Table 1. Modelling Westland petrel burrow density. Density indicates burrow density, r(colony) indicates a random effect of colony, and s(x,y) is a spatial smoother.

Model name	Model structure	AIC
Model 1	density ~ 1	-786.1
Model 2	density ~ year	-877.7
Model 3	density ~ year + r(colony)	-1139.4
Model 4	density ~ year + r(colony) + s(x,y)	-1156.9

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Table 2. Generalized additive mixed model (GAMM) results for Westland petrel burrow density as a function of year, colony and spatial auto-correlation (s(x,y)). edf indicates the estimated degrees of freedom. The year 2007 is used as a reference year.

Variable	Estimate (SE)	t-value	p-value	edf	F	p-value
Intercept	0.070 (0.021)	3.346	<0.001			
2008	-0.013 (0.022)	-0.615	0.539			
2011	0.004 (0.022)	0.183	0.854			
2014	0.026 (0.031)	0.850	0.396			
2016	0.095 (0.022)	4.356	<0.001			
2017	0.061 (0.022)	2.823	0.005			
2019	0.014 (0.020)	0.732	0.464			
s(x,y)				13.94	1.912	0.015
Colony				16.72	1.682	<0.001

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Table 3. Modelling temporal trend in Westland petrel burrow density using generalized additive mixed modelling. edf indicates the estimated degrees of freedom. The proportion of deviance explained is 49.2%.

Variable	Estimate (SE)	t-value	p-value	edf	F	p-value
Intercept	0.095 (0.012)	7.814	<0.001			
s(trend)				1.925	7.937	<0.001
s(colony)				8.023	1.288	<0.001
s(x,y)				17.505	2.692	<0.001

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Table 4. Burrow density, occupancy and estimated number of breeding pairs assessed in 2019. * For colonies with no burrow-scoping data, the average value for 2019, 0.385 was used. LC = low confidence in estimated burrow numbers, where field parties felt the number calculated was around 1 order of magnitude different than they observed on the ground.

Colony ID	Breeding area	A: total colony area estimated 2019 (m^2)	I: % colony impacted by storms since 2014	Number of transects 2019	D: Mean (±SD) burrow density 2019	O: Occupancy rate 2019	Estimated number of occupied burrows 2019	Estimated number of breeding pairs 2019
1	Middle bluff	708	0%	10	0.005 (0.015)	*	1 (1)	2 (0, LC)
2	Bees nest	7546	50%	10	0.029 (0.027)	0.50	55 (16)	26 (4)
4	Dougies Bluff	50566	38%	26	0.057 (0.63)	0.47	840 (1821)	403 (79)
5	Three Bluffs	7233	3%	4	0.015 (0.019)	*	40 (25)	19(3, LC)
7	Solomons 1-3	62425	4%	25	0.064 (0.098)	0.40	1534 (470)	735 (113)
9	Power Barrow	6311	2%	9	0.05 (0.033)	*	118 (26)	56 (9)
10	Study	49356	6%	41	0.203 (0.133)	0.44	4144 (424)	1993 (305)
11	Track in	13581	0%	8	0.013 (0.019)	*	67 (35)	32 (5)
12	Robs	11160	3%	4	0.046 (0.035)	*	189 (72)	91 (14)
13	Noisy Knob	18755	9%	7	0.178 (0.090)	0.43	1306 (250)	624 (98)
14	Middle	59218	7%	34	0.035 (0.031)	0.42	810 (123)	388 (59)
18a	Rowe 1&2	33540	11%	24	0.081 (0.091)	0.40	967 (222)	462 (71)
18b	Rowe 3	9323	2%	7	0.025 (0.025)	*	87 (33)	42 (6)
18c	Rowe 4	5554	0	14	0.011 (0.017)	0.43	26 (11)	12 (2)
19	Liddy's	86933	3%	34	0.042 (0.044)	0.34	1204 (216)	577 (88)
20	Studio	86918	1%	40	0.026 (0.028)	0.43	962 (164)	463 (70, LC)
21	Liddy's top	13992	0%	10	0.075 (0.057)	0.38	399 (96)	192 (29)
24, 25, 26	Lawson's	24540	0%	32	0.016 (0.040)	*	149 (66)	72 (11)
27	Nuggety	3714	0%	13	0.047 (0.053)	*	66 (21)	32 (5)
Total							12964 (1985)	6223 (380)

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Table 5. Storm damage at monitored colonies documented since 2014.

Colony ID	Breeding area	Area estimated 2019 (m^2)	2019 assessment of landslip damage	2019 estimate of windfall	% colony impacted By storms since 2014	Summary of storm damage in 2019
1	Middle bluff	708	0	0	0%	Burrows only in one small area, moderate vegetation damage
2	Bees nest	7546	443	3344	50%	Significant damage throughout the colony
4	Dougie's bluff	50566	480	18715	38%	Severe windfall along ridge and eastern side.
5	Three bluffs	7233	231	0	3%	Severe windfall on the upper section of the colony
7	Solomon's 1-3	62425	931	1666	4%	Smallish slips
9	Power-barrow	6311	0	141	2%	Intact
10	Study	49356	1178	1686	6%	Slips and windfalls throughout
11	Track-in	13581	0	0	0%	Intact
12	Rob's	11160	0	284	3%	Intact
13	Noisy Knob	18755	657	1103	9%	Slip occurred in a small but densely burrowed area on the SE edge
14	Middle	59218	400	3809	7%	Windfall around outer edges, minor slips
18	Rowe 1&2	33540	1197	2607	11%	Large slips in the centre, and windfall throughout, continuing into 2019
	Rowe 3	9323	0	215	2%	Not considered separately to Rowe 1&2
	Rowe 4	5554	0	0	0	Not considered separately to Rowe 1&2
19	Liddy's	86933	2668	0	3%	One smallish slip on a steep slope.
20	Studio	86918	0	583	1%	Intact
21	Liddy's top	13992	0	0	0%	Intact
24-26	Lawson's	24540	0	0	0%	Intact
27	Nuggety	3714	0	0	0%	Intact

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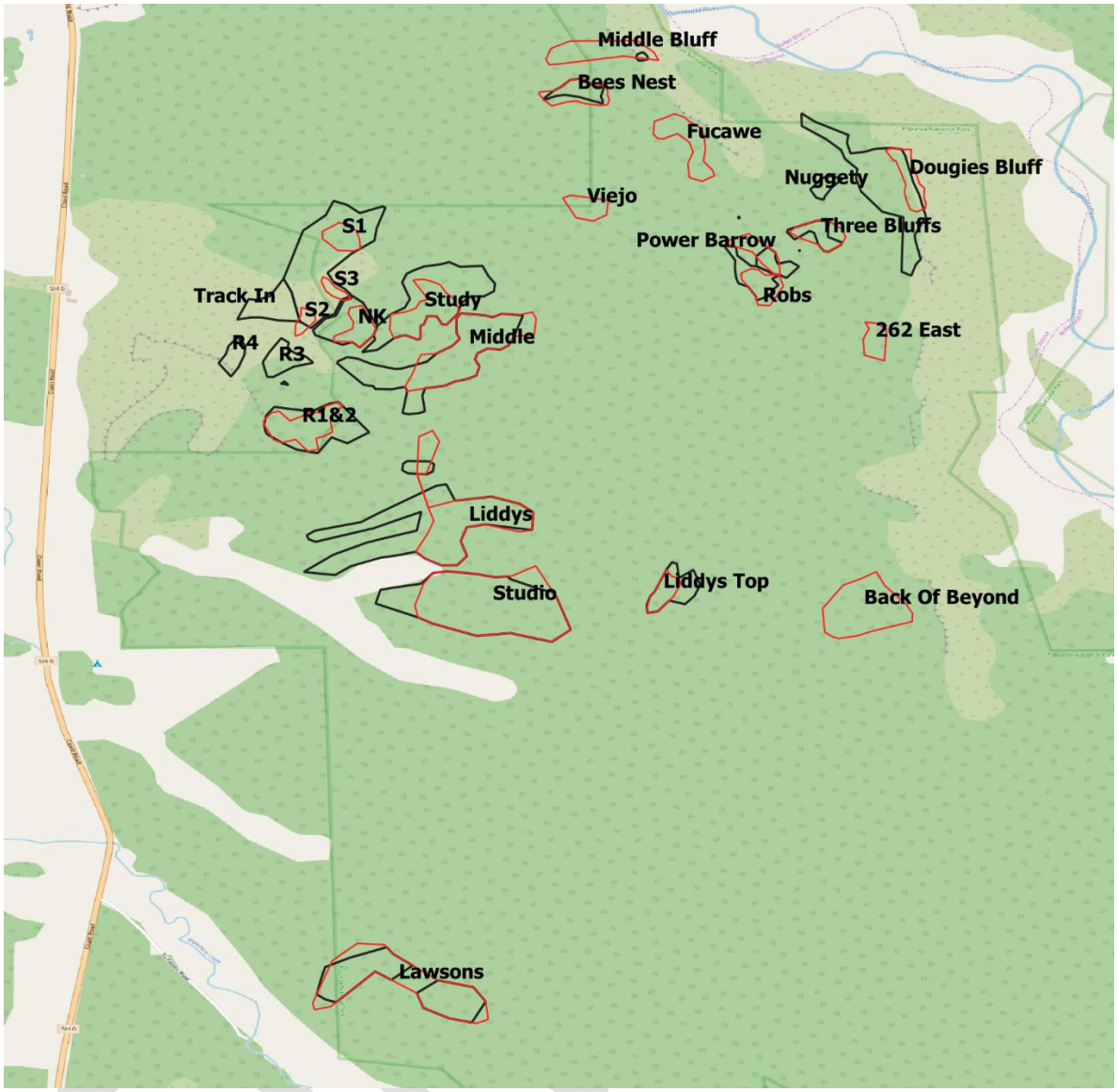

Figure 1. All colonies surveyed in 2007 – 11 (red outlines) and 2019 (black outlines). Colony code names are S1-S3 for Solomon's 1 – 3, R1 – R4 for Rowe 1 – 4. NK for Noisy Knob. Areas with red only were not surveyed in 2019.

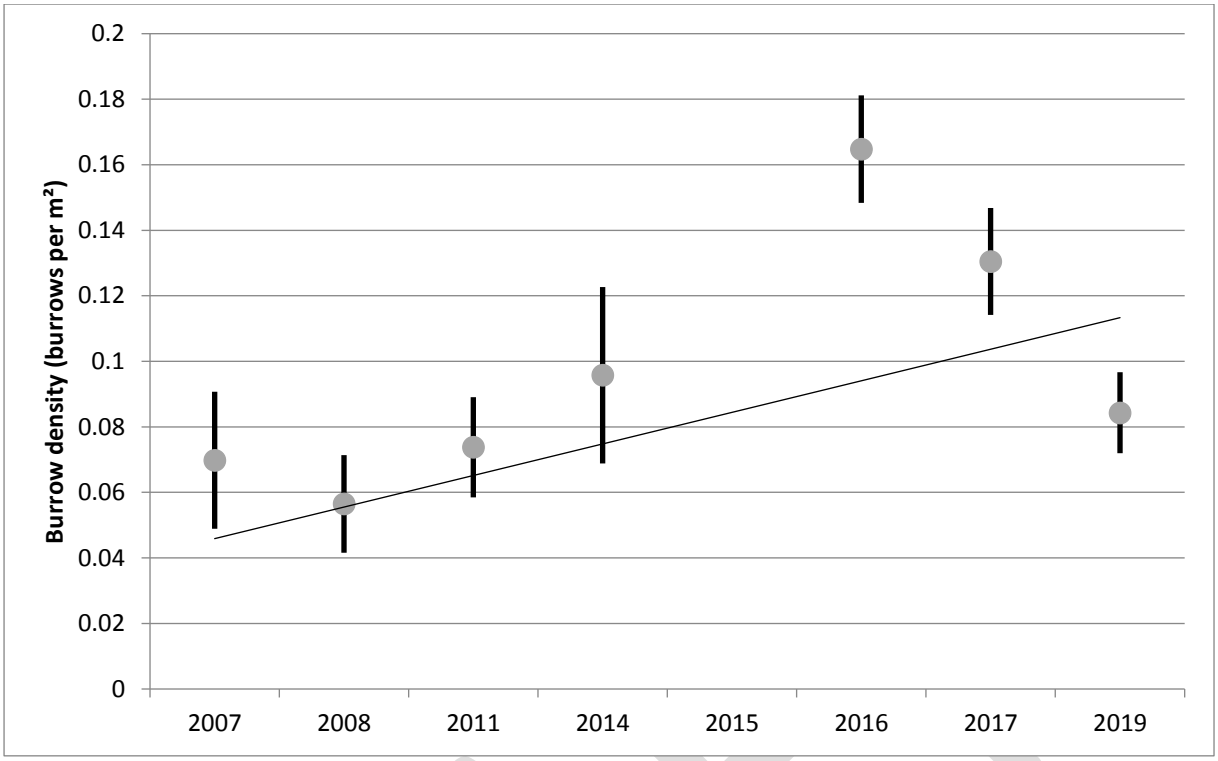

Figure 2. Westland petrel mean burrow density as a function of year. Error bars indicate ± SE. Geometric trend (grey solid line)

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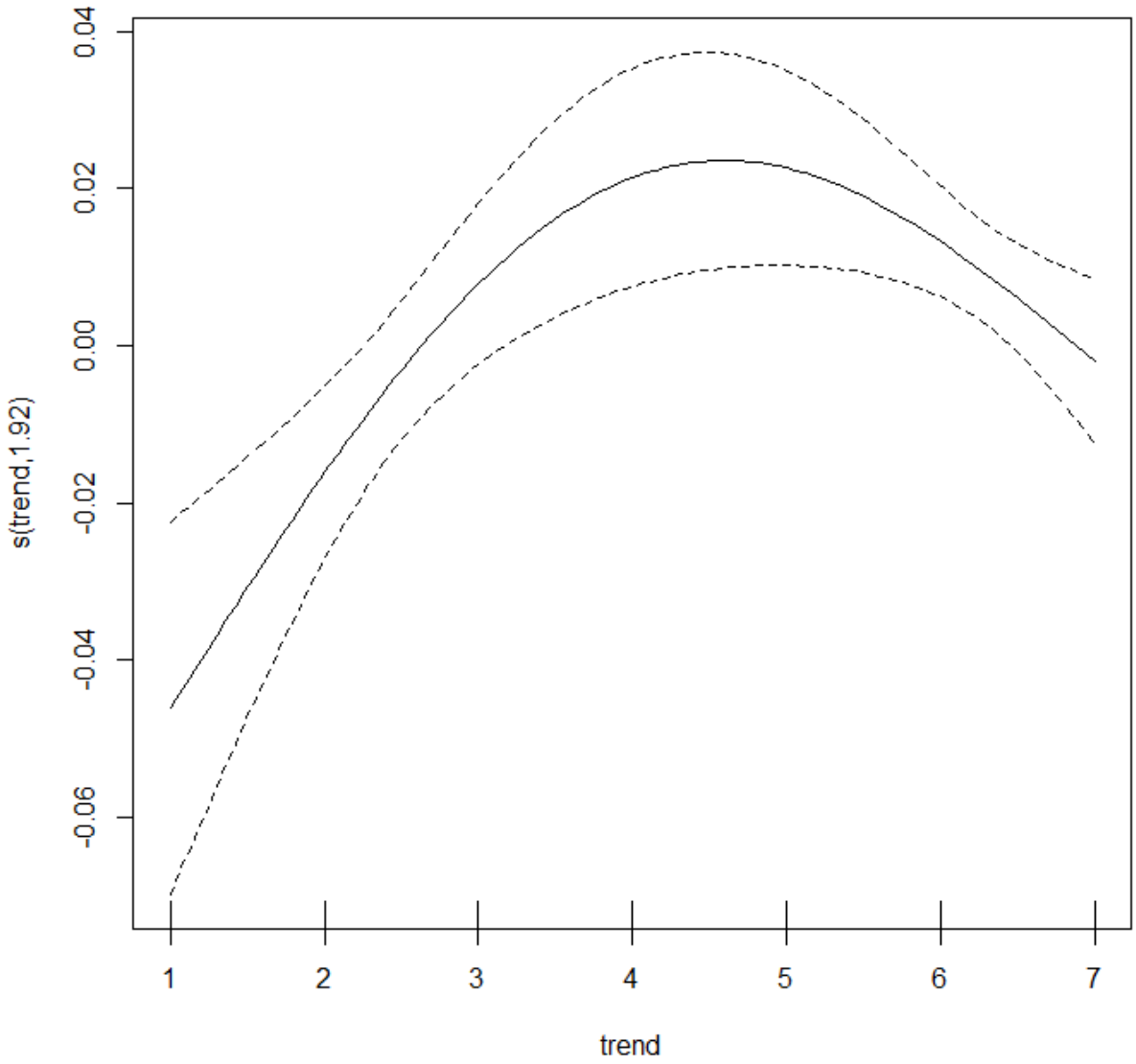

Figure 3. Westland petrel burrow density function. Plot show the predicted burrow density (solid line) and 95% confidence intervals (dashed lines) from a GAMM.