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Predator trap optimisation for Poutiri Ao ō Tāne

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Predator trap optimisation for Poutiri Ao ō Tāne

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Summary

Project and client

- This report used data from the Poutiri Ao ō Tāne predator trapping programme to look for possible strategies for optimising trapping in that area. The report was completed by Manaaki Whenua – Landcare Research, Lincoln, for Hawke’s Bay Regional Council during December 2018.

Objective

- To identify traplines, subsections of traplines, or individual traps that have caught few animals and may therefore be removed to optimise predator control at Poutiri Ao ō Tāne.

Methods

- We conducted hot-spot analyses for 546 traps to identify areas of high, medium and low capture rates.
- We further assessed traps individually to determine their capture rates.

Results and conclusions

- The distribution of hot-spots of mustelid and by-catch species captures varied annually. Despite this, some traplines or subsections of traplines consistently caught comparatively few mustelids and by-catch.
- One hundred and sixty-one traps caught no mustelids and no more than one by-catch animal.
- The trap network could be optimised by removing up to 202 traps.

Recommendations

- Remove 56 traps from traplines or subsections of traplines in cold-spots for mustelids and by-catch, 54 traps from hot-spots (20% of 269 traps), and 92 traps from moderate-heat-spots and cold-spots (42% of 221 traps).
- Deploy a network of wirelessly monitored traps to determine how long it takes for the trap network to become ‘saturated’ (i.e. greater than 20–30% of traps triggered) so that the appropriateness of the current trap-checking regime can be assessed.
- Undertake a more detailed optimisation study to assess habitat-based hot-spots and interspecific interactions that may affect capture rates.

1 Introduction

Hawke's Bay Regional Council started a trapping programme in late 2011 to reduce the number of invasive mammalian predators in Poutiri Ao ō Tāne, adjacent to Boundary Stream Mainland Island. This report used data from the Poutiri Ao ō Tāne trapping programme to identify hot-spots for captures of mustelid (ferrets, stoats and weasels) and non-target by-catch (all other species caught in traps). Based on hot-spot and individual trap analyses, we recommend strategies for optimising predator trapping in Poutiri Ao ō Tāne. The report was completed by Manaaki Whenua – Landcare Research, Lincoln, for Hawke's Bay Regional Council during December 2018.

2 Background

Poutiri Ao ō Tāne is a 15,000 ha pest control programme run by Hawke's Bay Regional Council. The aim is to reduce the number of introduced mammalian predators to mitigate their unwanted impacts on the native animals they kill. Predator control is carried out not only to produce favourable outcomes for native animals in Poutiri Ao ō Tāne, but also to reduce movement of predators from Poutiri Ao ō Tāne into the adjacent Boundary Stream Mainland Island, which is managed for conservation outcomes by the Department of Conservation.

Since the inception of predator control at Poutiri Ao ō Tāne in late 2011 the programme has used a total of 690 kill traps set along a series of traplines. The main predator species targeted are stoats, ferrets and feral cats, the latter currently targeted primarily using para-aminopropiophenone (PAPP). However, other predators, including possums, weasels, hedgehogs, rats and mice, are also killed, as are invasive rabbits.

3 Objectives

To optimise the Poutiri Ao ō Tāne kill-trap network by:

- summarising where mustelids (ferrets, stoats and weasels) and other species (hereafter 'by-catch') have been trapped from 2012 to 2018
- identifying hot- and cold-spots for mustelid and by-catch captures from 2016 to 2018
- identifying individual traps that have had low capture rates from 2016 to 2018
- determining traplines, subsections of traplines, or individual traps that may be removed without loss of trap network effectiveness
- recommending a spatial network of wirelessly monitored traps that can provide information on how long it takes for traps with moderate to high capture rates to be triggered by mustelids or clogged by by-catch: this information will help determine the appropriateness of the current trap-checking regime.

4 Methods

We assessed the spatial distribution of mustelid and by-catch captures using 546 traps that have remained active from early 2012 to late 2018. However, not all of the 690 traps set at Poutiri Ao ō Tāne have usable data for the period of interest.

Over the 7 years the trapping programme has been active, trap check frequency has changed from 17 times per year to four times per year. Different types of lures have also been tested during this period. Therefore, we summarised spatial patterns of mustelid and by-catch captures from 2012 to 2018, but conducted hot-spot analyses only for the last 3 years, when there was a consistent trap-checking regime (four times per year) and use of lures (ferret body odour). We also assumed that this 3-year period better reflected the maintenance phase, when capture rates are comparatively low and stable, rather than the initial knockdown phase, when capture rates are high due to a large target population and animals being naïve to the traps (Warburton & Gormley 2015).

Hot-spot analyses were performed to identify 'hot' and 'cold' areas of activity of mustelids and by-catch animals (as evidenced by high or low capture rates, respectively) each year from 2016 to 2018. A hot-spot analysis looks at the capture history of each trap in relation to captures at neighbouring traps. If a trap and its neighbours have high capture rates, then the trap is given a high positive score and a p-value, and a cluster of high-scoring traps is identified as a statistically significant 'hot-spot'. The same approach is used for traps with low capture rates to identify statistically significant 'cold-spots', i.e. a cluster of traps with high negative scores. Traps with intermediate capture rates are given scores near zero, indicating that there is no significant spatial clustering of high or low captures; we called these areas 'moderate-heat-spots'. The analysis was done using the Hot Spot Analysis tool (Getis-Ord G_i^* statistic) in ArcGIS 10.5 (ESRI 2016). To help visualise the results, the scores calculated for each trap were interpolated to a continuous surface using the inverse distance weighted (IDW) tool. Separate analyses were conducted for mustelids and by-catch.

In addition to conducting hot-spot analyses for each year (2016–2018) separately, we combined data and conducted a hot-spot analysis for the 3-year period, which allowed for capture rates in neighbouring traps over the 3-year period to influence the scoring of traps as belonging to a hot- or cold-spot. From these analyses, we identified entire traplines, or subsections of traplines, that fell within cold-spots for both mustelids and by-catch, and which therefore could be removed.

To identify individual traps suitable for removal, we then classed each trap as being in a mustelid or by-catch hot-spot, moderate-heat-spot or cold-spot based on their individual scores and p-values from the combined (2016–2018) hot-spot analysis. We further defined individual traps as having low capture rates if they did not capture any mustelids, and no more than one by-catch animal, during the period 2016 to 2018.

From the pool of traps in each of the three strata, we identified up to 50% of traps with low capture rates that could be removed from cold-spots and moderate-heat-spots. We used a lower, more conservative percentage (up to 20% of traps with low capture rates) for possible removal from hot-spots. These percentages are somewhat arbitrary, but taken together they should result in a trap reduction of between 25 and 50%, as recommended

by Warburton and Gormley (2015) using a simulation model of the trapping regime at Poutiri Ao ō Tāne.

Finally, to assess the appropriateness of the current trap-checking regime we looked at the level of saturation of the network (i.e. the proportion of traps that had been triggered) at each check during the period 2011–2018.

5 Results

The spatial and temporal pattern of captures is shown in Figure 1 for mustelids (ferrets, stoats and weasels) and by-catch species (possums, cats, hedgehogs, rats, mice, and rabbits). Cats, rats and hedgehogs are shown separately in Figure 2.

The results from the hot-spot analysis of mustelid captures for each year (2016–2018) are shown in Figure 3. Areas in red are those where a larger number of mustelids were captured for a given year, and areas in blue are those where very few or no mustelids were caught. Areas in yellow are intermediate between high and low extremes. There is some inter-annual variation in the distribution of hot- and cold-spots, but a few cold areas can be identified that are consistent across years: the northernmost trapline (traps 388–397, identified as area 1 in Figure 3) and the easternmost trapline (traps 194–219, identified as area 2) on Rangiora Station, and the westernmost trapline on Opouahi Station (traps 92–101, identified as area 3). Both the southwestern and southeastern areas were identified as cold-spots in 2016 and 2018, but not in 2017. The central area of Poutiri Ao ō Tāne was consistently identified as a hot-spot in all the years analysed, although a small cold-spot was identified in the centre (traps 141–145 and 399–416 on Opouahi Station, identified as area 4).

To supplement the mustelid analysis, we looked at the distribution of hot- and cold-spots for by-catch species (Figure 4). This is important because it shows areas where non-target pest species are most abundant and therefore where control for those species could be focused if their impacts were considered important. This analysis also shows areas where traps could have potentially caught mustelids but did not because they were clogged with by-catch.

As for the mustelids, these maps also show inter-annual variation in the location of hot- and cold-spots. However, three cold-spots appear consistent between years: the northernmost trapline (traps 388–397, identified as area 1 in Figure 4) on Rangiora Station, the westernmost trapline on Opouahi Station (traps 92–101, identified as area 2), and the small cold-spot in the centre of Poutiri Ao ō Tāne (traps 141–145 and 399–416 on Opouahi Station, identified as area 3). In contrast to the pattern shown in Figure 3, the easternmost trapline (traps 194–219) on Rangiora Station appears to be a hot area for by-catch.

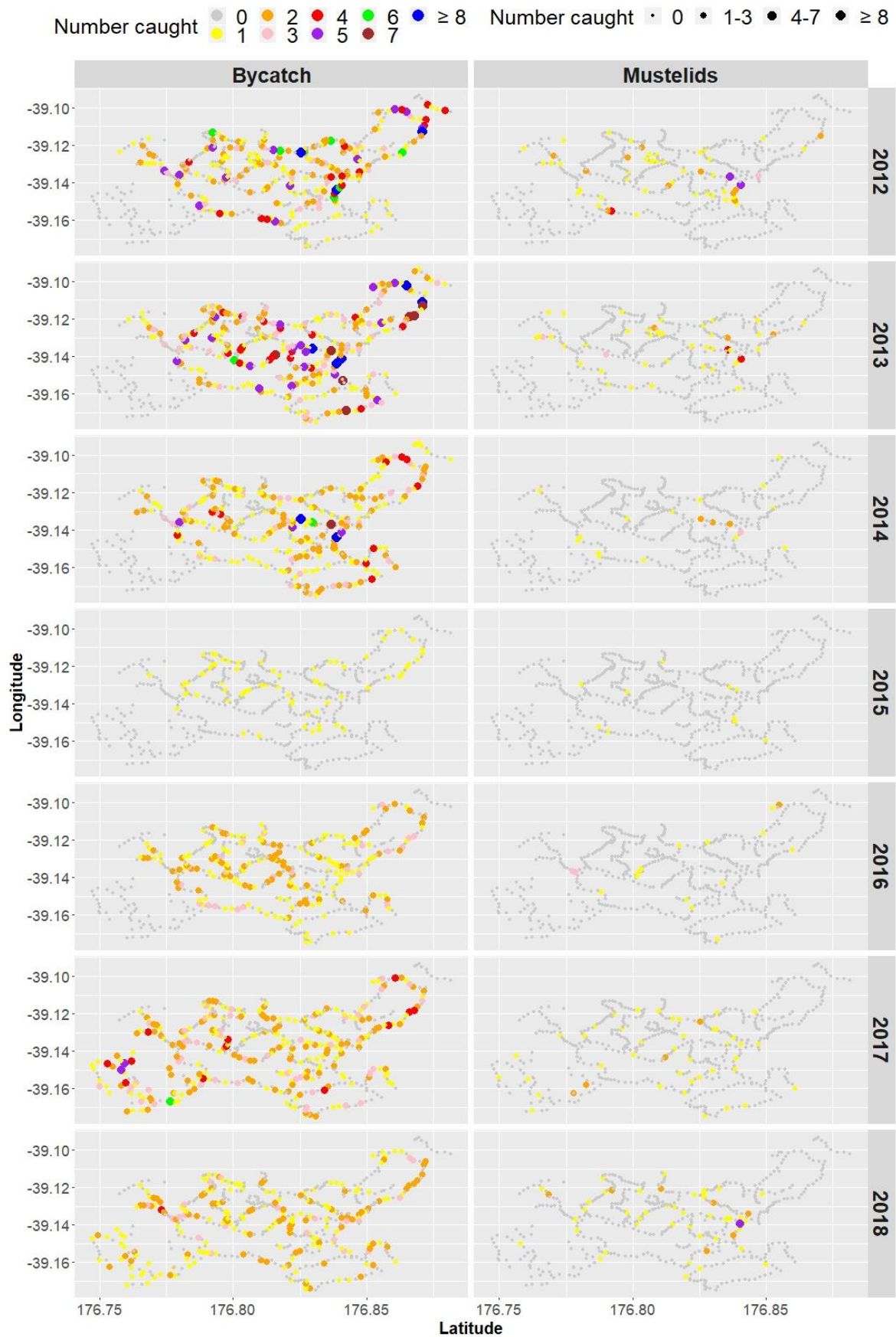


Figure 1. Captures of mustelids and all by-catch species combined, 2012–2018. The number of animals caught per year is presented using colour-coding and size coding for ease of interpretation.

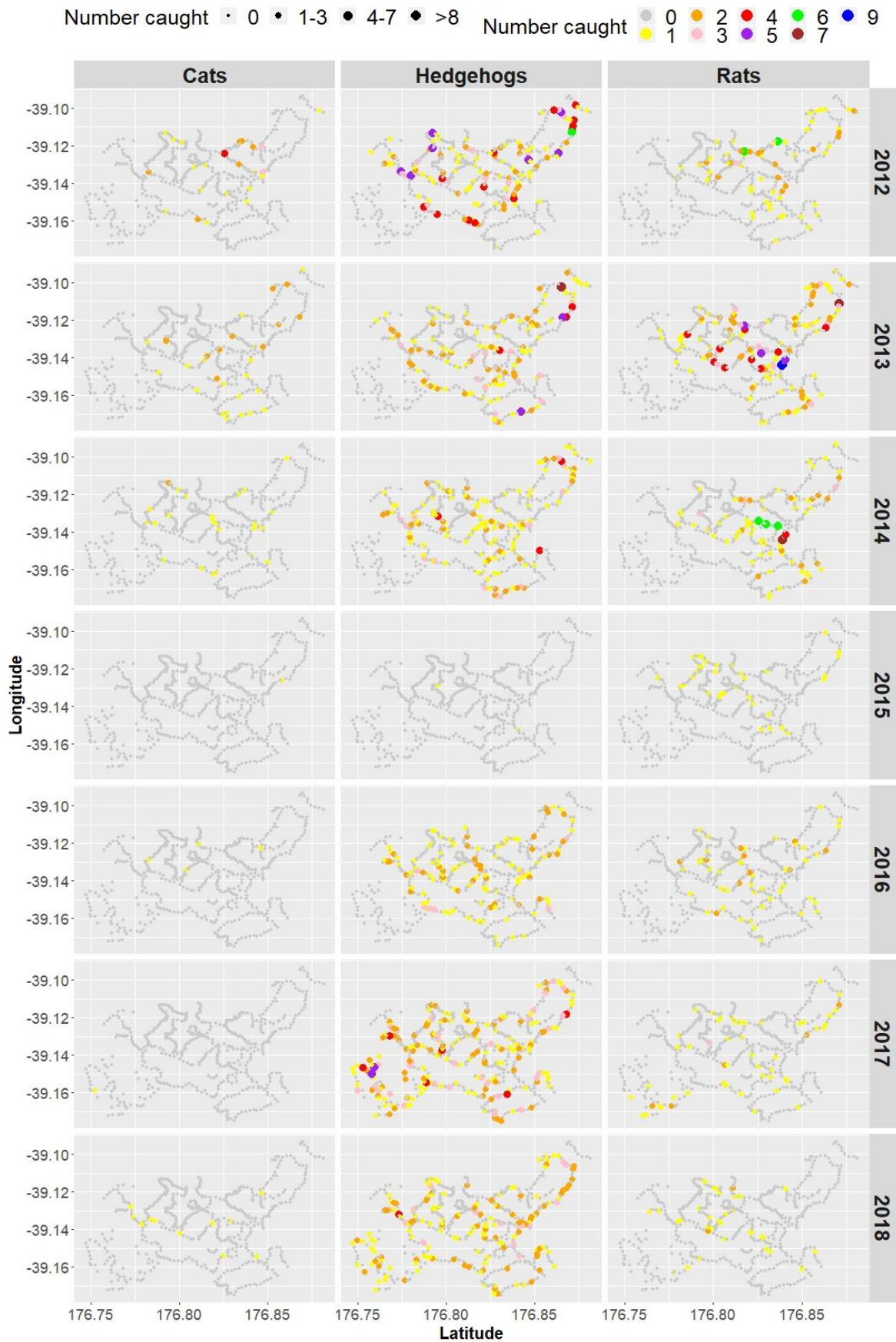


Figure 2. Captures of cats, rats and hedgehogs, 2012–2018. The number of animals caught per year is presented using colour-coding and size coding for ease of interpretation.

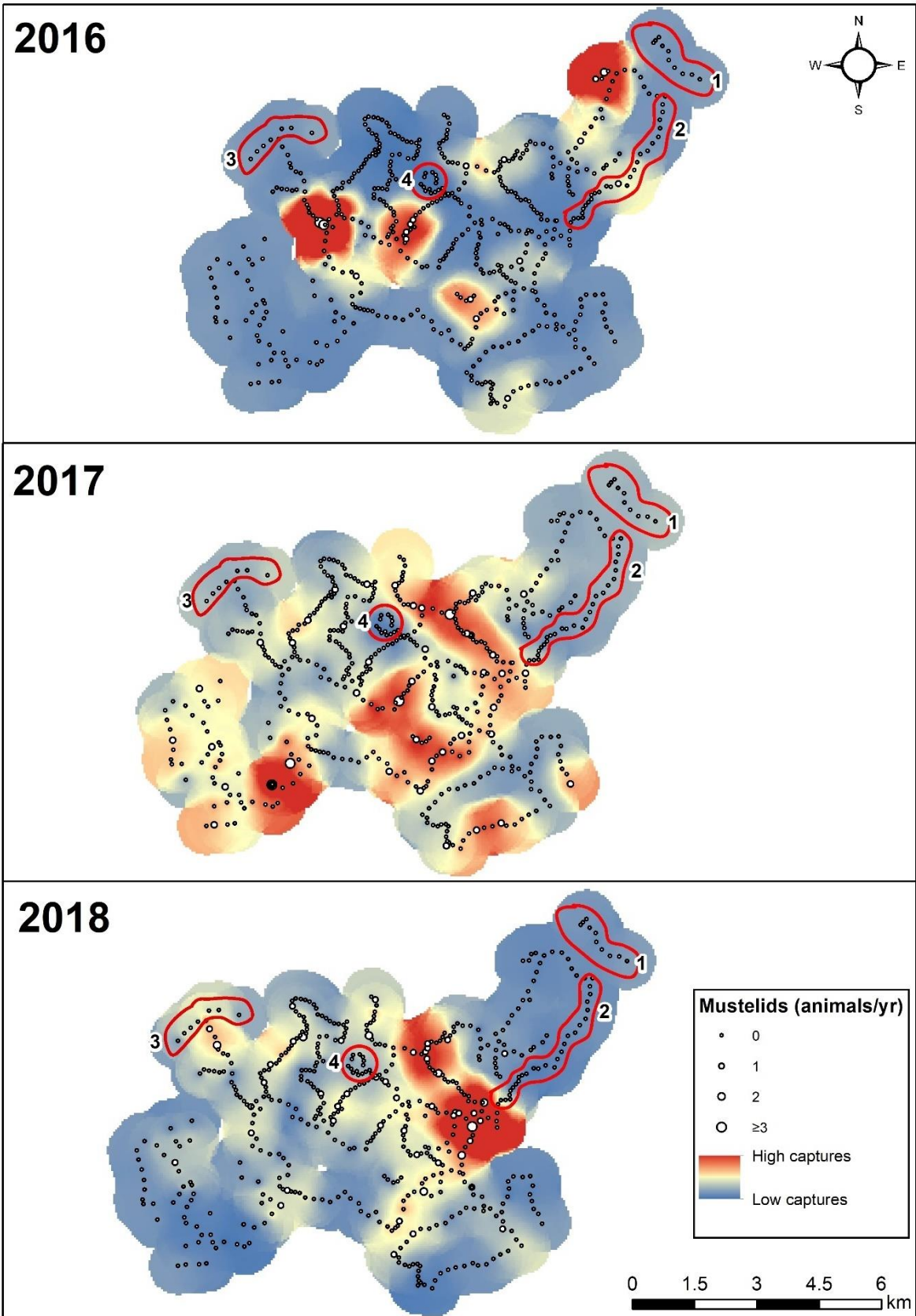


Figure 3. Hot-spots and cold-spots for mustelids for the last 3 years of the trapping programme. Entire traplines, or subsections of traplines that consistently fall within cold-spots, have been identified with a red outline.

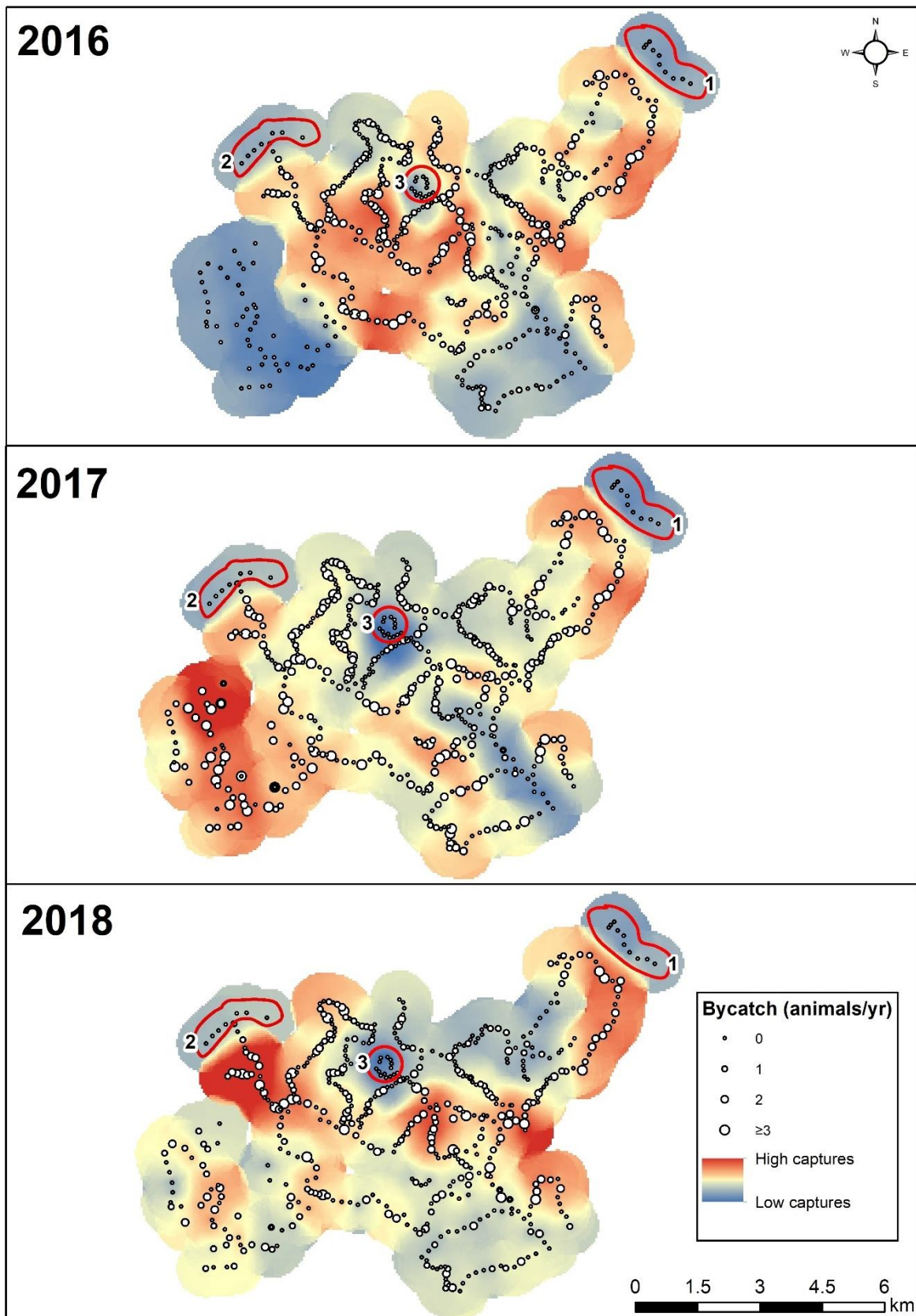


Figure 4. Hot-spots and cold-spots for by-catch species for the last 3 years of the trapping programme. Entire traplines, or subsections of traplines that consistently fall within cold-spots, have been identified with a red outline.

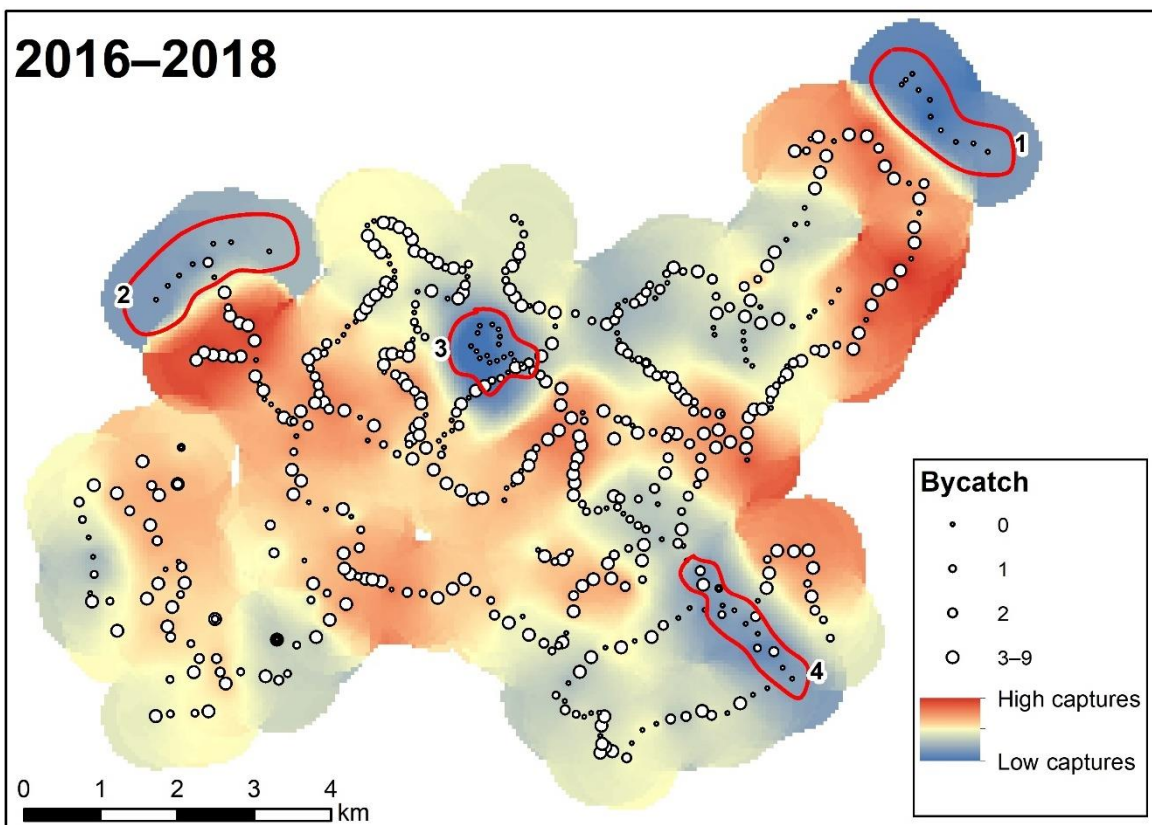
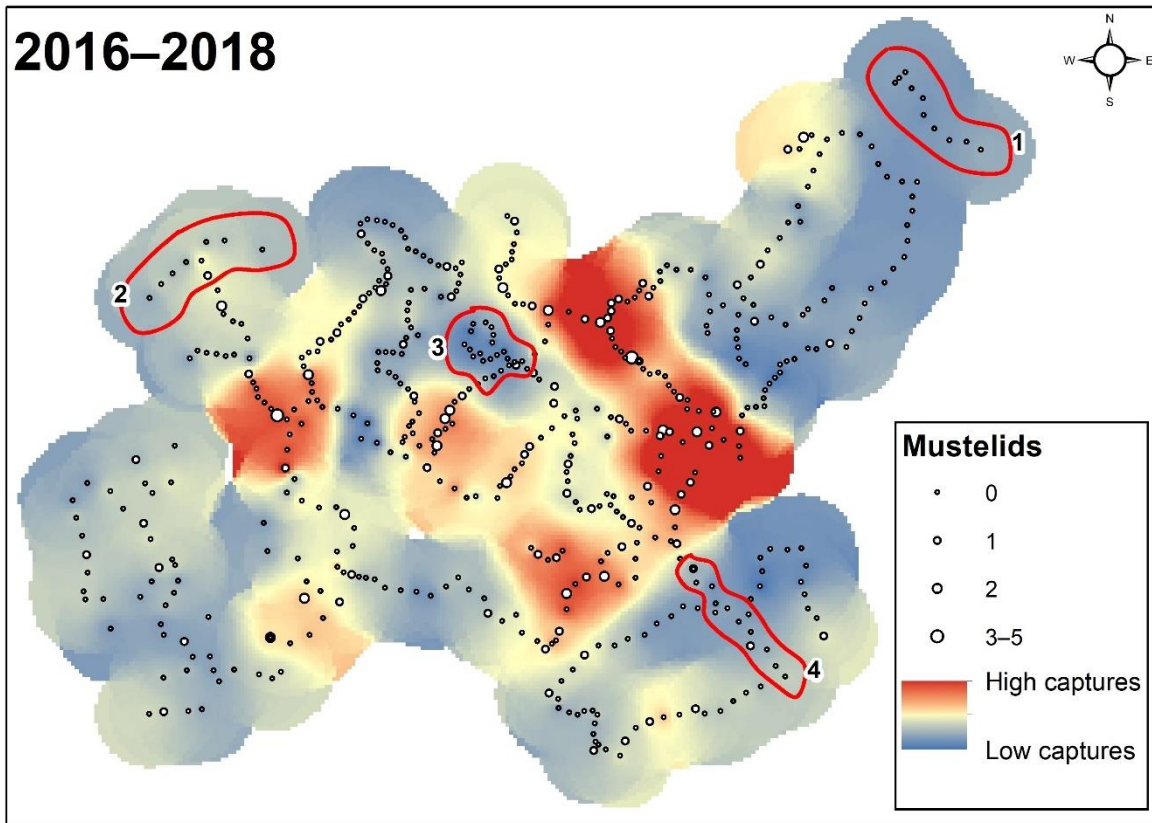


Figure 5. Hot-spots and cold-spots for mustelids and by-catch for the last 3 years of the trapping programme combined. Entire traplines, or subsections of traplines that consistently fall within cold-spots, have been identified with a red outline.

The hot-spot analyses combining all data from 2016 to 2018 for mustelids and by-catch are shown in Figure 5. These combined results confirm what was discussed above, but also highlight additional cooler spots for both groups of species, such as some of the traps in the southeastern part of Poutiri Ao ō Tāne. Based on these analyses, we identified a total of 56 traps within cold-spots for mustelids and by-catch (Appendix 1). Only four traps within these identified cold-spots caught a single mustelid during 2016–2018 and none caught more than one mustelid. Traps in cold-spots had significantly less mustelid or by-catch captures than traps outside of cold spots (Fig. 6) The 56 traps are highlighted in Figure 7 and correspond with the following traplines: traps 388–397 on Rangiora Station (identified as area 1 in Figure 5); 92–101 (identified as area 2), 141–145 and 399–416 on Opouahi Station (identified as area 3); and 418–428 on the trapline identified as Blair (identified as area 4).

We identified 269 traps within hot-spots (either for mustelids or by-catch). Of these, 69 traps caught no animals, or a maximum of one by-catch animal during 2016–2018. Assuming a conservative reduction of 20% of traps from hot-spots ($n = 269$), 54 of 69 traps with low capture rates could be removed (Appendix 1). In the absence of better information, we recommend choosing those 54 traps randomly.

A total of 277 traps fell within moderate-heat-spots or cold-spots for mustelids or by-catch species. Subtracting the 56 traps already identified for possible removal from the cold-spot analyses above leaves 221 traps. These 221 traps were assessed based on individual capture rates (as opposed to those identified from hot-spot analyses). Of these 221 traps, 92 traps caught no animals, or a maximum of one by-catch animal, during 2016–2018. Assuming a less conservative reduction of 50% of traps from moderate-heat-spots or cold-spots ($n = 221$) means all 92 traps with low capture rates could be removed (which actually represents a reduction of only 42%).

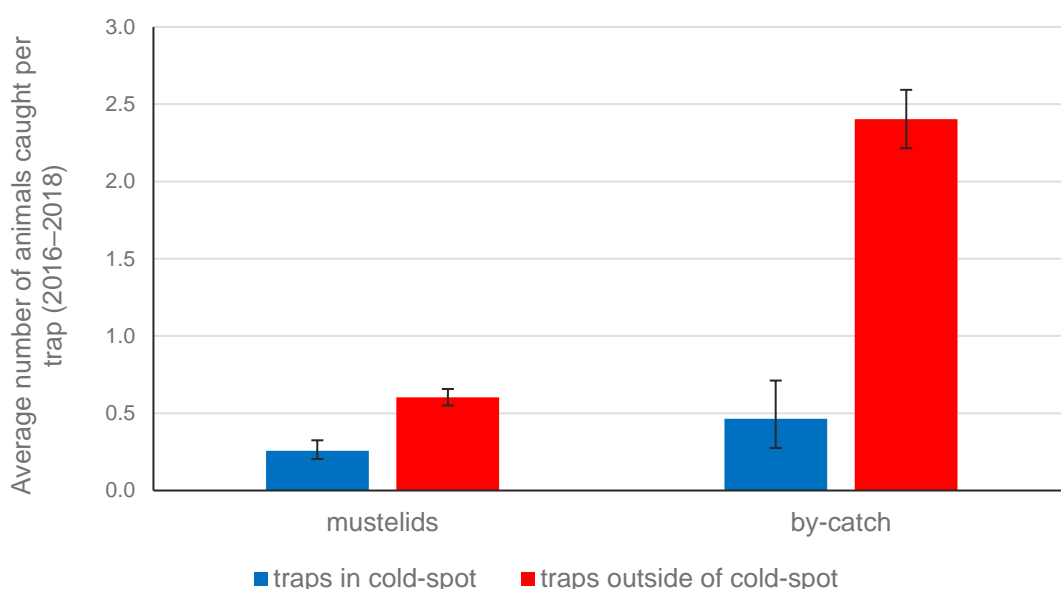


Figure 6. The average number of mustelids or by-catch captured per trap ($\pm 95\%CI$) for traps in cold-spots ($n = 56$) compared to traps outside of cold-spots ($n = 490$) during the period 2016–2018.

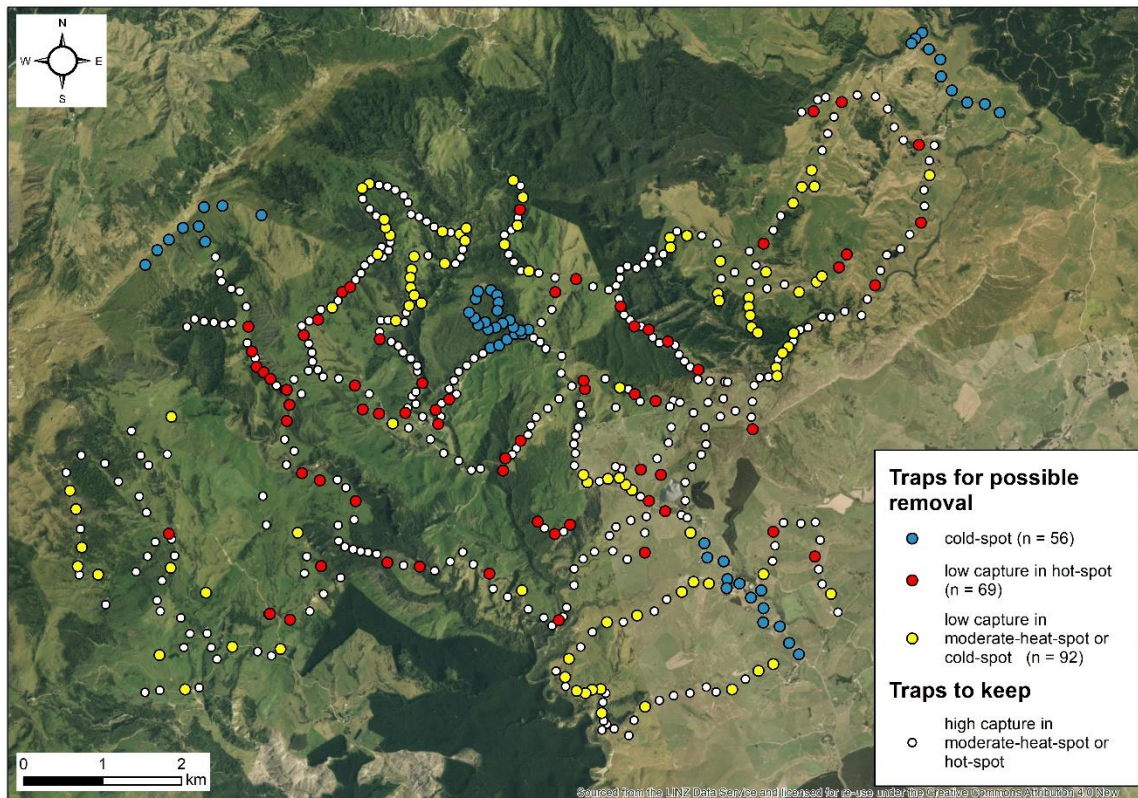


Figure 7. The spatial distribution of traps tagged for possible removal based on mustelid and by-catch captures during the period 2016–2018. Traps were identified based on: (1) being in a trapline or in sub-sections of traplines located within a cold-spot of activity for both mustelids and by-catch (blue dots), (2) having a low capture rate and located within a hot-spot of either mustelid or by-catch activity (red dots), and (3) having a low capture rate and located within moderate-heat-spots or cold-spots of either mustelid or by-catch activity (yellow dots).

The spatial distribution of 217 traps identified for possible removal is shown in Figure 6. Apart from the traps in traplines or subsections of traplines identified as cold-spots (blue dots in Figure 7), most of the remaining traps (red and yellow dots) appear to be spread evenly across the landscape, although a few small clusters are evident on Rangiora and Opouahi stations. We recommend only removing every second trap within clusters of red and yellow dots. This is to avoid having large sections of areas with high mustelid or by-catch activity without sufficient trap coverage. The white dots in Figure 6 represent the locations of 329 traps that should not be removed from the trapping programme.

The proportion of traps that caught animals (target species and bycatch combined) at each check was low (usually $\leq 15\%$) during the first 3 years of the trapping programme, possibly due to the high frequency of checks (Figure 7). Once the checking schedule was changed to four times per year (2016 onwards) the proportion of traps that caught animals at each check increased to 20–30%, with a peak of 41% in January 2017 and a low of c. 3% in June 2016.

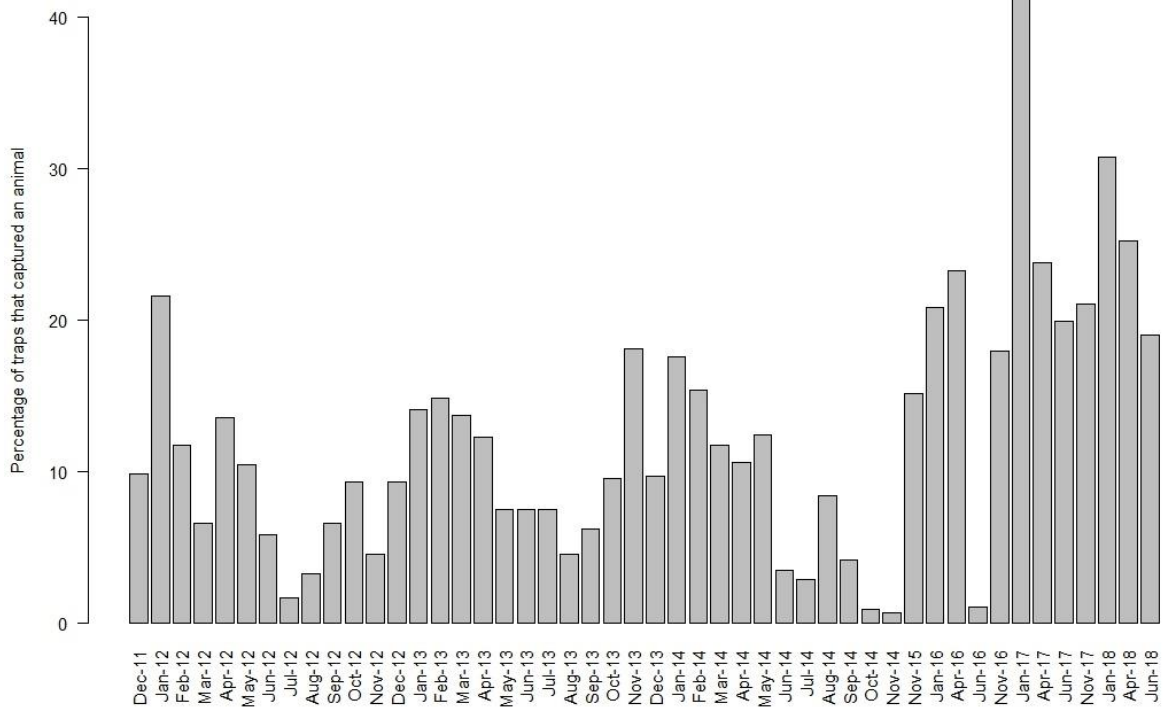


Figure 8. Percentage of traps that caught animals at each check between December 2011 and June 2018. Note that the checking regime changed from 17 times per year (2011–2014) to four times per year (2016–present). Trap checks during 2011–2014 have been amalgamated into monthly periods.

6 Conclusions

- Based on the hot-spot analysis for mustelids, the spatial distribution of captures varied annually. Despite this, some traplines or subsections of traplines consistently caught comparatively few mustelids.
- A similar pattern was evident for by-catch species, although with not as much annual variation as recorded for mustelids. Captures of by-catch species were more widespread than for mustelids, but a few areas always caught comparatively few by-catch animals.
- Comparing hot-spot analyses for mustelids and by-catch showed a few candidate traplines (or subsections of traplines) that could be removed to optimise trapping in Poutiri Ao ō Tāne. The traplines that should remain are in areas where mustelid capture rates have been comparatively high, and in areas where traps could have potentially caught mustelids but did not because they were clogged by by-catch.
- Some traplines located in hot-spots or moderate-heat-spots (and thus considered not suitable for removal of the entire trapline) had several traps that caught no mustelids (or only one by-catch animal) during the period 2016–2018. Some or all of these traps could be removed (depending on how risk averse or risk prone managers want to be) to further optimise trapping in Poutiri Ao ō Tāne.
- Removing traplines based on the hot-spot analyses for mustelids and by-catch assumes there are no or very few mustelids in areas identified as cold-spots. However,

these areas may have mustelids that are difficult to kill with the current trapping design, or current cold-spots may become future hot-spots for mustelids.

- When the proportion of traps in a network that are sprung (either by target or non-target species, or simple malfunction) is greater than about 20%, trapping networks get saturated and capture rates decline (Warburton et al. 2015). Consequently, if target or non-target densities are high, frequent trap checking will be required. The current trapping schedule of four times per year appears to be appropriate for the Poutiri Ao ō Tāne network, with a mean proportion of traps sprung at each check of 22% for the period 2016–2018.
- Warburton et al. (2015) recommend that if the cost of enabling all traps in a network to be wirelessly monitored is too high, then there is the option of monitoring a subset of traps to determine when a predetermined proportion of traps have been sprung. Under these circumstances, at least 250 traps in a network would need to be wirelessly monitored to be confident that the level of 20% traps triggered has been reached or exceeded.

7 Recommendations

- Based on hot-spot analyses for mustelids and by-catch, we recommend that the following traplines or subsections of traplines be removed to optimise trapping at Poutiri Ao ō Tāne: 388–397 on Rangiora Station; 92–101, 141–145 and 399–416 on Opouahi Station; and 418–428 on the trapline identified as Blair.
- An independent monitoring method, such as camera traps, could be used periodically to determine the status of mustelids in areas where traplines have been removed, and traplines re-established at some point in the future if deemed necessary.
- In addition to removing the traplines identified above, we recommend that up to 20% and 50% of individual traps that have not caught any mustelids or up to one by-catch animal during the period 2016–2018 could be removed from hot-spots, and cold-spots and moderate-heat-spots (combined), respectively. A list of individual traps that could be removed to optimise trapping is presented in Appendix 1. The resulting reduction in the trap network (c. 37%) is between the levels (25–50% reduction) recommended by Warburton and Gormley (2015) using a simulation model of the trapping regime in Poutiri Ao ō Tāne.
- The current trap-checking schedule of four times per year seems to have produced acceptable levels of trap-network saturation of 20–30%. If the 'true' value is nearer 30% saturation in Poutiri Ao ō Tāne, it is possible that current capture rates are lower than what could be achieved if the checking frequency was higher. Therefore, to have greater confidence in these figures, we recommend deploying 250 wirelessly monitored traps in hot-spots and moderate-heat-spots to provide fine temporal information about the timing of triggering of traps in the network. This number of traps represents a high proportion (c. 50%) of the current or the reduced (c. 75%) trap network in Poutiri Ao ō Tāne. If it is not possible to monitor this number of traps wirelessly because of funding constraints, having a lower number of wireless traps will decrease the confidence that the 20% triggered level has been reached (see Warburton et al. 2015 for a range of recommended sample sizes).

- To reduce trap saturation by by-catch, we recommend modifying traps, or the way they are set, to make them more species-specific. For example, hedgehogs are common by-catch. It is relatively straightforward to raise traps off the ground to limit hedgehog interference. If, however, captures of hedgehogs and other by-catch species are considered desirable for conservation outcomes in Poutiri Ao ō Tāne, we recommend that they be defined as a target species and the necessary levels of population reduction identified. Doing so would necessitate conducting a cost-benefit analysis to assess whether conservation outcomes resulting from by-catch reductions achieved with the current trap network are larger than what could be achieved using a control method specifically targeted to those species.
- A detailed optimisation study should look at more than just capture hot-spots. We recommend that future analyses should include habitat, interspecific interactions that may affect capture rates, and data from independent monitoring methods, such as camera traps. Identifying habitats and landscape features where target species are more abundant and (presumably) more trappable would allow trap networks to be more optimally designed from the beginning of a trapping programme, rather than as a post-captures exercise.
- The optimisation presented here was based solely on the spatial and temporal distribution of animals captured. Additional information on the time and effort needed by the contractor to check each trap in the network could be used to further inform the optimisation. This is a critical component of trap 'optimisation'; for example, a 25% reduction in the number of traps used in Poutiri Ao ō Tāne will not necessarily result in a 25% reduction in costs or time needed to check the remaining traps.

8 Acknowledgements

We thank Natalie de Burgh, Campbell Leckie, Pouri Rakete-Stones and Wendy Rakete-Stones, Hawke's Bay Regional Council, and Andrew Gormley, Simon Howard, Grant Norbury, Ray Prebble and Bruce Warburton, Manaaki Whenua – Landcare Research.

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Appendix 1. A list of traps that have remained active from early 2012 to late 2018 in Poutiri Ao ō Tāne and a recommendation for each as to whether it should be kept or removed based on the hot-spot analysis and on the number of animals that they caught between 2016 and 2018.

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Blair	418DB	-39.1526000	176.8410000	0	2	Yes	Cold-spot
	420TU	-39.1545390	176.8439230	0	0	Yes	Cold-spot
	421DU	-39.1565480	176.8445870	0	0	Yes	Cold-spot
	422TB	-39.1570270	176.8463810	0	0	Yes	Cold-spot
	423DU	-39.1585570	176.8481510	0	0	Yes	Cold-spot
	424DB	-39.1596870	176.8500440	0	0	Yes	Cold-spot
	425TU	-39.1613350	176.8500930	1	1	Yes	Cold-spot
	426DB	-39.1616870	176.8525670	0	2	Yes	Cold-spot
	427DU	-39.1635360	176.8540130	0	0	Yes	Cold-spot
	428TU	-39.1647660	176.8555180	0	0	Yes	Cold-spot
	454TB	-39.1576660	176.8496120	0	2	Yes	Cold-spot
	455DU	-39.1558240	176.8498470	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	469DB	-39.1509400	176.8510070	0	1	Yes	Low capture in hot-spot
	470DB	-39.1498650	176.8524410	0	7	No	
	471TU	-39.1498550	176.8549980	0	3	No	
	472DB	-39.1496520	176.8571080	0	3	No	
	473TU	-39.1516700	176.8579210	0	5	No	
	474DU	-39.1535580	176.8572330	0	1	Yes	Low capture in hot-spot
	475DB	-39.1550140	176.8578960	0	3	No	
	476TB	-39.1566590	176.8584690	0	2	No	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Blair, con't	477TU	-39.1577350	176.8598410	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	478TB	-39.1598040	176.8609880	1	1	No	
	479TB	-39.1542740	176.8510900	0	5	No	
	480DU	-39.1525240	176.8513470	0	5	No	
Harris	429TB	-39.1660120	176.8518400	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	430TU	-39.1668430	176.8497210	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	431TB	-39.1678750	176.8478400	0	5	No	
	432DU	-39.1691090	176.8459870	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	433DB	-39.1694640	176.8436340	0	2	No	
	434DU	-39.1689770	176.8421890	1	3	No	
	435DB	-39.1697200	176.8398200	0	2	No	
	436TU	-39.1701020	176.8374870	0	2	No	
	437TB	-39.1706930	176.8353910	1	0	No	
	438DB	-39.1714930	176.8333480	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	439TB	-39.1730950	176.8318370	1	0	No	
	440TU	-39.1748440	176.8311540	0	2	No	
	441DU	-39.1741570	176.8289810	0	5	No	
	442DB	-39.1736660	176.8278690	0	3	No	
	443TU	-39.1743480	176.8271810	1	3	No	
	444DU	-39.1733100	176.8273880	0	3	No	
	445TB	-39.1724160	176.8270360	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	446DB	-39.1711850	176.8271700	0	6	No	
	447DU	-39.1701220	176.8275210	0	5	No	
	448TB	-39.1696940	176.8267400	0	0	Yes	Low capture in moderate-heat-spot or cold-spot

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Harris, con't	449TU	-39.1697950	176.8255230	0	0	Yes	low capture in moderate-heat-spot or cold-spot
	450TU	-39.1702450	176.8245340	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	451DU	-39.1700110	176.8232640	0	1	Yes	low capture in moderate-heat-spot or cold-spot
	452DB	-39.1695450	176.8216040	0	2	No	
	453TB	-39.1685050	176.8214890	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	456DB	-39.1576000	176.8445560	0	1	Yes	Cold-spot
	457TU	-39.1571530	176.8419140	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	458TB	-39.1570290	176.8396780	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	459TU	-39.1582370	176.8380110	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	460DU	-39.1591610	176.8358290	0	2	No	
	461DB	-39.1605780	176.8341190	0	7	No	
	462DU	-39.1611310	176.8316070	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	463DB	-39.1619370	176.8296310	0	3	No	
	464TB	-39.1620450	176.8272450	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	465TU	-39.1632260	176.8251860	1	3	No	
	466DB	-39.1650010	176.8235520	0	3	No	
	467TB	-39.1663900	176.8219180	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	468DU	-39.1678590	176.8201250	1	1	No	
Opouahi Station	100DB	-39.1189170	176.7651430	0	2	Yes	Cold-spot
	101TB	-39.1206150	176.7661930	1	0	Yes	Cold-spot
	102DU	-39.1223140	176.7677950	0	4	No	
	103TU	-39.1241100	176.7684760	2	1	No	
	104TB	-39.1250490	176.7688060	0	5	No	
	105TU	-39.1258640	176.7702910	0	6	No	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	106DU	-39.1261220	176.7715670	0	4	No	
	107DB	-39.1278300	176.7726060	0	4	No	
	108TB	-39.1301000	176.7730000	0	0	Yes	Low capture in hot-spot
	109DU	-39.1319700	176.7729620	1	7	No	
	10DU	-39.1364670	176.8355620	2	2	No	
	110DB	-39.1329130	176.7736940	0	0	Yes	Low capture in hot-spot
	111TB	-39.1336400	176.7742410	0	3	No	
	112TU	-39.1346370	176.7744820	0	0	Yes	Low capture in hot-spot
	113TU	-39.1352120	176.7755320	0	0	Yes	Low capture in hot-spot
	114TB	-39.1359360	176.7765720	0	0	Yes	Low capture in hot-spot
	115DU	-39.1366770	176.7774940	3	7	No	
	116DB	-39.1371000	176.7790000	0	1	Yes	Low capture in hot-spot
	116DU	-39.1370840	176.7786480	4	2	No	
	117DB	-39.1375130	176.7811810	0	2	No	
	118TB	-39.1358850	176.7800090	0	7	No	
	119TU	-39.1348260	176.7820840	0	7	No	
	11TU	-39.1371810	176.8351200	1	2	No	
	120DU	-39.1354660	176.7842400	0	2	No	
	121DB	-39.1355840	176.7865370	0	7	No	
	122TU	-39.1363020	176.7889710	0	0	Yes	Low capture in hot-spot
	123TB	-39.1371800	176.7911000	0	4	No	
	124TB	-39.1389800	176.7902430	0	0	Yes	Low capture in hot-spot
	125TU	-39.1393840	176.7926530	0	1	Yes	Low capture in hot-spot
126DB	-39.1404360	176.7947290	0	1	Yes	low capture in moderate-heat-spot or cold-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	127DU	-39.1408810	176.7970680	0	4	No	
	128DU	-39.1395330	176.7990470	0	3	No	
	129TB	-39.1402790	176.8013810	0	1	Yes	Low capture in hot-spot
	12TB	-39.1366460	176.8330220	0	1	Yes	Low capture in hot-spot
	130TU	-39.1394310	176.8017180	2	0	No	
	131DB	-39.1386890	176.8009190	0	0	Yes	Low capture in hot-spot
	132TB	-39.1379320	176.8017320	1	0	No	
	133DU	-39.1374110	176.8028360	0	0	Yes	Low capture in hot-spot
	134TU	-39.1367960	176.8038720	0	2	No	
	135DB	-39.1362310	176.8027440	2	0	No	
	136TU	-39.1352360	176.8034020	2	2	No	
	137DU	-39.1342230	176.8040630	0	3	No	
	138TB	-39.1334880	176.8051860	1	0	No	
	139DB	-39.1326300	176.8061840	0	3	No	
	13DU	-39.1367480	176.8307380	0	5	No	
	140DU	-39.1320440	176.8074530	0	3	No	
	141TU	-39.1313380	176.8085200	0	1	Yes	Cold-spot
	142DB	-39.1310280	176.8098050	0	1	Yes	Cold-spot
	143TB	-39.1303240	176.8108770	0	0	Yes	Cold-spot
	144TU	-39.1296700	176.8120210	0	4	Yes	Cold-spot
145DB	-39.1296150	176.8130830	1	1	Yes	Cold-spot	
146TB	-39.1514640	176.8389310	0	0	Yes	Low capture in moderate-heat-spot or cold-spot	
147DU	-39.1494800	176.8374770	0	2	No		
148TB	-39.1491090	176.8350630	0	0	Yes	Low capture in hot-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	149DB	-39.1480230	176.8326350	0	1	Yes	Low capture in hot-spot
	14DB	-39.1359300	176.8299230	0	0	Yes	Low capture in hot-spot
	150TU	-39.1475780	176.8313820	1	1	No	
	151DU	-39.1468870	176.8301110	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	152TU	-39.1462770	176.8291120	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	153DU	-39.1455350	176.8281550	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	154TB	-39.1444940	176.8285160	0	2	No	
	155DB	-39.1442690	176.8275500	0	5	No	
	156DB	-39.1457220	176.8265350	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	157TB	-39.1460380	176.8252970	1	1	No	
	158DU	-39.1462150	176.8235440	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	159TU	-39.1453680	176.8228860	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	15TU	-39.1354070	176.8289400	1	2	No	
	160TU	-39.1443620	176.8215120	1	6	No	
	161DU	-39.1429490	176.8215890	0	4	No	
	162DB	-39.1419060	176.8213140	0	3	No	
	163TB	-39.1409320	176.8214820	1	2	No	
	164DU	-39.1399830	176.8218700	0	3	No	
	165TU	-39.1384430	176.8223580	0	5	No	
	166DB	-39.1374320	176.8219770	0	4	No	
167TB	-39.1355990	176.8226080	0	1	Yes	Low capture in hot-spot	
168TB	-39.1353210	176.8206720	0	3	No		
169DB	-39.1338810	176.8190000	1	4	No		
16TB	-39.1352530	176.8276700	0	1	Yes	Low capture in moderate-heat-spot or cold-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	170DU	-39.1319340	176.8190070	1	4	No	
	171TU	-39.1312010	176.8166180	0	6	No	
	172DU	-39.1304500	176.8157290	1	2	No	
	173DB	-39.1300090	176.8147470	0	2	No	
	174TB	-39.1291050	176.8139770	0	2	Yes	Cold-spot
	175TU	-39.1282300	176.8158090	0	6	No	
	176DU	-39.1267170	176.8172830	0	5	No	
	177TU	-39.1247060	176.8176680	0	0	Yes	Low capture in hot-spot
	178TB	-39.1230580	176.8175530	2	3	No	
	179DB	-39.1226080	176.8151440	1	5	No	
	17TU	-39.1375440	176.8272270	0	4	No	
	180TB	-39.1224170	176.8137090	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	181DU	-39.1224310	176.8125160	0	3	No	
	182DB	-39.1214630	176.8114280	0	4	No	
	183TU	-39.1206120	176.8106140	2	3	No	
	184TU	-39.1195260	176.8099750	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	185TB	-39.1184230	176.8098720	1	1	No	
	186DU	-39.1178410	176.8108800	0	4	No	
	187DB	-39.1172810	176.8117340	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	188DB	-39.1163840	176.8117600	0	7	No	
189TU	-39.1154620	176.8119790	0	1	Yes	Low capture in hot-spot	
190TB	-39.1140550	176.8123500	0	1	Yes	Low capture in moderate-heat-spot or cold-spot	
191DU	-39.1127700	176.8119380	1	0	No		
192DU	-39.1122060	176.8108360	0	1	Yes	Low capture in moderate-heat-spot or cold-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	19DB	-39.1343410	176.8254960	0	4	No	
	1TB	-39.1497510	176.8383470	1	0	No	
	20TB	-39.1346520	176.8223460	0	0	Yes	Low capture in hot-spot
	21TU	-39.1420610	176.8003380	1	4	No	
	22TB	-39.1435850	176.8023510	0	3	No	
	23DB	-39.1443700	176.8046110	0	6	No	
	24DU	-39.1453710	176.8064920	0	6	No	
	25TU	-39.1451540	176.8078270	0	3	No	
	26TB	-39.1368320	176.8188770	0	3	No	
	279DU	-39.1391850	176.7964810	0	1	Yes	Low capture in hot-spot
	27DU	-39.1379820	176.8172800	0	6	No	
	284TU	-39.1385890	176.7967880	0	5	No	
	28DB	-39.1390690	176.8156230	1	1	No	
	293DU	-39.1346940	176.7834190	0	8	No	
	294TB	-39.1337530	176.7826260	0	2	No	
	295TU	-39.1327440	176.7824790	0	2	No	
	296TU	-39.1317430	176.7819470	2	2	No	
	297TB	-39.1308090	176.7811820	0	1	Yes	Low capture in hot-spot
	298DU	-39.1297590	176.7808330	0	5	No	
	299DB	-39.1291430	176.7818780	0	7	No	
	29DB	-39.1400240	176.8148970	1	5	No	
2DU	-39.1478310	176.8379620	0	5	No		
300TU	-39.1289740	176.7831720	0	1	Yes	Low capture in hot-spot	
301DB	-39.1278210	176.7834890	1	2	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	302TB	-39.1275320	176.7851490	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	303DU	-39.1267100	176.7859670	1	0	No	
	304TB	-39.1257050	176.7865200	0	0	Yes	Low capture in hot-spot
	305DB	-39.1251100	176.7876650	0	0	Yes	Low capture in hot-spot
	306TU	-39.1242640	176.7884200	0	4	No	
	307DU	-39.1234770	176.7891580	0	4	No	
	308TB	-39.1225630	176.7896620	1	4	No	
	309DU	-39.1218900	176.7905340	0	3	No	
	30TU	-39.1410850	176.8145560	0	4	No	
	310DB	-39.1212370	176.7914610	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	311TU	-39.1204030	176.7919930	0	6	No	
	312TB	-39.1215620	176.7922880	2	2	No	
	313DB	-39.1207550	176.7930460	0	2	No	
	314TU	-39.1198040	176.7932370	1	0	No	
	315DU	-39.1190070	176.7931860	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	316DB	-39.1181690	176.7924570	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	317TB	-39.1172310	176.7922200	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	318DU	-39.1168840	176.7910490	0	4	No	
	319TU	-39.1160960	176.7900220	0	4	No	
	31TB	-39.1417820	176.8135120	0	0	Yes	Low capture in hot-spot
	320TU	-39.1150080	176.7889620	1	3	No	
	321DB	-39.1138000	176.7888290	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	322DU	-39.1132550	176.7898030	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
323TB	-39.1133570	176.7912600	0	3	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	324TB	-39.1134740	176.7924890	0	4	No	
	325DB	-39.1138370	176.7936530	0	4	No	
	326DU	-39.1144240	176.7949560	0	2	No	
	327TU	-39.1152070	176.7956180	0	3	No	
	328TU	-39.1165470	176.7961070	0	4	No	
	329DB	-39.1167940	176.7972980	0	2	No	
	32DU	-39.1426590	176.8129630	0	6	No	
	330TB	-39.1172860	176.7984450	0	2	No	
	331DU	-39.1178430	176.7995620	0	4	No	
	332DU	-39.1183250	176.8008070	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	333DB	-39.1183940	176.8020290	1	3	No	
	334TB	-39.1185490	176.8033930	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	335TU	-39.1178330	176.8042800	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	336DB	-39.1192860	176.8041540	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	337DU	-39.1202980	176.8038910	0	2	No	
	338TB	-39.1212120	176.8036320	0	4	No	
	339TU	-39.1219390	176.8029170	1	3	No	
	33DB	-39.1434140	176.8123600	2	0	No	
	340TB	-39.1219700	176.8013480	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	341DU	-39.1228290	176.7965400	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	342DB	-39.1237450	176.7964080	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	343TU	-39.1248720	176.7965090	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	344DU	-39.1257420	176.7970470	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	345DB	-39.1265910	176.7981660	0	1	Yes	Low capture in moderate-heat-spot or cold-spot

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	346TB	-39.1431730	176.8335920	1	2	No	
	347TU	-39.1413250	176.8351290	0	3	No	
	348TB	-39.1395240	176.8354440	0	2	No	
	34DU	-39.1438570	176.8114080	0	0	Yes	Low capture in hot-spot
	35TB	-39.1452840	176.8111330	0	0	Yes	Low capture in hot-spot
	362TB	-39.1380840	176.7979830	0	4	No	
	363TU	-39.1372610	176.7973980	0	9	No	
	364DU	-39.1367260	176.7978850	0	3	No	
	365TB	-39.1357100	176.7987890	0	0	Yes	Low capture in hot-spot
	366DB	-39.1343880	176.7980490	0	5	No	
	367TU	-39.1337260	176.7979100	1	6	No	
	368TB	-39.1329530	176.7969720	0	2	No	
	369DU	-39.1323170	176.7957970	0	3	No	
	36TU	-39.1230990	176.8206390	0	1	Yes	Low capture in hot-spot
	370TU	-39.1315750	176.7950620	0	5	No	
	371DB	-39.1311220	176.7940160	0	2	No	
	372TB	-39.1308910	176.7922910	0	0	Yes	Low capture in hot-spot
	373DB	-39.1300500	176.7922060	0	3	No	
	374TU	-39.1287720	176.7923300	0	5	No	
	375DU	-39.1287040	176.7933940	0	5	No	
376DU	-39.1287100	176.7945340	0	1	Yes	Low capture in moderate-heat-spot or cold-spot	
377DB	-39.1288700	176.7958240	0	6	No		
378TB	-39.1277440	176.7960070	1	2	No		
379TU	-39.1269310	176.7964010	0	0	Yes	Low capture in moderate-heat-spot or cold-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	37DU	-39.1238820	176.8231290	1	1	No	
	380DB	-39.1450090	176.8342230	0	0	Yes	Low capture in hot-spot
	382TB	-39.1522560	176.8191050	0	1	Yes	Low capture in hot-spot
	383DU	-39.1445010	176.8312840	0	1	Yes	Low capture in hot-spot
	384DB	-39.1519450	176.8203410	1	4	No	
	385TU	-39.1511320	176.8212570	0	1	Yes	Low capture in hot-spot
	386DU	-39.1516550	176.8175650	1	3	No	
	387TB	-39.1509440	176.8165100	0	0	Yes	Low capture in hot-spot
	399TB	-39.1292600	176.8128300	0	0	Yes	Cold-spot
	39TB	-39.1498180	176.8323710	0	4	No	
	3TU	-39.1457460	176.8378440	2	1	No	
	400DB	-39.1288840	176.8117490	0	0	Yes	Cold-spot
	401DU	-39.1281120	176.8111850	0	0	Yes	Cold-spot
	402TU	-39.1285290	176.8101620	0	0	Yes	Cold-spot
	403TB	-39.1290090	176.8091820	0	0	Yes	Cold-spot
	404DB	-39.1292710	176.8080800	0	0	Yes	Cold-spot
	405TB	-39.1284470	176.8076240	0	0	Yes	Cold-spot
	406TU	-39.1288130	176.8065770	0	0	Yes	Cold-spot
	407DB	-39.1280160	176.8060430	0	0	Yes	Cold-spot
	408DU	-39.1274160	176.8051850	0	0	Yes	Cold-spot
	40TU	-39.1503460	176.8301220	1	1	No	
	410TU	-39.1258560	176.8060930	0	0	Yes	Cold-spot
	411DB	-39.1249820	176.8063630	0	0	Yes	Cold-spot
413TB	-39.1247740	176.8082370	0	0	Yes	Cold-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	414DU	-39.1253100	176.8091710	0	0	Yes	Cold-spot
	415DB	-39.1261800	176.8094430	0	0	Yes	Cold-spot
	416TU	-39.1270760	176.8093360	0	0	Yes	Cold-spot
	418DU	-39.1211370	176.7988580	0	4	No	
	419TB	-39.1541960	176.8415250	0	4	Yes	Cold-spot
	41DU	-39.1511660	176.8280040	0	2	No	
	420TU	-39.1545390	176.8439230	0	1	Yes	Cold-spot
	42TU	-39.1521790	176.8270920	0	3	No	
	43TB	-39.1516790	176.8322270	0	5	No	
	44DB	-39.1539170	176.8323670	0	1	Yes	Low capture in hot-spot
	45TB	-39.1547920	176.8298440	0	2	No	
	46TU	-39.1539220	176.8276780	2	4	No	
	47DB	-39.1541000	176.8250000	1	7	No	
	481DB	-39.1525790	176.8410090	1	2	Yes	Cold-spot
	482DU	-39.1213230	176.7968100	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	48DU	-39.1549360	176.8233930	0	5	No	
	49TU	-39.1561130	176.8221300	2	2	No	
	4DB	-39.1439190	176.8387180	1	2	No	
	50DU	-39.1579700	176.8222170	0	3	No	
	51TB	-39.1605530	176.8212610	1	0	No	
52DB	-39.1616340	176.8208080	0	6	No		
53DU	-39.1620420	176.8201990	0	1	Yes	Low capture in hot-spot	
54TU	-39.1627170	176.8192680	1	1	No		
55TB	-39.1618400	176.8180000	0	2	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	56DB	-39.1609310	176.8156690	0	3	No	
	57DU	-39.1588310	176.8146500	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	58TB	-39.1596360	176.8125890	0	4	No	
	59DB	-39.1588030	176.8103880	1	2	No	
	5TB	-39.1424920	176.8400200	1	1	No	
	60TU	-39.1570820	176.8097540	0	1	Yes	Low capture in hot-spot
	61DB	-39.1561040	176.8073680	0	2	No	
	62TU	-39.1547540	176.8057290	0	3	No	
	63TB	-39.1558910	176.8039660	0	5	No	
	64DU	-39.1570320	176.8017340	0	6	No	
	65DU	-39.1566180	176.7995150	0	1	Yes	Low capture in hot-spot
	66TB	-39.1565390	176.7971700	0	2	No	
	67DB	-39.1563010	176.7947610	0	0	Yes	Low capture in hot-spot
	68TU	-39.1553900	176.7931830	0	7	No	
	69TB	-39.1552340	176.7918690	0	3	No	
	6DB	-39.1412980	176.8406480	0	5	No	
	70DB	-39.1551580	176.7908140	0	5	No	
	71DU	-39.1549510	176.7896860	1	1	No	
	72TU	-39.1547100	176.7884740	0	6	No	
	73TU	-39.1540900	176.7875110	0	5	No	
	74DB	-39.1523010	176.7873480	0	3	No	
75DU	-39.1515740	176.7896740	0	2	No		
76TB	-39.1494700	176.7897670	0	1	Yes	Low capture in hot-spot	
77DB	-39.1479630	176.7882640	2	0	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Opouahi Station, con't	78TB	-39.1471160	176.7869530	0	6	No	
	79TU	-39.1472500	176.7843890	0	0	Yes	Low capture in hot-spot
	7TU	-39.1393930	176.8403730	5	2	No	
	80DU	-39.1465060	176.7817610	0	0	Yes	Low capture in hot-spot
	81TB	-39.1456520	176.7794480	0	5	No	
	82DB	-39.1440360	176.7804830	0	7	No	
	83TU	-39.1427810	176.7790330	1	4	No	
	84DU	-39.1406500	176.7792040	0	1	Yes	Low capture in hot-spot
	85DB	-39.1388190	176.7795240	0	0	Yes	Low capture in hot-spot
	86TU	-39.1297610	176.7706270	0	4	No	
	87TB	-39.1299600	176.7693910	0	2	No	
	88DU	-39.1297680	176.7679790	0	9	No	
	89DB	-39.1296960	176.7665260	0	4	No	
	8DU	-39.1377830	176.8386100	0	2	No	
	90TU	-39.1294700	176.7651370	0	4	No	
	91TB	-39.1304120	176.7640240	0	3	No	
	92DU	-39.1166940	176.7657900	0	0	Yes	Cold-spot
	93TU	-39.1164480	176.7685030	0	0	Yes	Cold-spot
	95DB	-39.1173310	176.7742530	0	0	Yes	Cold-spot
	96DU	-39.1191710	176.7628510	0	0	Yes	Cold-spot
97DU	-39.1205670	176.7608860	0	0	Yes	Cold-spot	
98TU	-39.1218270	176.7592510	0	0	Yes	Cold-spot	
99TB	-39.1235230	176.7575660	0	0	Yes	Cold-spot	
9DB	-39.1366680	176.8365530	1	3	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Rangiora Station	193DB	-39.1061690	176.8721300	0	2	No	
	194TU	-39.1079270	176.8715010	0	6	No	
	195TB	-39.1095980	176.8716220	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	196TU	-39.1112940	176.8709210	0	3	No	
	197DU	-39.1131130	176.8710920	0	6	No	
	198DB	-39.1150250	176.8706710	0	0	Yes	Low capture in hot-spot
	199TB	-39.1164310	176.8691160	0	4	No	
	200DB	-39.1181200	176.8678670	0	9	No	
	201DU	-39.1188720	176.8658960	0	9	No	
	202TU	-39.1206630	176.8650620	0	4	No	
	203TB	-39.1223890	176.8643470	0	0	Yes	Low capture in hot-spot
	204TB	-39.1239790	176.8633040	0	5	No	
	205DU	-39.1258670	176.8625640	0	7	No	
	206TU	-39.1254960	176.8600740	1	1	No	
	207DB	-39.1262540	176.8580580	0	8	No	
	208TB	-39.1262040	176.8568210	0	2	No	
	209DB	-39.1275150	176.8548440	0	6	No	
	210DU	-39.1278130	176.8536850	0	2	No	
	211TU	-39.1282240	176.8527510	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	212DU	-39.1291550	176.8527700	0	3	No	
	213TB	-39.1298220	176.8520450	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
214TU	-39.1305310	176.8512620	0	1	Yes	Low capture in moderate-heat-spot or cold-spot	
215DB	-39.1312880	176.8506350	0	4	No		
216DU	-39.1322410	176.8504420	0	1	Yes	Low capture in moderate-heat-spot or cold-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Rangiora Station, con't	217TB	-39.1331910	176.8506220	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	218DB	-39.1333350	176.8493440	0	3	No	
	219TU	-39.1334390	176.8480820	0	4	No	
	220DB	-39.1343690	176.8473160	0	5	No	
	221TB	-39.1362220	176.8471520	1	3	No	
	222TU	-39.1380090	176.8470920	0	8	No	
	223DU	-39.1393600	176.8473490	0	0	Yes	Low capture in hot-spot
	224TU	-39.1373560	176.8447230	0	3	No	
	225DB	-39.1360290	176.8428910	0	7	No	
	226DB	-39.1285340	176.8315490	0	1	Yes	Low capture in hot-spot
	226TB	-39.1341000	176.8430000	0	2	No	
	227TU	-39.1340800	176.8408100	0	2	No	
	228TB	-39.1328540	176.8390430	0	1	Yes	Low capture in hot-spot
	229TU	-39.1325980	176.8378400	1	3	No	
	230DU	-39.1319430	176.8369720	0	4	No	
	231DB	-39.1312090	176.8361300	0	4	No	
	232TU	-39.1301610	176.8355030	0	3	No	
	233DB	-39.1297880	176.8344380	0	1	Yes	Low capture in hot-spot
	234TB	-39.1299870	176.8332080	0	2	No	
	235DU	-39.1294110	176.8321560	0	4	No	
236DB	-39.1285340	176.8315490	1	2	No		
237TB	-39.1281620	176.8304080	3	1	No		
238TU	-39.1282350	176.8294330	0	0	Yes	Low capture in hot-spot	
239DU	-39.1275150	176.8287510	0	2	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Rangiora Station, con't	240DU	-39.1269760	176.8278630	0	3	No	
	241DB	-39.1260100	176.8273180	0	0	Yes	Low capture in hot-spot
	242TU	-39.1061930	176.8698930	0	0	Yes	Low capture in hot-spot
	243TB	-39.1057110	176.8675990	0	5	No	
	244DU	-39.1042870	176.8661600	0	8	No	
	245DB	-39.1022340	176.8650880	0	2	No	
	246TB	-39.1008750	176.8632460	0	3	No	
	247TU	-39.1007990	176.8605650	0	7	No	
	248DB	-39.1016670	176.8583490	0	0	Yes	Low capture in hot-spot
	249DU	-39.1012200	176.8559720	0	7	No	
	250TU	-39.1015230	176.8548190	2	0	No	
	251TB	-39.1028830	176.8542570	0	1	Yes	Low capture in hot-spot
	252TU	-39.1030180	176.8525340	1	3	No	
	253TB	-39.1033870	176.8573050	0	3	No	
	254DU	-39.1053500	176.8564780	0	4	No	
	255DB	-39.1072760	176.8557840	0	4	No	
	256DB	-39.1095800	176.8543830	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	257TB	-39.1114310	176.8548640	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	258DU	-39.1115540	176.8530420	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	259TU	-39.1134200	176.8518550	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	260TU	-39.1149220	176.8501390	0	3	No	
	261DB	-39.1165860	176.8491340	1	5	No	
	262TB	-39.1181900	176.8477870	0	1	Yes	Low capture in hot-spot
263DU	-39.1191010	176.8458010	1	2	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Rangiora Station, con't	264DB	-39.1206770	176.8468280	0	5	No	
	265TU	-39.1214000	176.8483290	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	266DU	-39.1232860	176.8485850	1	5	No	
	267TB	-39.1227460	176.8511170	0	4	No	
	268DU	-39.1235260	176.8533050	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	269TB	-39.1223100	176.8558060	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	270DB	-39.1216160	176.8565440	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	271TU	-39.1205100	176.8589640	0	0	Yes	Low capture in hot-spot
	272DU	-39.1190220	176.8600320	0	0	Yes	Low capture in hot-spot
	273TB	-39.1226040	176.8461340	0	3	No	
	274DB	-39.1244000	176.8460000	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	275TU	-39.1254570	176.8460340	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	276TB	-39.1264260	176.8462980	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	277DB	-39.1277460	176.8465420	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	278TU	-39.1283410	176.8475430	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	280TB	-39.1215930	176.8437630	0	2	No	
	281TU	-39.1223680	176.8418640	0	6	No	
	282DB	-39.1240740	176.8414480	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	283DU	-39.1249110	176.8416590	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	285TB	-39.1203890	176.8416120	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
286DB	-39.1184020	176.8409740	0	2	No		
287DU	-39.1175660	176.8387120	0	3	No		
288TB	-39.1176430	176.8365520	0	1	Yes	Low capture in moderate-heat-spot or cold-spot	
289DB	-39.1171990	176.8350820	0	3	No		

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Rangiora Station, con't	290DU	-39.1179620	176.8340780	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	291TU	-39.1190590	176.8342310	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	292DB	-39.1198690	176.8332000	0	2	No	
	349DB	-39.1380580	176.8425690	1	4	No	
	350DU	-39.1365110	176.8406890	2	5	No	
	351TU	-39.1339420	176.8390310	0	2	No	
	352DB	-39.1251470	176.8270210	1	0	No	
	353TB	-39.1236670	176.8265360	1	2	No	
	354TU	-39.1228050	176.8270440	1	2	No	
	355DU	-39.1218600	176.8269760	1	0	No	
	356TB	-39.1213690	176.8280380	1	0	No	
	357TU	-39.1216030	176.8293950	0	2	No	
	358DB	-39.1210980	176.8304540	0	5	No	
	359DU	-39.1202650	176.8310860	0	2	No	
	360DU	-39.1194100	176.8316000	1	1	No	
	361DB	-39.1208880	176.8325420	1	0	No	
	388DU	-39.0933740	176.8696670	0	0	Yes	Cold-spot
	389DB	-39.0940960	176.8687370	0	0	Yes	Cold-spot
	38DB	-39.1241910	176.8254520	2	3	No	
	390TB	-39.0946720	176.8681750	0	0	Yes	Cold-spot
	391DU	-39.0952380	176.8707140	0	0	Yes	Cold-spot
	392TU	-39.0963410	176.8724630	0	0	Yes	Cold-spot
	393TU	-39.0982930	176.8726860	0	0	Yes	Cold-spot
394TB	-39.0998210	176.8743460	0	0	Yes	Cold-spot	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Rangiora Station, con't	395DU	-39.1011230	176.8766810	0	0	Yes	Cold-spot
	396DB	-39.1011980	176.8792920	0	0	Yes	Cold-spot
	397DU	-39.1021050	176.8814970	0	0	Yes	Cold-spot
	Tu226	-39.1341140	176.8433940	2	0	No	
Toronui	K01	-39.1674743	176.7783810	0	2	No	
	K02	-39.1670680	176.7763655	0	8	No	
	K03	-39.1666461	176.7726381	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K04	-39.1680957	176.7704511	0	4	No	
	K05	-39.1714557	176.7680162	0	3	No	
	K06	-39.1717266	176.7659844	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K07	-39.1719391	176.7622994	1	1	No	
	K08	-39.1679315	176.7620368	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K09	-39.1722528	176.7601164	0	3	No	
	K10	-39.1669541	176.7655491	0	4	No	
	K11	-39.1653400	176.7663436	0	2	No	
	K114	-39.1652328	176.7688844	0	2	No	
	K12	-39.1636018	176.7649418	1	1	No	
	K13	-39.1629315	176.7618632	0	2	No	
	K15	-39.1668247	176.7695382	0	2	No	
	K16	-39.1617120	176.7613270	0	3	No	
	K17	-39.1594356	176.7619395	0	5	No	
	K18	-39.1579371	176.7631166	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K19	-39.1565322	176.7636424	0	4	No	
	K20	-39.1546728	176.7631026	0	2	No	

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Toronui, con't	K21	-39.1550529	176.7607246	1	0	No	
	K22	-39.1567345	176.7596686	0	6	No	
	K23	-39.1585687	176.7580810	0	3	No	
	K24	-39.1624486	176.7538359	0	3	No	
	K25	-39.1590349	176.7525604	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K26	-39.1591545	176.7498188	0	4	No	
	K27	-39.1582063	176.7495316	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	K28	-39.1560033	176.7499958	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K29	-39.1539341	176.7497204	1	0	No	
	K30	-39.1516878	176.7489265	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	K31	-39.1496191	176.7479260	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K32	-39.1475828	176.7472987	0	2	No	
	K33	-39.1455312	176.7493980	0	3	No	
	K34	-39.1463566	176.7528807	0	5	No	
	K35	-39.1483590	176.7549583	0	2	No	
	K36	-39.1666724	176.7796751	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K37	-39.1626864	176.7779341	0	1	Yes	Low capture in hot-spot
	K38	-39.1626864	176.7779341	0	1	Yes	Low capture in hot-spot
	K39	-39.1627196	176.7778483	0	2	No	
	K40	-39.1627196	176.7778483	0	0	Yes	Low capture in hot-spot
	K41	-39.1627196	176.7778483	0	3	No	
	K42	-39.1627196	176.7778483	2	1	No	
	K43	-39.1627196	176.7778483	1	0	No	
	K44	-39.1627196	176.7778483	0	0	Yes	Low capture in hot-spot

Line	Trap	Latitude	Longitude	Total mustelids captured 2016–2018	Total by-catch animals captured 2016–2018	Trap for possible removal	Reason for removal
Toronui, con't	K45	-39.1452866	176.7580845	0	2	No	
	K46	-39.1499329	176.7580919	1	6	No	
	K47	-39.1517412	176.7592566	0	2	No	
	K48	-39.1540579	176.7626356	0	0	Yes	Low capture in hot-spot
	K49	-39.1463608	176.7592566	0	6	No	
	K50	-39.1425301	176.7565515	1	3	No	
	K51	-39.1606067	176.7684499	0	4	No	
	K52	-39.1606067	176.7684499	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K53	-39.1450200	176.7619568	0	2	No	
	K54	-39.1450200	176.7619568	0	4	No	
	K55	-39.1407015	176.7622951	0	1	Yes	Low capture in moderate-heat-spot or cold-spot
	K56	-39.1407015	176.7622951	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	K57	-39.1493299	176.7761693	0	2	No	
	K58	-39.1525913	176.7768691	0	2	No	
	K59	-39.1533220	176.7815068	0	0	Yes	Low capture in moderate-heat-spot or cold-spot
	K60	-39.1559936	176.7829525	0	4	No	
	K61	-39.1579392	176.7827439	2	1	No	
	K62	-39.1570305	176.7851209	0	1	Yes	Low capture in hot-spot
	K64	-39.1582285	176.7880400	1	3	No	
	K65	-39.1601657	176.7856435	0	3	No	
K66	-39.1622135	176.7837495	0	3	No		
K67	-39.1632854	176.7808794	0	1	Yes	Low capture in hot-spot	