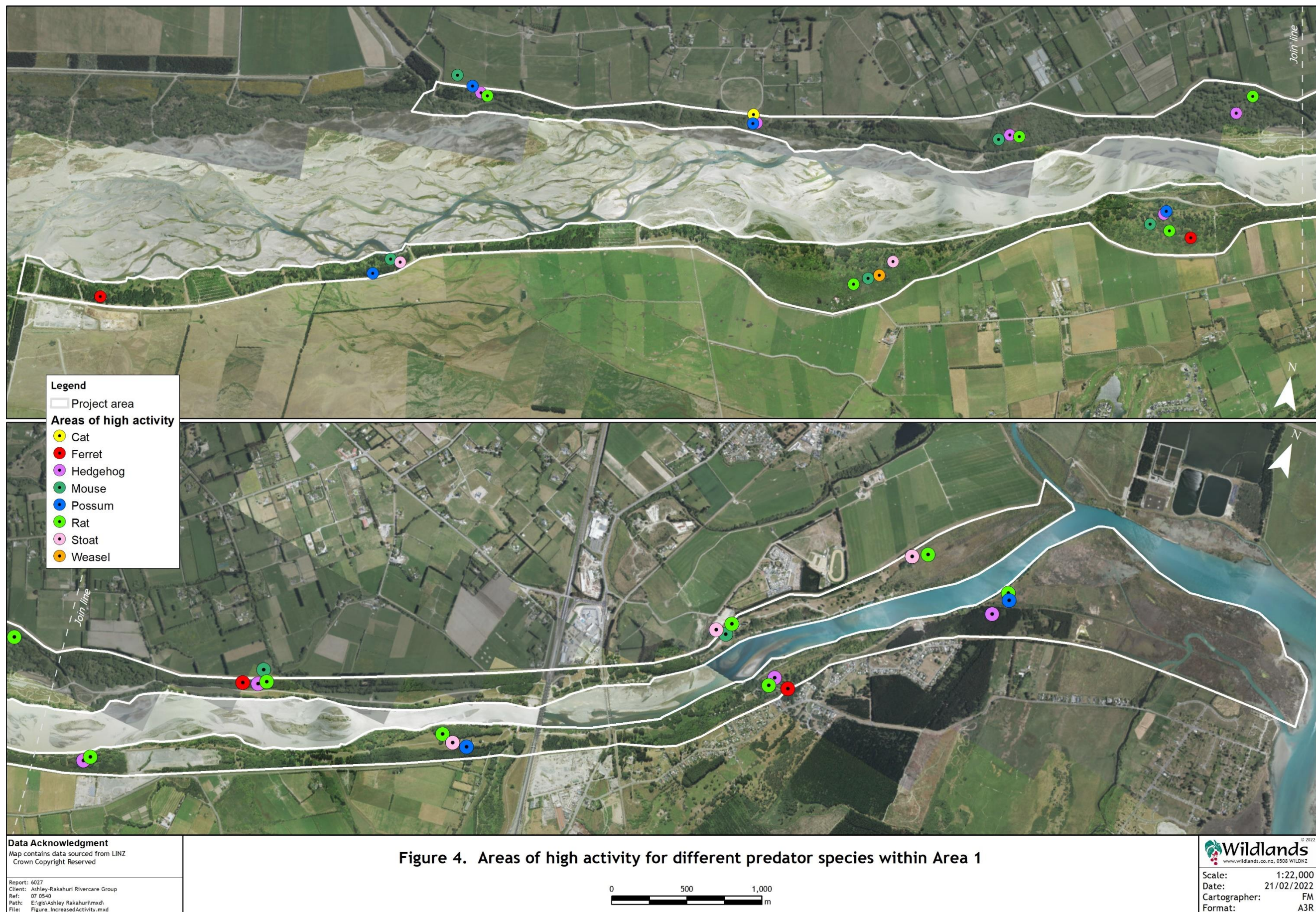
5.1 Areas of high predator activity

Areas where predator activity is greater than average for each species across all lines of each monitoring method are shown in Figure 4 (Table 2). The purpose of identifying areas of high predator activity was to determine patterns in predator occupancy. For mustelids and cats, the areas of high activity could be an artefact of the way monitoring data is collected (e.g. the same stoat could be leaving tracks in multiple tracking tunnels). For mice and rats, the areas of high activity probably indicate areas of high abundance at the time of the monitoring.

Table 2: Areas of high predator activity, determined from the results of the previous monitoring round.

Species	Camera Line Areas of High Predator Activity	Wax Tag/Tracking Tunnel Line Areas of High Predator Activity
Mouse		4, 7, 10, 11, 12, 13, 14
Rat		2, 3, 4, 5, 6, 7-13
Possum	1, 4	2, 6, 10, 13, 14
Cat	4	
Stoat		3, 4, 6, 12, 14
Weasel		12
Ferret		5, 7, 10, 15
Hedgehog	1, 4	5, 7-11, 13

Area 1 contains large areas of suitable habitat for supporting mammalian predators. The ability of mammals to move into and between habitat patches should not be underestimated. Areas of high predator activity are likely to shift depending on habitat and food availability, though some seasonal or temporal consistency may remain. Continued monitoring (Section 7) will determine how predator abundance changes over time, allowing pest control to respond adaptively.



A recommended pest control plan is illustrated in Figure 5 and consists of trapping and poisoning lines covering all mammalian predator species detected, supplemented with additional rat poison lines and grids at some locations of high rat abundance.

5.1.1 Cats

In close proximity to urban areas, where the risk of catching domestic pets is elevated, cage traps should be used to target cats. Cats that are not identified as domestic pets should be humanely dispatched, either by shooting or a blow to the head and cutting the carotid arteries. A blanket flung over a cat as it is let out of a cage trap helps to subdue it so that a blow can be delivered (NPCA 2018).

In areas where domestic pets are less likely to be caught, Sentinel traps set at least 1.3 metres off the ground should be used.

Traps should be pre-fed for at least a week before being set, and baited with rabbit or jelly meat.

A community outreach programme consisting of public advertising and question and answer sessions should be directed at cat owners. Advice should be given to keep cats indoors, and to microchip and collar pets. The public should be advised when traps are to be set so that people can keep cats indoors during that time. If the public are made aware of the traps, they may be more likely to keep their cats indoors, which will also benefit braided river birds during the breeding season.

5.1.2 Possums

To control possums, Timms traps baited with apple and a possum flour blaze should be set in areas without trees. Sentinel traps should be used where trees are available, set at least 1.3 metres off the ground and baited with possum dough and a possum flour blaze.

5.1.3 Rodents

Pulses of Double Tap and pindone poison baiting will help to control possums and rats simultaneously. Philproof bait stations should be used and poison deployed according to poison label guidelines and local laws. Care must be taken to follow laws regarding landowner permission, signage, tracks, roads, and waterways (i.e. label instructions).

Bait stations should be left out year-round. When pindone uptake is reduced, or monitoring suggests rat populations are no longer responding to the poison, pindone baiting should cease and Double Tap should be deployed.

Rats may also be caught in DOC 150s deployed for mustelids (Section 5.2.4).

Table 3: Device placement along lines and within grids shown on Figure 5.

Line type	Devices	Bait	Pests targeted	Spacing	Timing
All species control	Pindone OR Double tap in Philproof bait station ^{1,2}	Poison bait plus flour lure	Possums, rats	50 metres	Year-round checks, with frequency of checks depending on bait uptake
	Sentinel trap, or Timms trap (where trees are unavailable)	Possum dough or apple, plus flour lure	Possums	50 metres	Monthly checks September-March; check every three months April-August
	Sentinel trap, or cage trap (where domestic pets are at risk)	Jelly meat or fresh rabbit	Cats	400 metres	Sentinels: fortnightly checks September-March; monthly checks April-August Cage traps: Daily checks, run for one week at a time once every two months during spring and summer. If high cat density expected, run more frequent cage trapping operations
	DOC 150	Fresh rabbit	Mustelids	600 metres (alternating with DOC 200s and 250s, so there is one DOC trap every 200 metres)	Fortnightly checks September-March; monthly checks April-August
	DOC 200	Fresh rabbit	Mustelids	600 metres (alternating with DOC 150s and DOC 250s, so there is one DOC trap every 200 metres)	Fortnightly checks September-March; monthly checks April-August
	DOC 250	Fresh rabbit	Mustelids	600 metres (alternating with DOC 150s and DOC 200s, so there is one DOC trap every 200 metres)	Fortnightly checks September-March; monthly checks April-August
Rat poison grid	Pindone OR Double tap in Philproof bait station ²	Poison bait	Rats	50 metres by 50 metres	Year-round checks, with frequency of checks depending on bait uptake
Rat poison line	Pindone OR Double tap in Philproof bait station ²	Poison bait	Rats	50 metres	Year-round checks, with frequency of checks depending on bait uptake

¹ Not required where poison grids are present.

² Double tap replaces pindone where bait shyness occurs.



Data Acknowledgment
 Map contains data sourced from LINZ
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Figure 5. Proposed new pest control lines

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5.1.4 Mustelids

Lines of DOC 150s, DOC 200s, and DOC 250s should be used to control stoats, ferrets, and weasels (if present). The larger DOC 200s and 250s target ferrets and large stoats, while weasels and smaller stoats are caught in DOC 150s. Each trap site should have only one trap, with one of the three trap types alternating between sites. Traps should be baited with fresh rabbit or hen eggs, pre-fed for at least a month, and checked monthly from September until March, then every other month from March till September.

5.1.5 Hedgehogs

There is currently no best-practice pest control method for hedgehogs. However, they are frequently caught in DOC series traps. Effective hedgehog control would require a more intensive trapping programme than outlined in this plan. An area where hedgehogs are particularly active could be identified for a potential trial of intensive hedgehog trapping using DOC 200 trap grids with 100 metre spacings.

6. FURTHER PEST MONITORING

The pest mammal monitoring established during this project should continue with two monitoring rounds per year: one in August and one in November. The intensity of control can then be adjusted where necessary based on the results.

Trap catch and kill data along control lines can also be used to monitor predator populations using catch-per-unit effort.

During the breeding season, cameras should be placed near nesting colonies in order to observe what predator species are venturing out onto the river bed and preying on nests.

7. CONCLUSIONS

Monitoring data indicates that rat, stoat, ferret, possum, cat, mouse, and hedgehog numbers are spread throughout Area 1 and that in some locations their activity index is reasonably high.

Predator control should prioritise berm trapping and poisoning. Monitoring must be continued in order to understand predator population dynamics and how they respond to the implementation of predator control.

ACKNOWLEDGMENTS

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RESULTS FROM 2021
MONITORING PROGRAMME

RELATIVE ABUNDANCE INDEX (RAI) CALCULATED FROM CAMERA TRAP DATA

Monitoring Round	Line Number	RAI (cat)	RAI (hedgehog)	RAI (possum)	RAI (all species)
October	1	9.3	1.3	6.6	17.2
	2	11.9	0.0	2.0	13.9
	3	2.7	0.0	1.3	4.0
	4	9.9	4.0	2.0	15.9
November	1	4.0	2.7	0.0	6.6
	2	0.0	0.0	0.0	0.0
	3	1.3	2.7	2.7	6.6
	4	15.9	2.0	4.0	21.8
Both	1	6.6	2.0	3.3	11.9
	2	6.7	0.0	1.1	7.8
	3	2.0	1.3	2.0	5.3
	4	12.9	3.0	3.0	18.9
Average Relative Abundance Index	7.0	1.6	2.3	11.0	

TRACKING TUNNEL MONITORING (OCTOBER ROUND, PEANUT BUTTER BAIT)

Monitoring Round	Bait	Line Number	TTI (possums)	TTI (mice)	TTI (rats)	TTI (hedgehogs)	TTI (stoats)	TTI (All species)
October	Peanut butter	1	0.0	0.0	0.0	0.0	0.0	0.0
		2	0.0	0.0	0.0	0.0	0.0	0.0
		3	0.0	0.0	0.0	0.0	0.0	0.0
		4	0.0	40.0	0.0	0.0	0.0	40.0
		5	0.0	0.0	0.0	10.5	0.0	10.5
		6	21.1	0.0	10.5	0.0	0.0	31.6
		7	0.0	0.0	0.0	11.1	0.0	11.1
		8	0.0	0.0	0.0	10.5	0.0	10.5
		9	0.0	0.0	0.0	10.0	10.0	20.0
		10	0.0	0.0	0.0	10.0	0.0	10.0
		11	0.0	0.0	0.0	20.0	0.0	20.0
		12	0.0	11.1	0.0	0.0	0.0	11.1
		13	0.0	30.0	0.0	10.0	0.0	40.0
		14	0.0	10.0	0.0	0.0	0.0	10.0
		15	0.0	0.0	0.0	10.0	0.0	10.0
		TTI (all lines)	1.4	9	6.2	1	0.7	15.1

TRACKING TUNNEL MONITORING (OCTOBER ROUND, RABBIT BAIT)

Monitoring Round	Bait	Line Number	TTI (mice)	TTI (rats)	TTI (hedgehogs)	TTI (stoats)	TTI (Weasels)	TTI (ferrets)	TTI (all species)
October	Rabbit	2	0.0	0.0	0.0	25.0	0.0	0.0	25.0
		3	20.0	20.0	0.0	20.0	0.0	0.0	60.0
		4	75.0	0.0	0.0	0.0	0.0	0.0	75.0
		6	0.0	57.1	28.6	57.1	0.0	0.0	142.9
		7	0.0	0.0	20.0	40.0	0.0	0.0	60.0
		10	0.0	0.0	20.0	0.0	0.0	20.0	40.0
		11	40.0	20.0	40.0	20.0	0.0	0.0	120.0
		12	80.0	20.0	0.0	0.0	20.0	0.0	120.0
		13	40.0	0.0	20.0	40.0	0.0	0.0	100.0
		14	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TTI (all lines)		25.8	10.8	12.9	19.4	2.2	2.2	73.1	

TRACKING TUNNEL MONITORING (NOVEMBER ROUND, PEANUT BUTTER BAIT)

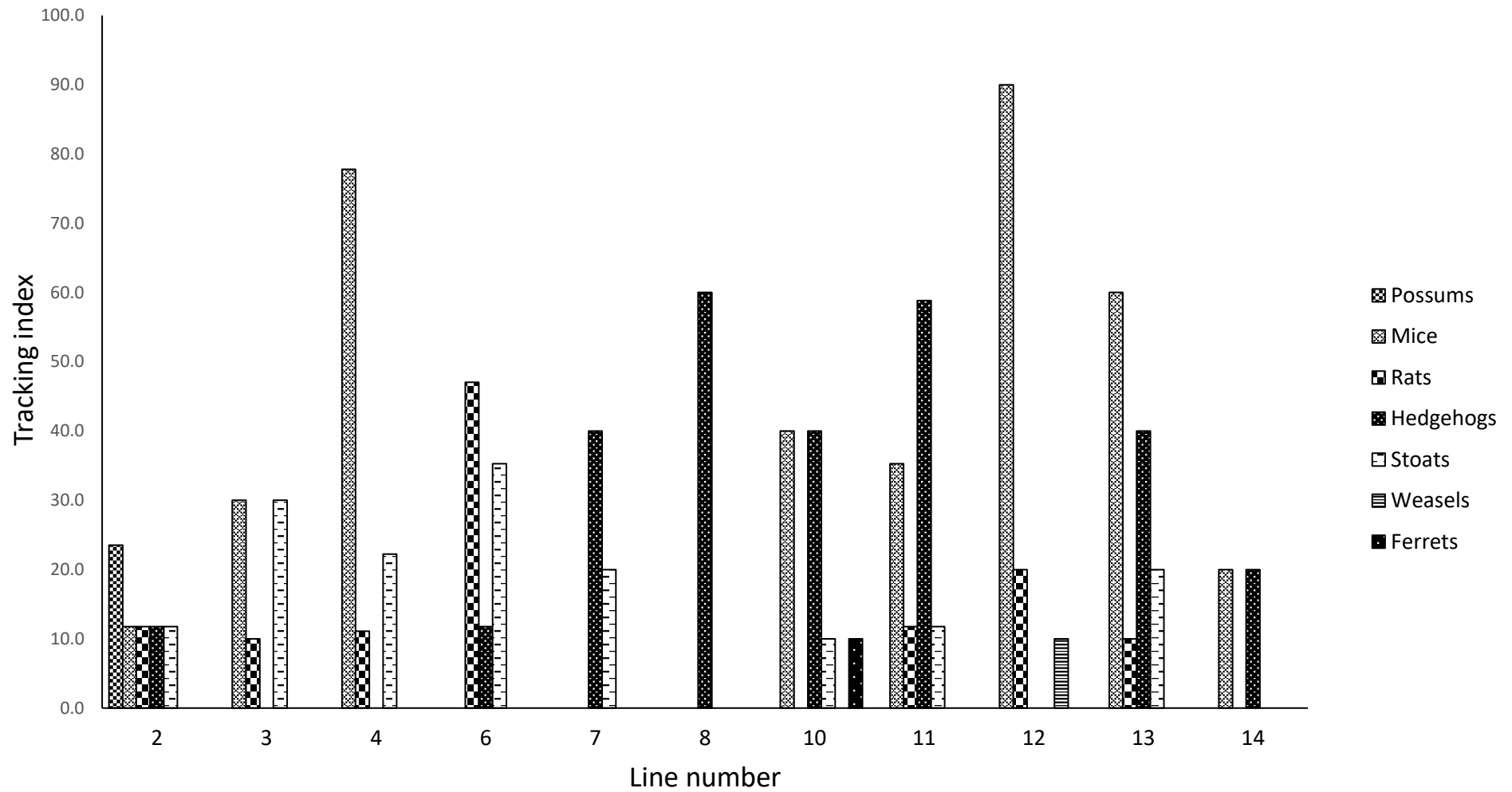
Monitoring Round	Bait	Line Number	TTI (possums)	TTI (mice)	TTI (rats)	TTI (hedgehogs)	TTI (stoats)	TTI (ferrets)	TTI (wētā)	TTI (all species)
November	Peanut butter	1	0.0	0.0	0.0	0.0	0.0	0.0	11.1	11.1
		2	20.0	10.0	0.0	0.0	0.0	0.0	10.0	40.0
		3	0.0	20.0	10.0	10.0	0.0	0.0	40.0	80.0
		4	0.0	70.0	20.0	0.0	0.0	0.0	10.0	100.0
		5	31.6	0.0	10.5	10.5	0.0	10.5	0.0	63.2
		6	11.8	0.0	35.3	0.0	0.0	0.0	0.0	47.1
		7	0.0	0.0	0.0	10.0	0.0	10.0	0.0	20.0
		8	0.0	10.5	0.0	21.1	10.5	0.0	10.5	52.6
		9	20.0	0.0	0.0	10.0	0.0	0.0	10.0	40.0
		10	0.0	55.6	22.2	22.2	0.0	0.0	0.0	100.0
		11	0.0	0.0	0.0	20.0	0.0	0.0	0.0	20.0
		12	0.0	80.0	0.0	0.0	10.0	0.0	20.0	110.0
		13	10.0	50.0	0.0	0.0	0.0	0.0	0.0	60.0
		14	0.0	33.3	0.0	11.1	11.1	0.0	0.0	55.6
		15	31.6	10.5	0.0	0.0	0.0	10.5	0.0	52.6
	TTI (all lines)	8.3	22.9	6.3	6.9	0.7	0.0	1.4	56.9	

TRACKING TUNNEL MONITORING (NOVEMBER ROUND, RABBIT BAIT)

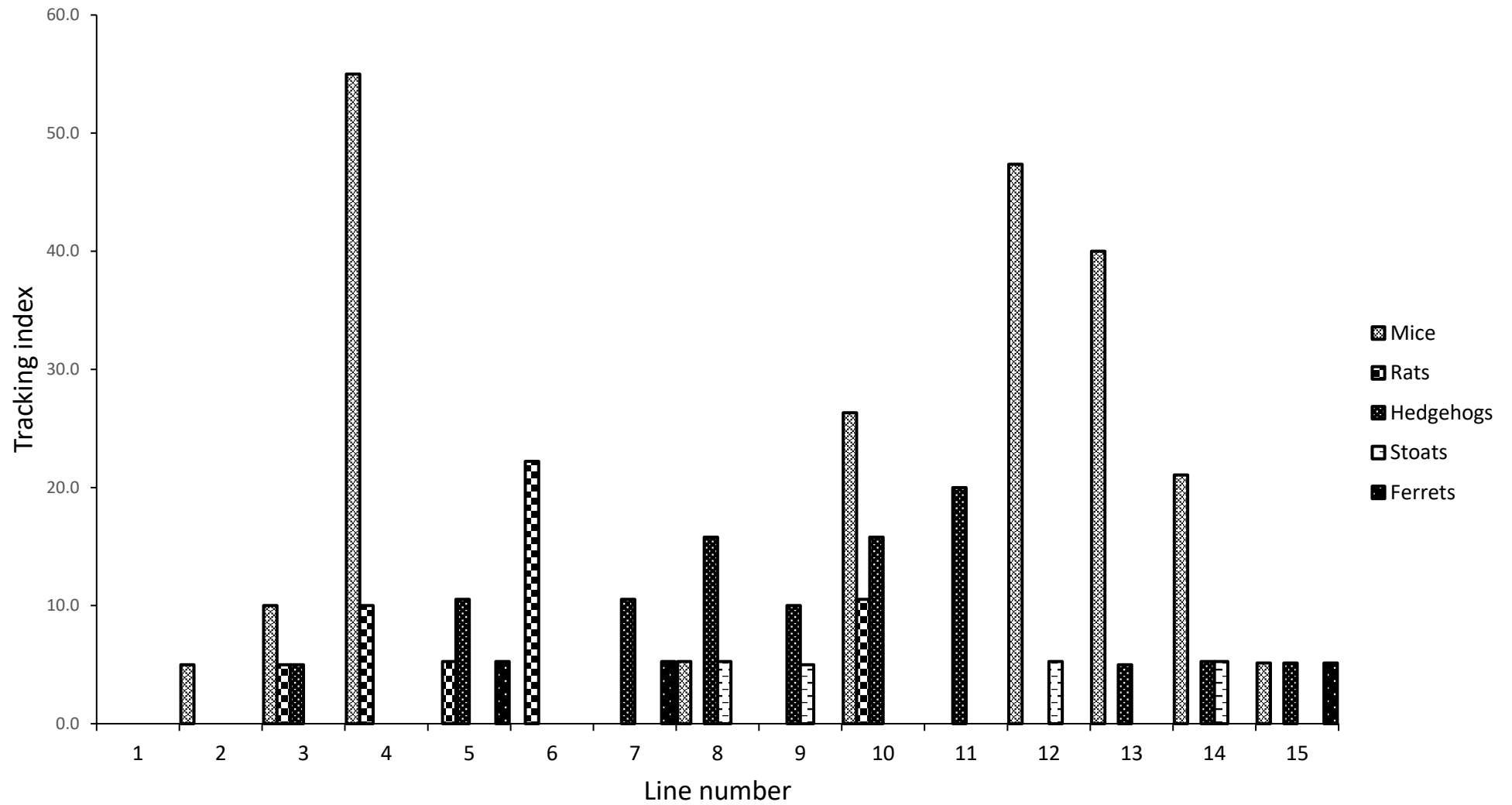
Monitoring Round	Bait	Line No.	TTI (possums)	TTI (mice)	TTI (rats)	TTI (hedgehogs)	TTI (stoats)	TTI (all species)
November	Rabbit	2	44.4	22.2	22.2	22.2	0.0	111.1
		3	0.0	40.0	0.0	0.0	40.0	80.0
		4	0.0	80.0	20.0	0.0	40.0	140.0
		6	0.0	0.0	40.0	0.0	20.0	60.0
		7	0.0	0.0	0.0	60.0	0.0	60.0
		10	0.0	80.0	0.0	60.0	20.0	160.0
		11	0.0	28.6	0.0	85.7	0.0	114.3
		12	0.0	100.0	20.0	0.0	0.0	120.0
		13	0.0	80.0	20.0	60.0	0.0	160.0
		14	0.0	40.0	0.0	40.0	0.0	80.0
		TTI (all lines)	4.2	47.9	12.5	31.3	12.5	108.3

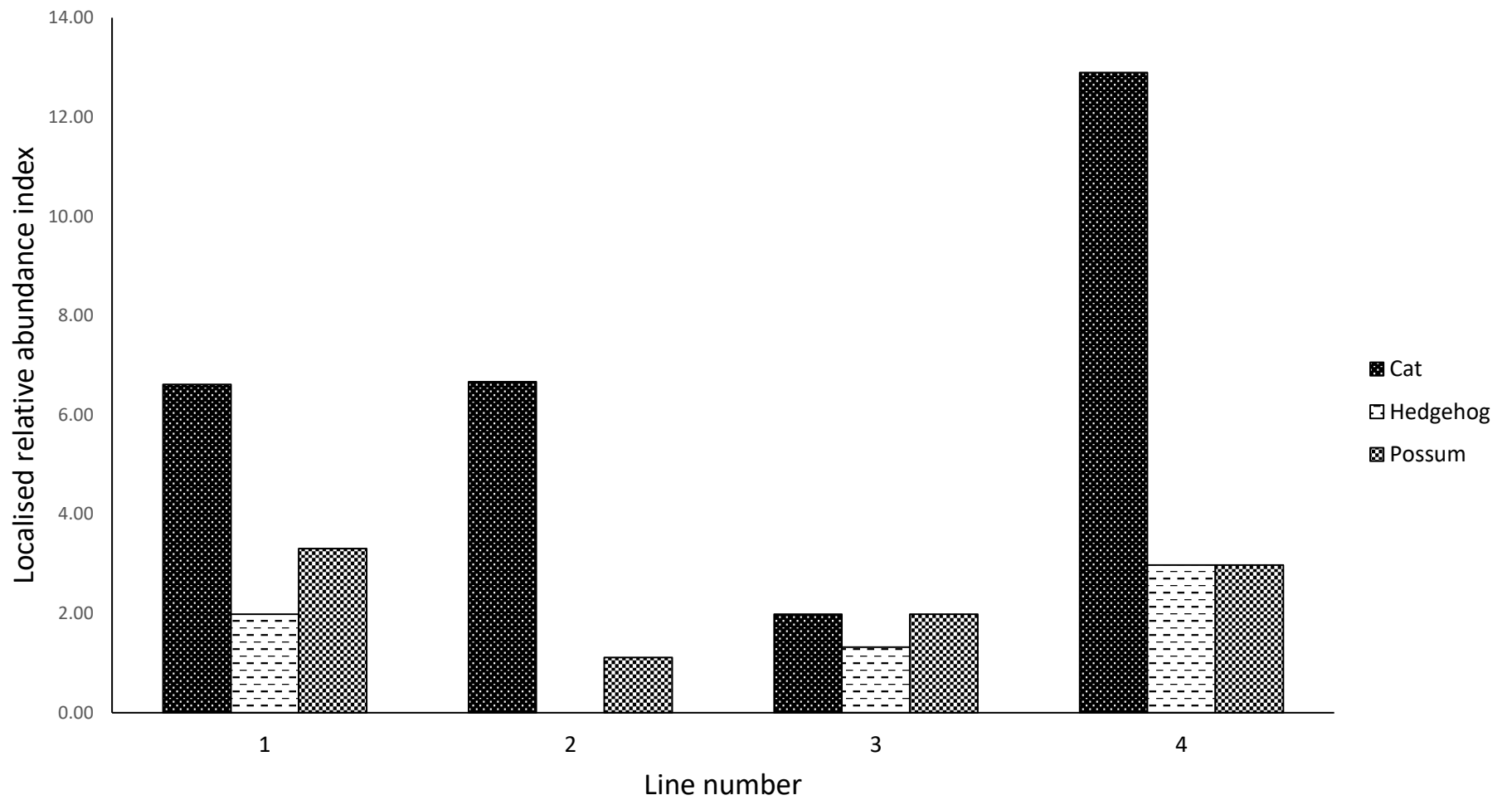
CAMERA TRAPPING

Monitoring Round	Line No.	Wax Tag Index (WTI) possums	WTI (mice)	WTI (rats)	WTI (across all species)
October	2	0.30	0.20	0.00	0.50
	3	0.10	0.20	0.00	0.30
	4	0.20	0.10	0.00	0.30
	6	0.70	0.20	0.00	0.90
	7	0.00	0.30	0.20	0.50
	10	0.33	0.22	0.22	0.78
	11	0.00	0.70	0.20	0.90
	12	0.30	0.30	0.20	0.80
	13	0.40	0.20	0.10	0.70
	14	0.30	0.50	0.00	0.80
	WTI across all lines	26.26	17.17	5.05	48.48
November	2	0.44	0.33	0.00	0.78
	3	0.00	0.00	0.00	0.00
	4	0.30	0.30	0.10	0.70
	6	0.90	0.00	0.00	0.90
	7	0.10	0.30	0.00	0.40
	10	0.50	0.10	0.00	0.60
	11	0.00	0.80	0.10	0.90
	12	0.20	0.30	0.20	0.70
	13	0.30	0.60	0.30	1.20
	14	0.88	0.00	0.00	0.88
	WTI across all lines	0.35	0.28	0.07	0.70

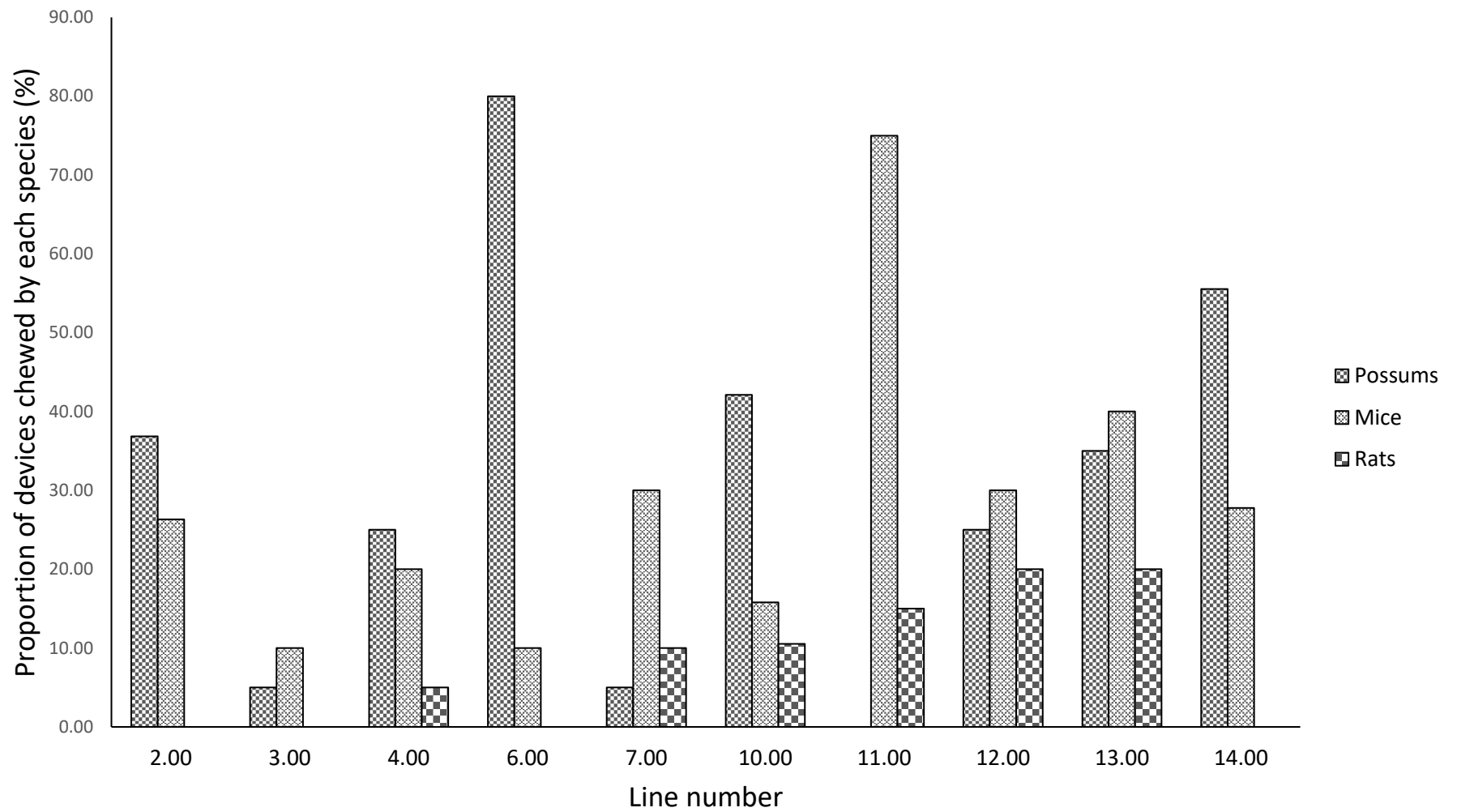


Tracking index for rabbit-baited tunnels





Relative abundance index for camera traps





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