

Advancing riverine eDNA sampling methodology for monitoring and surveillance of terrestrial pest species

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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus









Remotely-reporting AI camera = \$5.80 /ha
eDNA sampling = ?





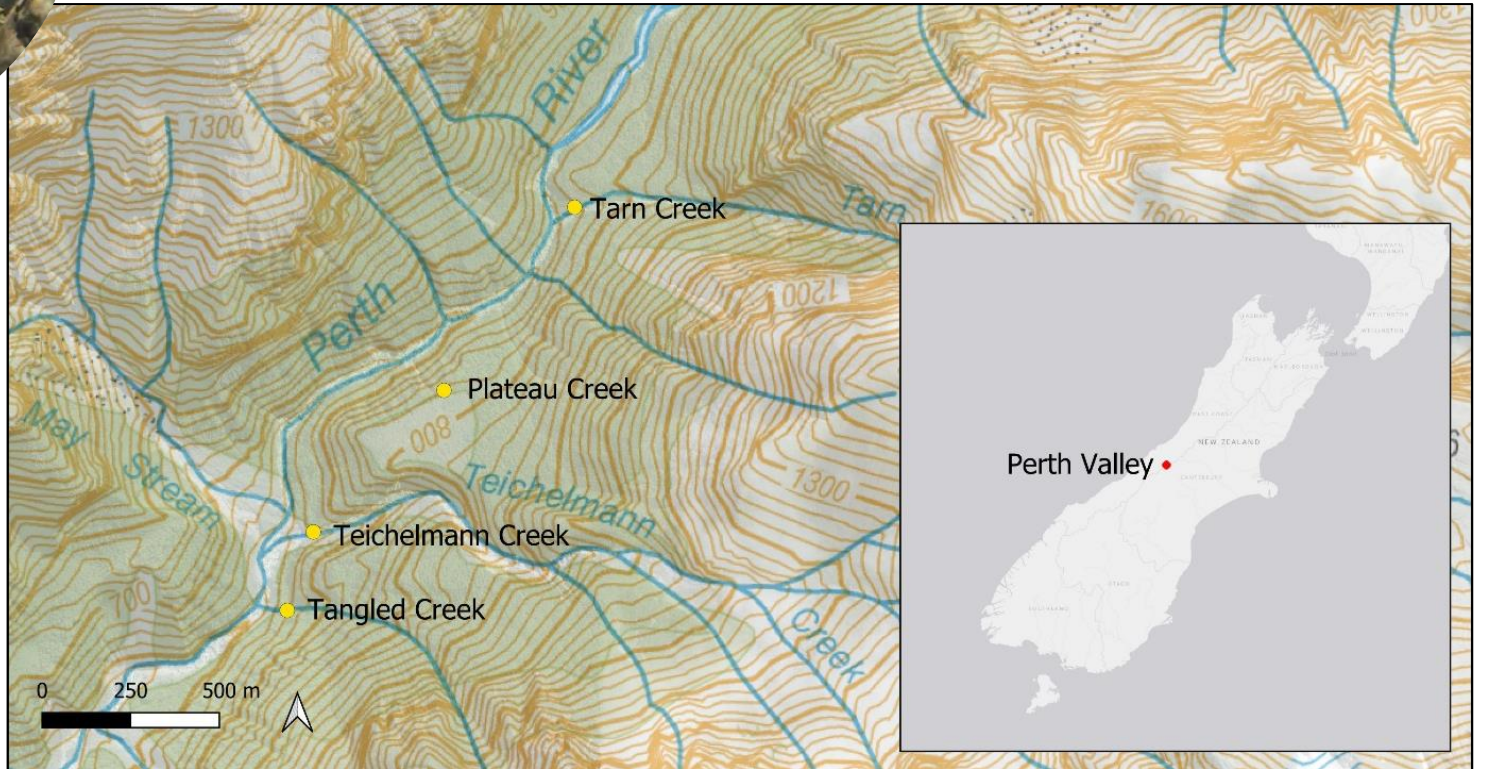
'...seeks to use innovative new eDNA technologies to test, develop and establish efficient, sensitive and reliable in-the-field surveys of mammalian pests and native species.'

'...to advance eDNA sampling as technique that is (i) fit for purpose as a pest surveillance tool, and (ii) beats traditional detection techniques on a cost-per-ha basis.'

Syringe sampling vs. Passive sampling



Syringe sampling vs. Passive sampling



Syringe sampling vs. Passive sampling



Site	S1	P1	P2	P3	P Mean	% Passive/ Syringe	Volume (cumecs)	Deployment duration	Flow (m/s)
Teichelmann Creek	44	62	58	67	62.33	142%	0.85	28 hours	1.45
Tarn Creek	47	52	55	50	52.33	111%	1.01	27 hours	1.10
Plateau Creek	53	47	62	40	49.67	94%	0.05	24 hours	0.15
Tangled Creek	69	54	62	62	59.33	86%	0.21	22 hours	0.49

Mean AD Syringe = 53.25

Passive = 55.92

Syringe sampling vs. Passive sampling

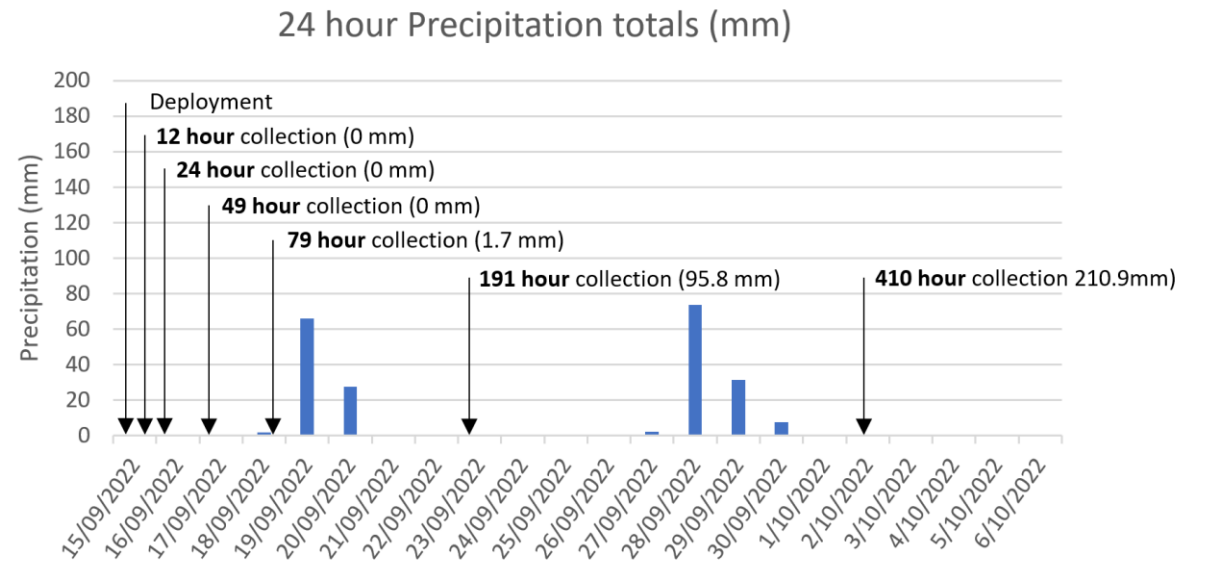
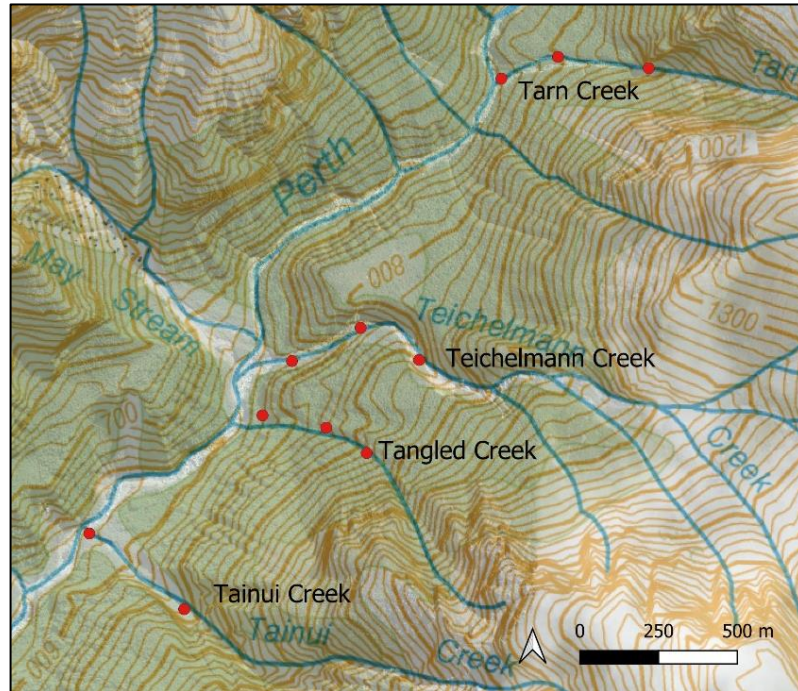


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Optimal deployment duration

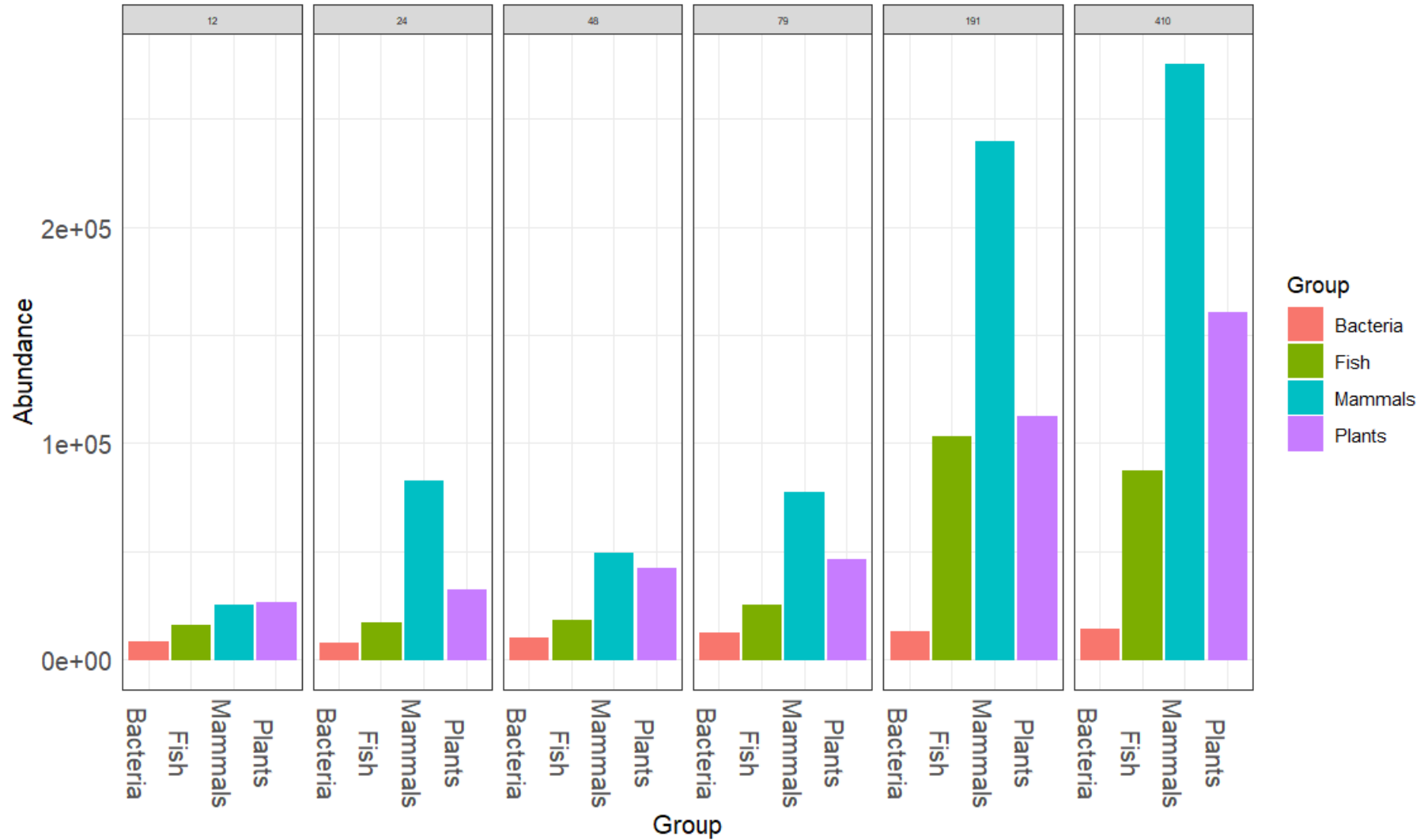


Optimal deployment duration



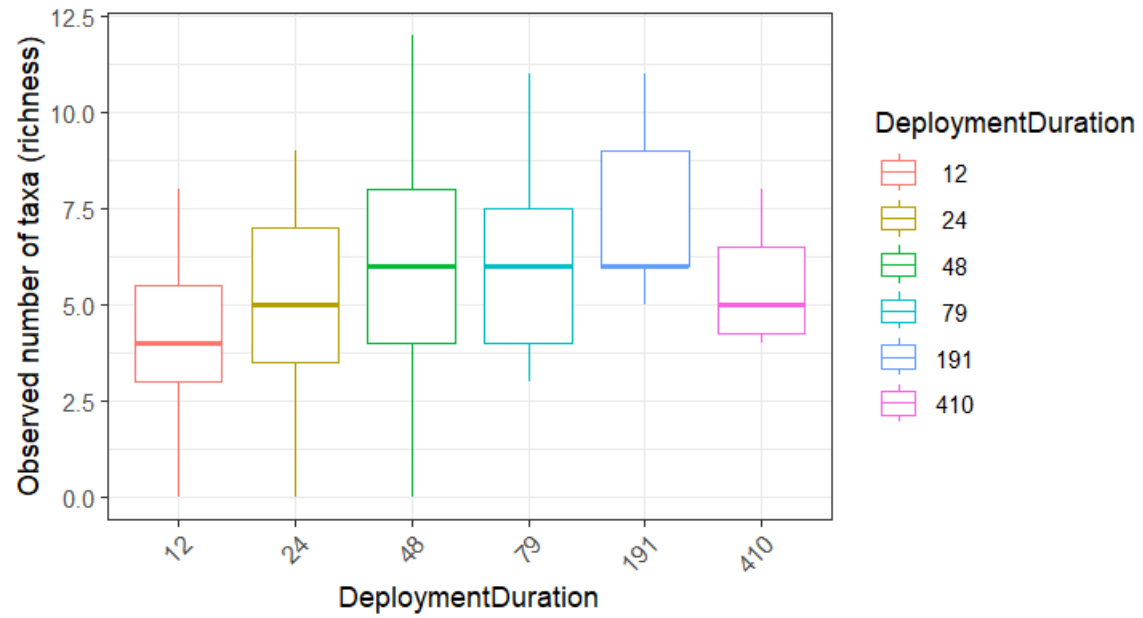
Optimal deployment duration

All taxa (major)

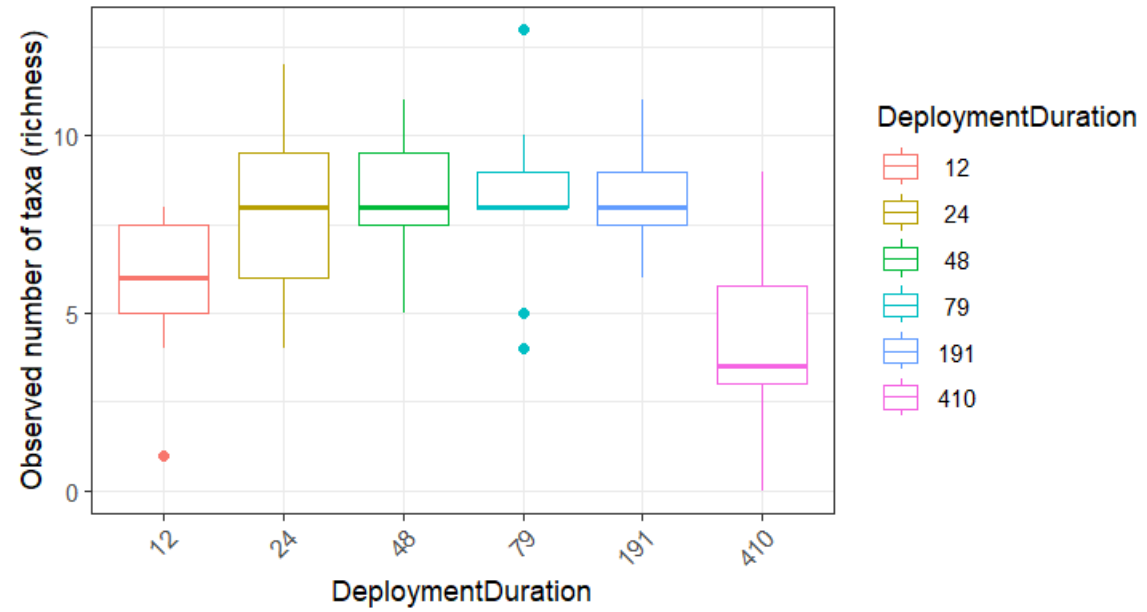


Optimal deployment duration

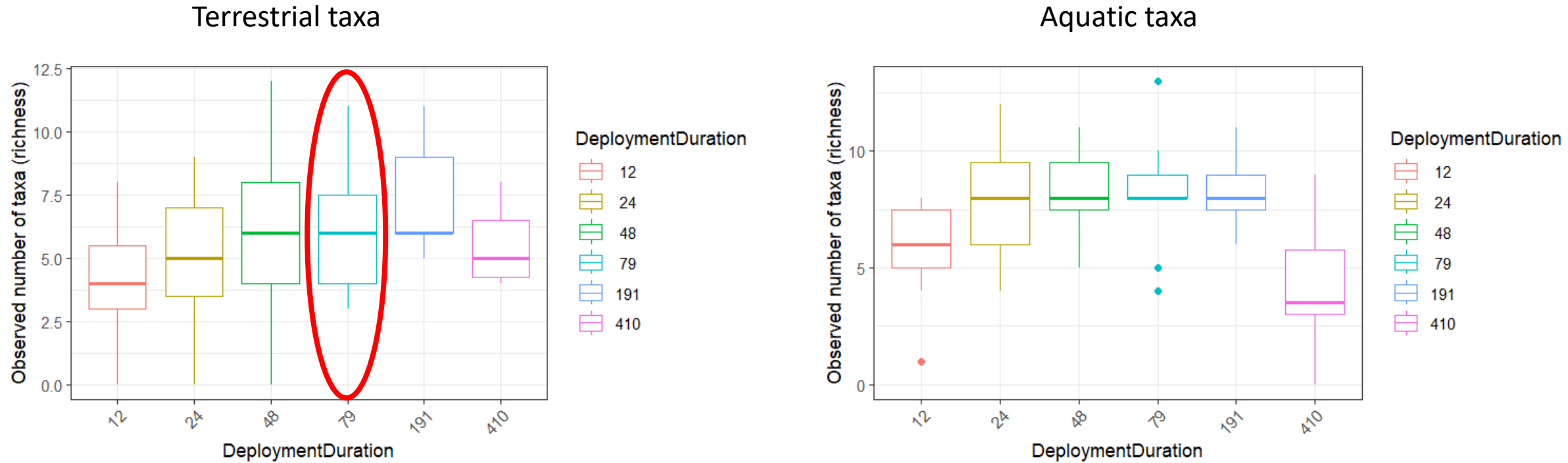
Terrestrial taxa



Aquatic taxa



Optimal deployment duration



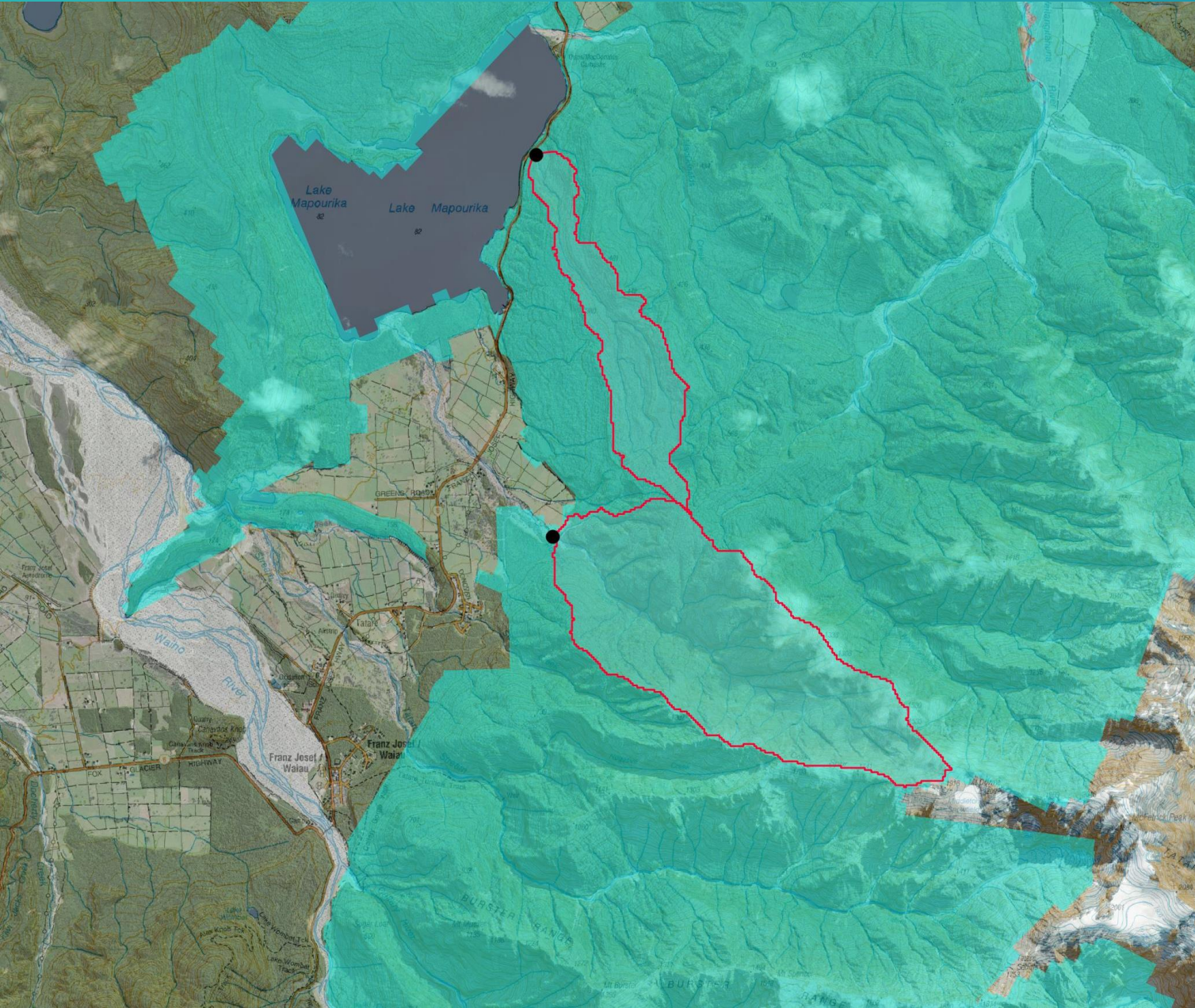
Longer deployments = more terrestrial species detected. Field practicalities: 4-8 days ideal

Read counts strongly influenced by deployment duration: important to standardise if to be used in any quantitative way.

Rat signal decay after an aerial toxin operation

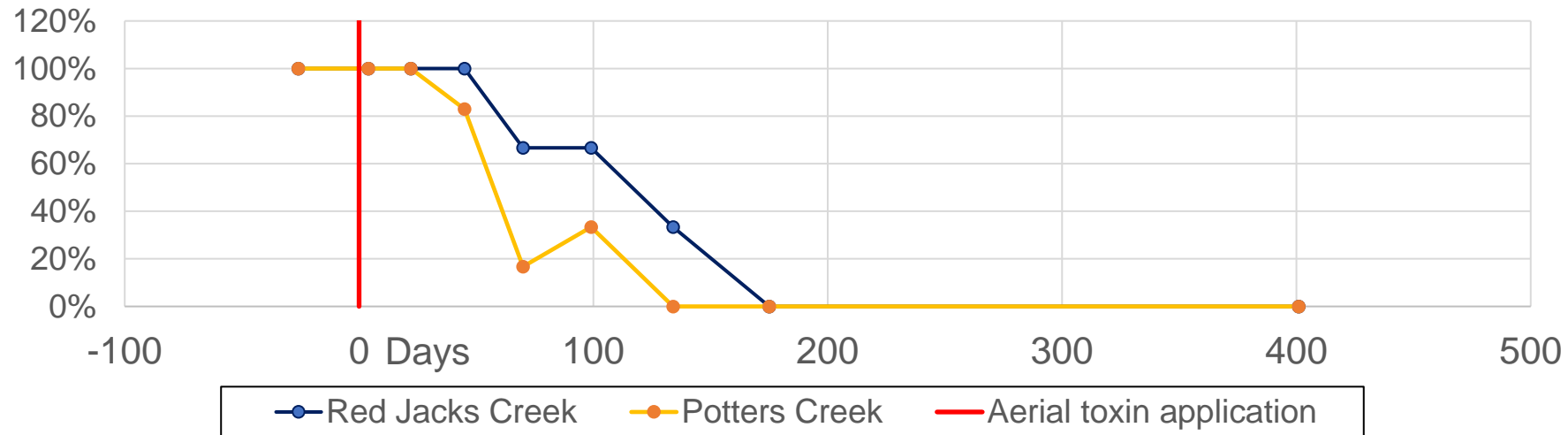


Rat signal decay after an aerial toxin operation

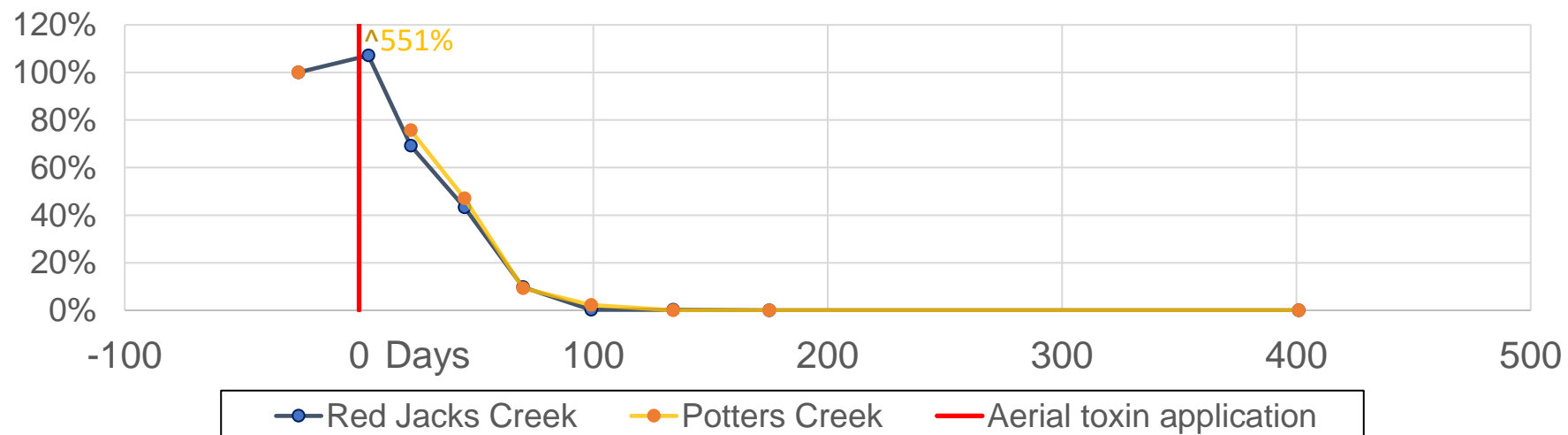


Rat signal decay after an aerial toxin operation

Sampler occupancy over time



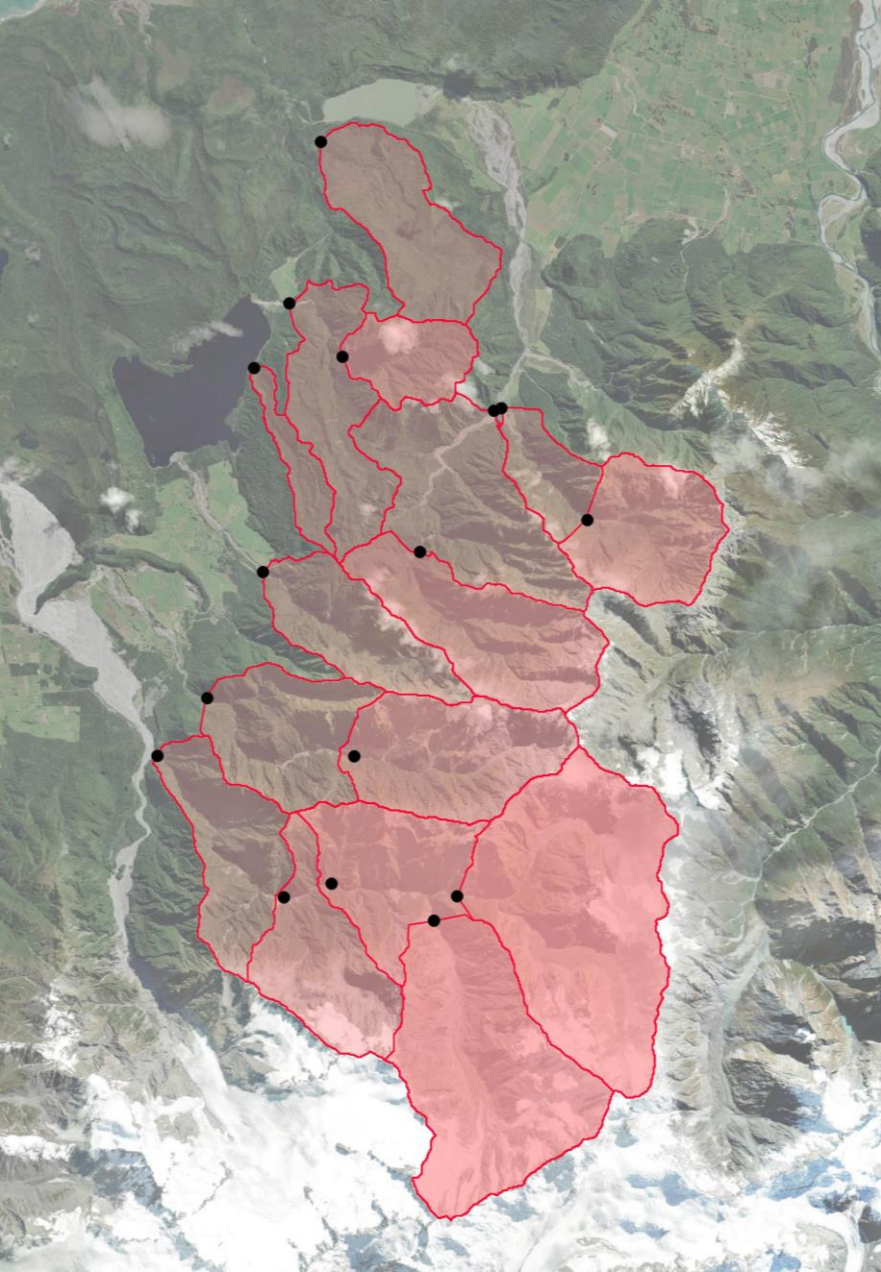
Proportional mean read count relative to pre-operation levels



Passive sampling for index of abundance?



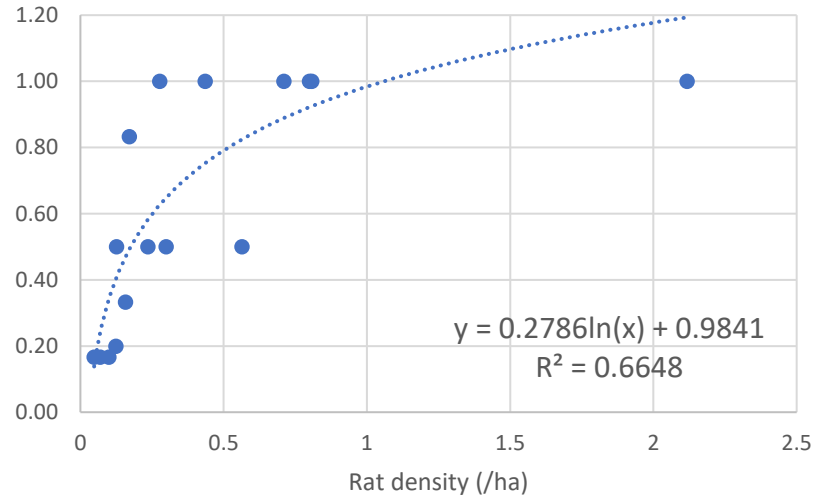
Passive sampling for index of abundance?



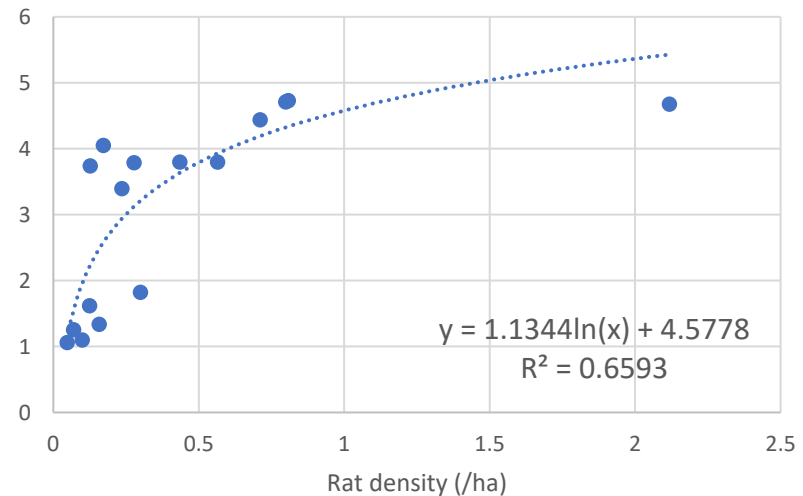
Site name	Density (Rats/ha)	Sampler occupancy (/6)	Mean read count	log mean read count
Zalas Creek	2.12	1.00	47486	4.68
MacDonalds Creek Lower	0.81	1.00	53385	4.73
Red Jacks Creek	0.80	1.00	50997	4.71
MacDonalds Creek Upper	0.71	1.00	27271	4.44
Waitangitahuna Creek Lower	0.56	0.50	6267	3.80
Potters Creek	0.44	1.00	6248	3.80
Darnley Creek Lower	0.30	0.50	66	1.82
Tatare Stream Lower	0.28	1.00	6132	3.79
Waitangitahuna Creek upper	0.24	0.50	2482	3.39
Darnley Creek Upper	0.17	0.83	11234	4.05
Callery River Bridge	0.16	0.33	22	1.33
Tatare Stream Upper	0.13	0.50	5502	3.74
Callery River Gorge	0.12	0.20	42	1.62
Callery River Mid	0.10	0.17	13	1.10
Spencer Creek	0.07	0.17	18	1.26
Callery River Upper	0.05	0.17	12	1.06

Passive sampling for index of abundance?

Sampler occupancy x est. rat density



log Mean read count x est. rat density

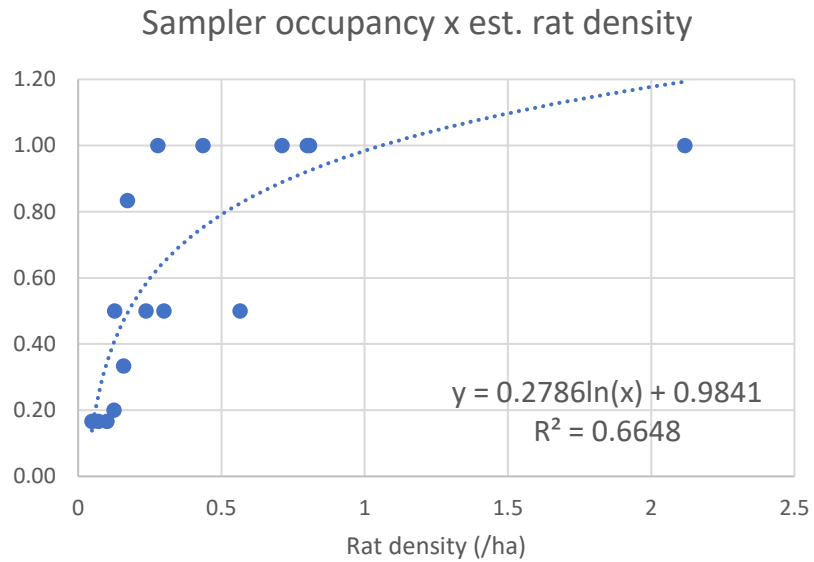


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Estimating sufficient sampling effort for survivor detection

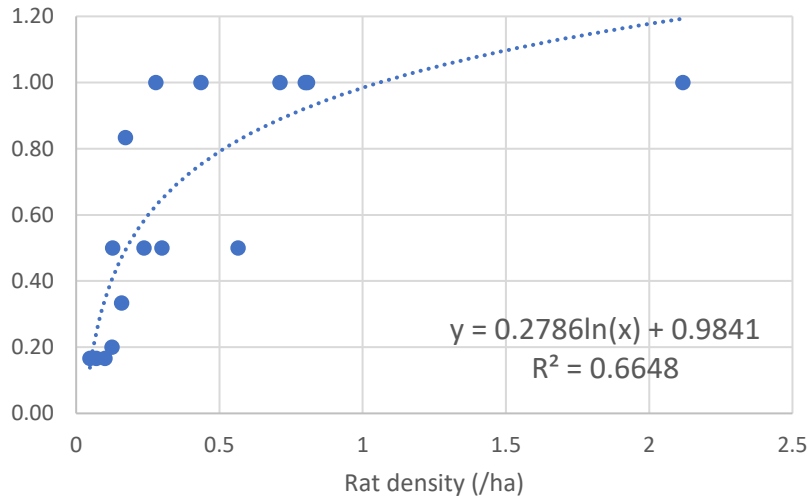


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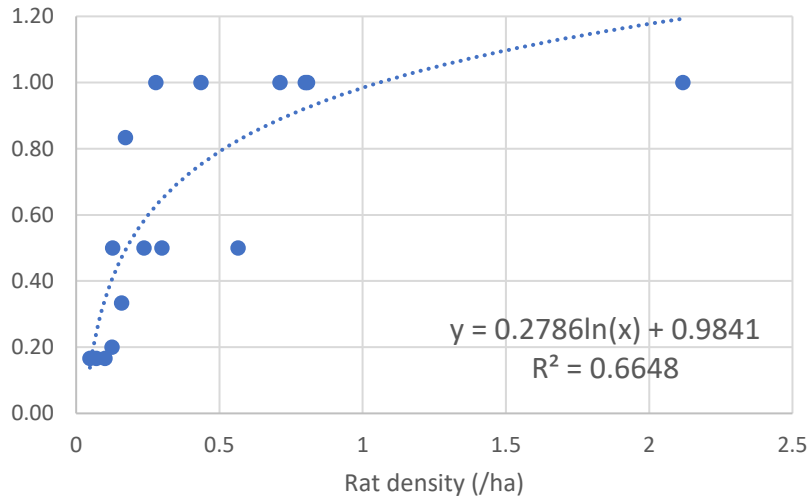
Sampler occupancy x est. rat density



	Sampler occupancy x rat density												
	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2.5	-0.04	0.40	0.60	0.79	0.90	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
2	-0.11	0.34	0.54	0.73	0.84	0.92	0.98	1.00	1.00	1.00	1.00	1.00	
1.5	-0.19	0.26	0.46	0.65	0.76	0.84	0.90	0.95	1.00	1.00	1.00	1.00	
1	-0.30	0.15	0.34	0.54	0.65	0.73	0.79	0.84	0.88	0.92	0.95	0.98	
0.5	-0.49	-0.04	0.15	0.34	0.46	0.54	0.60	0.65	0.69	0.73	0.76	0.79	

Estimating sufficient sampling effort for survivor detection

Sampler occupancy x est. rat density



Sampler occupancy x rat density

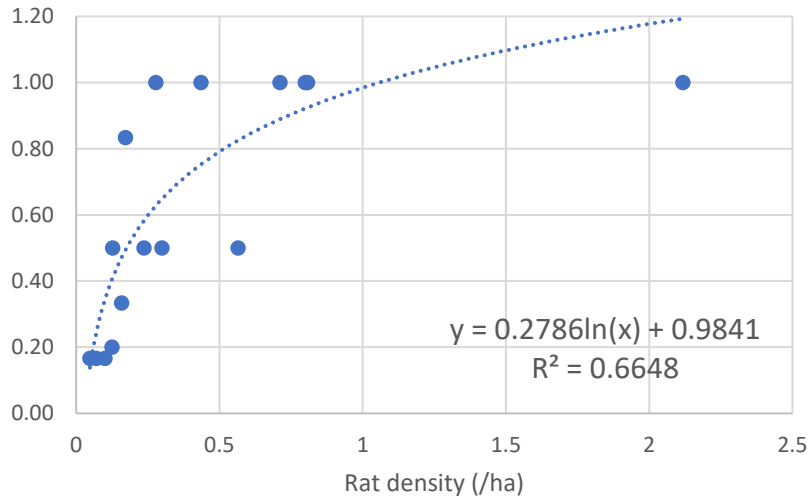
2.5	-0.04	0.40	0.60	0.79	0.90	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	-0.11	0.34	0.54	0.73	0.84	0.92	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1.5	-0.19	0.26	0.46	0.65	0.76	0.84	0.90	0.95	1.00	1.00	1.00	1.00	1.00
1	-0.30	0.15	0.34	0.54	0.65	0.73	0.79	0.84	0.88	0.92	0.95	0.98	0.98
0.5	-0.49	-0.04	0.15	0.34	0.46	0.54	0.60	0.65	0.69	0.73	0.76	0.79	0.79
	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

samplers required for 95% confidence rat detection x rat density

2.5	NA	5.77	3.29	1.91	1.28	0.72	0.26	0.26	0.26	0.26	0.26	0.26	0.26
2	NA	7.14	3.90	2.30	1.62	1.17	0.72	0.26	0.26	0.26	0.26	0.26	0.26
1.5	NA	9.84	4.93	2.86	2.09	1.62	1.28	0.97	0.49	0.26	0.26	0.26	0.26
1	NA	18.50	7.14	3.90	2.86	2.30	1.91	1.62	1.39	1.17	0.97	0.72	0.72
0.5	NA	NA	18.50	7.14	4.93	3.90	3.29	2.86	2.55	2.30	2.09	1.91	1.91
	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

Estimating sufficient sampling effort for survivor detection

Sampler occupancy x est. rat density



Sampler occupancy x rat density

2.5	-0.04	0.40	0.60	0.79	0.90	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	-0.11	0.34	0.54	0.73	0.84	0.92	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1.5	-0.19	0.26	0.46	0.65	0.76	0.84	0.90	0.95	1.00	1.00	1.00	1.00	1.00
1	-0.30	0.15	0.34	0.54	0.65	0.73	0.79	0.84	0.88	0.92	0.95	0.98	0.98
0.5	-0.49	-0.04	0.15	0.34	0.46	0.54	0.60	0.65	0.69	0.73	0.76	0.79	0.79
	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	100%

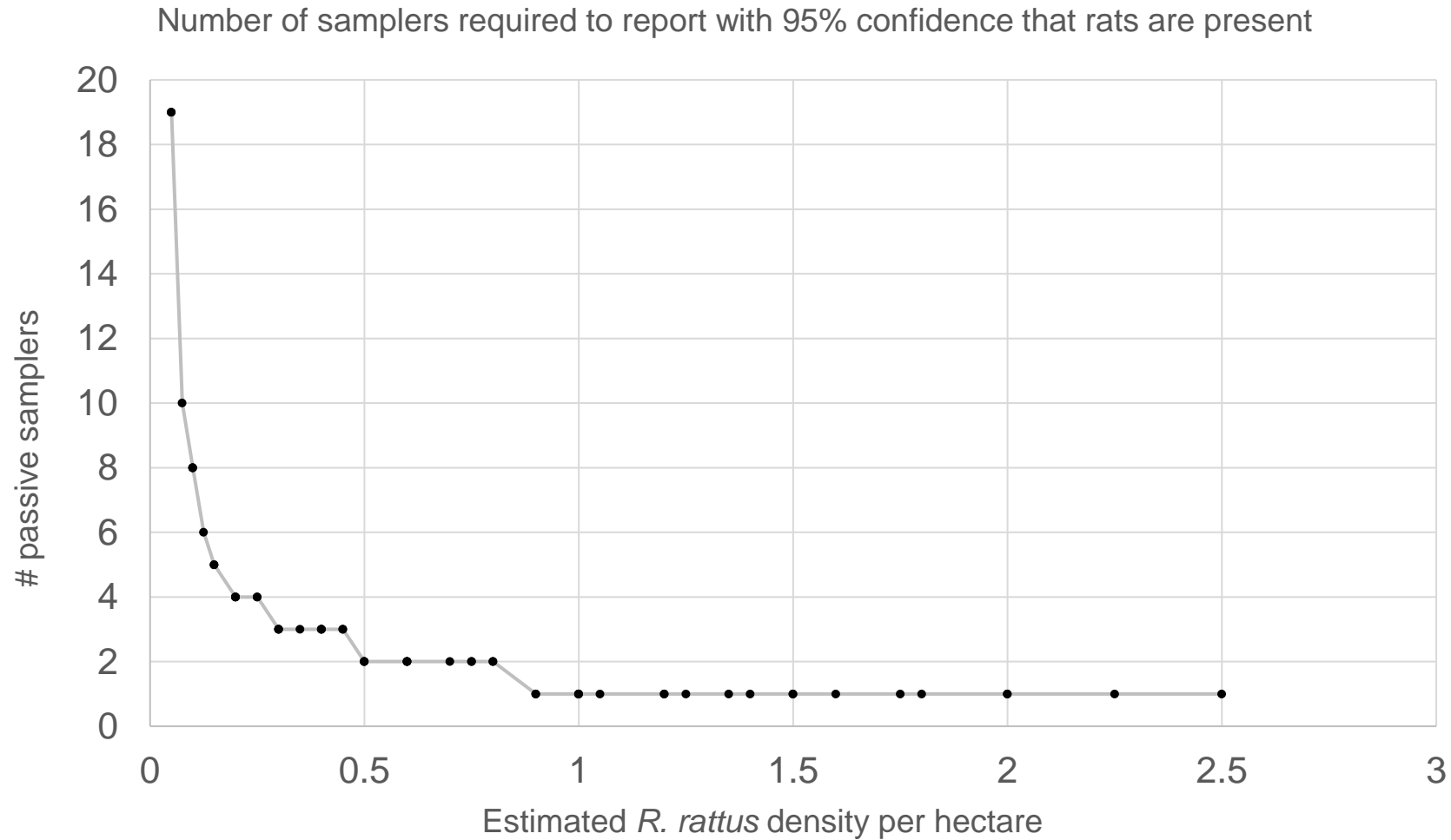
samplers required for 95% confidence rat detection x rat density

2.5	NA	5.77	3.29	1.91	1.28	0.72	0.26	0.26	0.26	0.26	0.26	0.26	0.26
2	NA	7.14	3.90	2.30	1.62	1.17	0.72	0.26	0.26	0.26	0.26	0.26	0.26
1.5	NA	9.84	4.93	2.86	2.09	1.62	1.28	0.97	0.49	0.26	0.26	0.26	0.26
1	NA	18.50	7.14	3.90	2.86	2.30	1.91	1.62	1.39	1.17	0.97	0.72	0.72
0.5	NA	NA	18.50	7.14	4.93	3.90	3.29	2.86	2.55	2.30	2.09	1.91	1.91
	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	100%

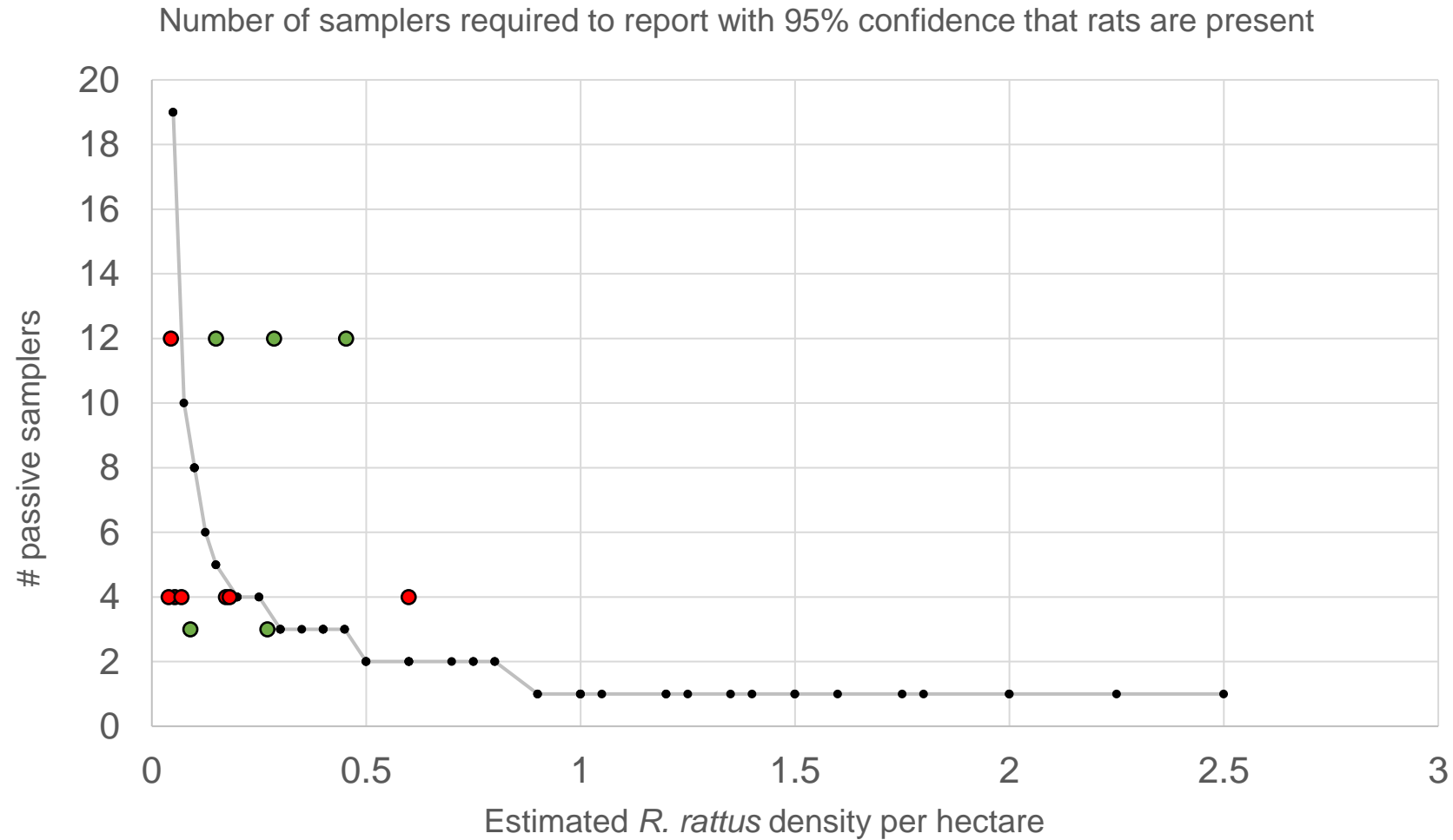
samplers required for 95% confidence rat detection x rat density (rounded up)

2.5	NA	6.00	4.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	NA	8.00	4.00	3.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.5	NA	10.00	5.00	3.00	3.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
1	NA	19.00	8.00	4.00	3.00	3.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
0.5	NA	NA	19.00	8.00	5.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	2.00
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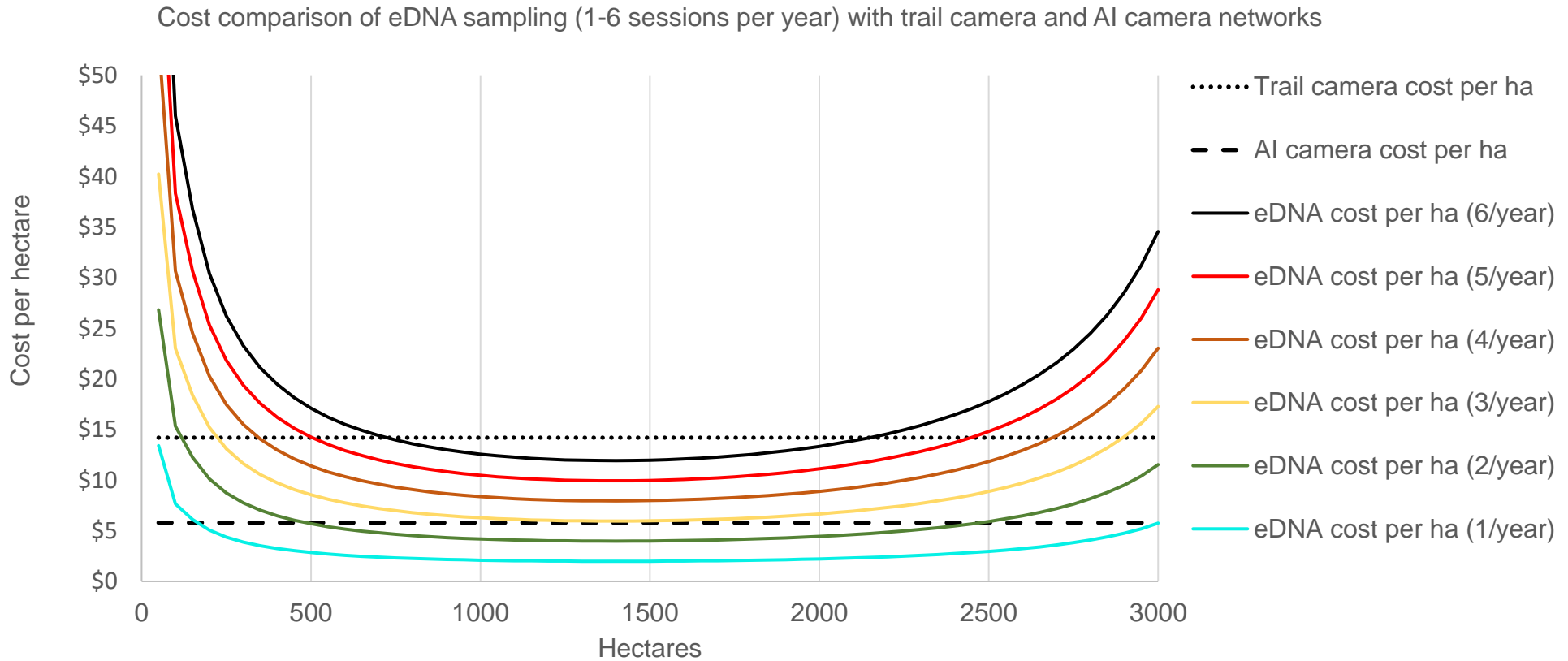


Estimating sufficient sampling effort for survivor detection



How does eDNA sampling compete with traditional techniques?

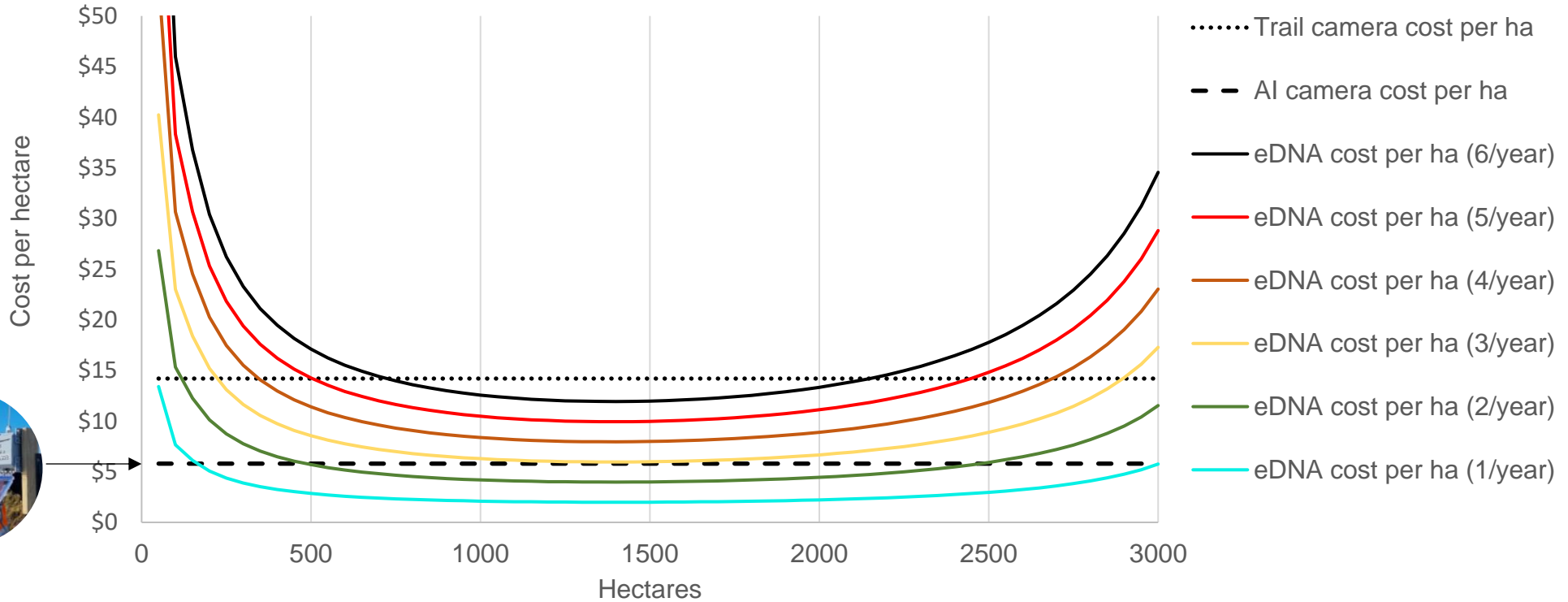
Target population size = 100 individuals



How does eDNA sampling compete with traditional techniques?

Target population size = 100 individuals

Cost comparison of eDNA sampling (1-6 sessions per year) with trail camera and AI camera networks





For more information: zip.org.nz
Contact: nicholas.foster@zip.org.nz

