

**Supplementary Material**

**Unravelling male advertisement call variability in the brown tree frog (*Litoria ewingii*) complex by using citizen science**

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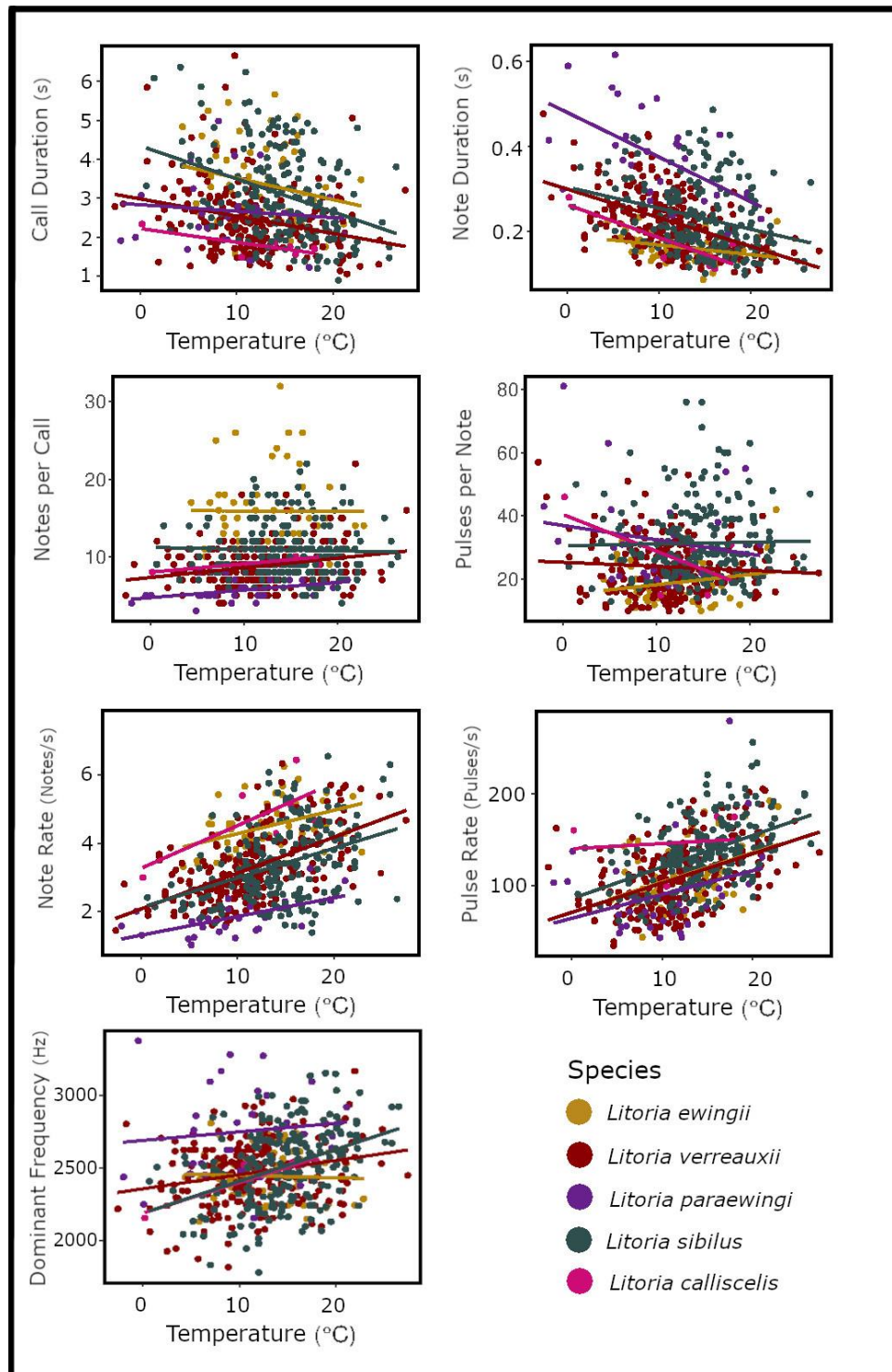
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## Supplementary Data

**Figure S1.** Correlation of ambient temperature (°C) with the call duration, note duration, dominant frequency, notes per call, pulses per note and note rate for *Litoria ewingii*, *Litoria verreauxii*, *Litoria paraewingii*, *Litoria sibilus* and *Litoria calliscelis*. Lines represent linear regressions. The statistical significance of each parameter can be seen in Table S1.



**Table S1.** Pearsons correlation coefficient , pvalue and the Bonferroni adjusted p-value for ambient temperature and advertisement call parameters in *Litoria ewingii*, *Litoria verreauxii*, *Litoria paraewingi*, *Litoria sibilus* and *Litoria calliscelis*. Asterisks signify values with statistical significance.

Call parameter	Species	R- value	P-value	Bonferroni adjusted P-value
Call duration	<i>L. ewingii</i>	-0.260	<0.001*	0.001*
	<i>L. verreauxii</i>	-0.354	<0.001*	<0.001*
	<i>L. paraewingi</i>	-0.107	0.571	3.999
	<i>L. sibilus</i>	-0.746	0.089	0.620
	<i>L. calliscelis</i>	-0.237	0.078	0.548
Note duration	<i>L. ewingii</i>	-0.504	<0.001*	<0.001*
	<i>L. verreauxii</i>	-0.277	<0.001*	<0.001*
	<i>L. paraewingi</i>	-0.559	0.001*	0.009
	<i>L. sibilus</i>	-0.813	0.049	0.344
	<i>L. calliscelis</i>	-0.314	0.019	0.128
Dominant frequency	<i>L. ewingii</i>	0.229	0.001*	0.004*
	<i>L. verreauxii</i>	0.389	<0.001*	<0.001*
	<i>L. paraewingi</i>	0.110	0.562	3.937
	<i>L. sibilus</i>	0.917	0.010	0.070
	<i>L. calliscelis</i>	-0.043	0.7545	5.282
Notes per call	<i>L. ewingii</i>	0.241	0.001*	0.002*
	<i>L. verreauxii</i>	-0.031	0.654	4.582
	<i>L. paraewingi</i>	0.404	0.026*	0.187
	<i>L. sibilus</i>	0.679	0.138	0.969
	<i>L. calliscelis</i>	-0.004	0.978	6.844
Pulses per note	<i>L. ewingii</i>	-0.077	0.249	1.744
	<i>L. verreauxii</i>	0.022	0.751	5.263
	<i>L. paraewingi</i>	-0.177	0.346	2.427
	<i>L. sibilus</i>	-0.633	0.177	1.24
	<i>L. calliscelis</i>	0.21	0.120	0.843
Note rate	<i>L. ewingii</i>	0.564	<0.001*	<0.001*
	<i>L. verreauxii</i>	0.375	<0.001*	0.841
	<i>L. paraewingi</i>	0.589	<0.001*	0.004*
	<i>L. sibilus</i>	0.702	0.120	0.841
	<i>L. calliscelis</i>	0.403	0.002*	0.015

Pulse rate	<i>L. ewingii</i>	0.459	<0.001*	<0.001*
	<i>L. verreauxii</i>	0.454	<0.001*	<0.001*
	<i>L. paraewingi</i>	0.301	0.106	0.740
	<i>L. sibilus</i>	0.117	0.826	5.782
	<i>L. calliscelis</i>	0.404	0.002*	0.014

**Table S2.** Male advertisement call parameters for *Litoria ewingii*, *Litoria verreauxii*, *Litoria paraewingi*, *Litoria sibilus* and *Litoria calliscelis*. The data table shows the maximum, minimum and mean of each temporal call parameter, inclusive of outliers.

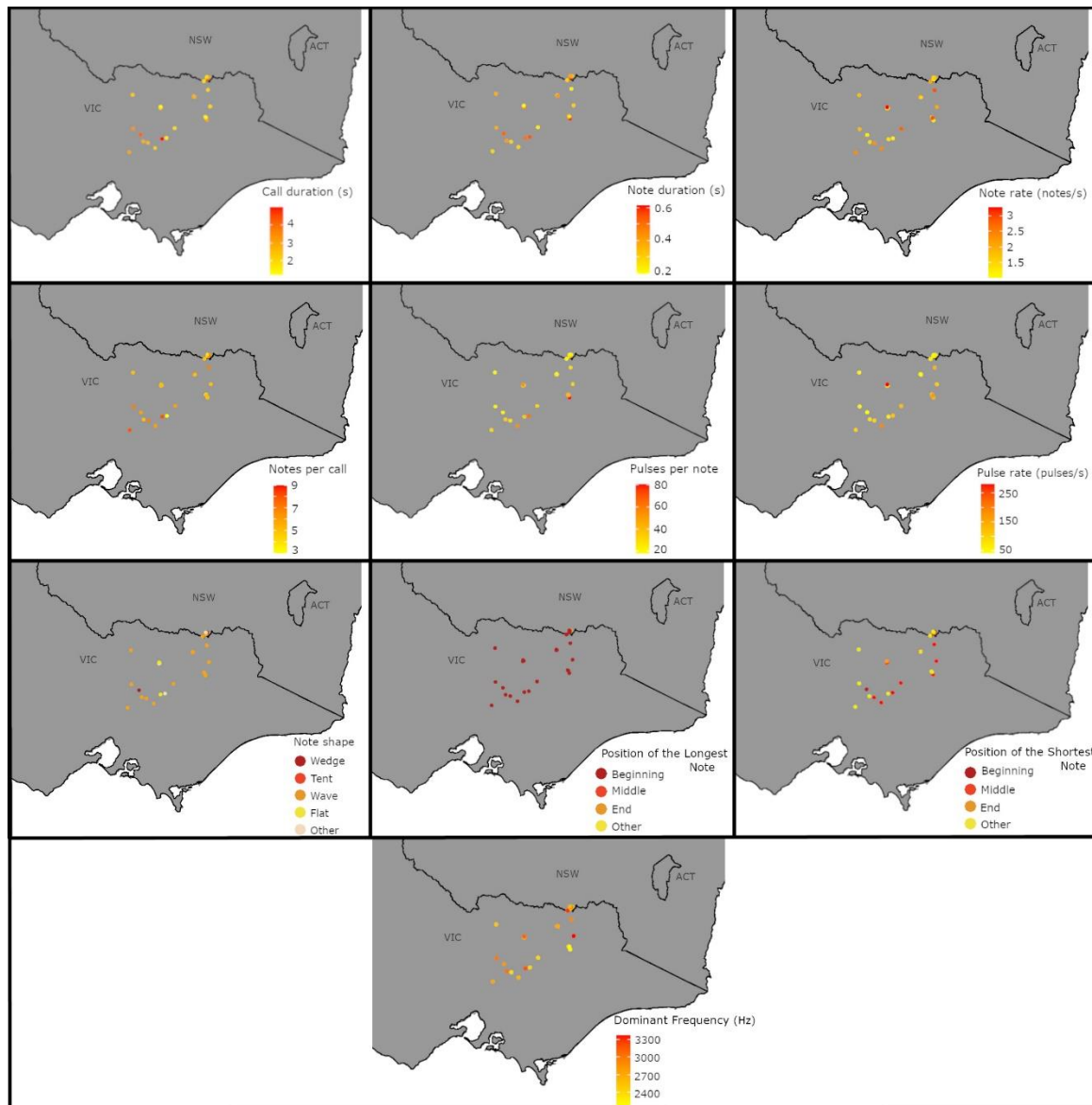
Parameters with asterisks indicate those whose result is shown as a mode (as opposed to a range with the mean). See methods (Table 1) for parameter definitions.

	Number of calls (n)	Call duration (s)	Note duration (s)	Dominant frequency (Hz)	Notes / call	Pulses / note	Note rate (notes/s)	Pulse rate (pulses/s)	Note shape *	Longest note *	Shortest note *
<i>L. ewingii</i>	236	1.05-6.66 (2.44)	0.10-0.48 (0.22)	1817-3167 (2472)	4-22 (9)	10-57 (24)	1.44-6.35 (3.33)	33.59- 205.69 (108.56)	Wedge	Beginning	Other
<i>L. verreauxii</i>	210	0.9-6.36 (3.1)	0.1-0.49 (0.23)	1781-3153 (2510)	4-22 (11)	13-76 (31)	1.38-6.56 (3.43)	60.55- 256.78 (136.58)	Wave	End	Beginning
<i>L. paraewingi</i>	31	1.23-4.98 (2.64)	0.2-0.62 (0.37)	2156-3375 (2738)	3-9 (6)	18-81 (32)	1.02-3.26 (1.89)	42.52- 280.07 (91.11)	Wave	Beginning	Middle
<i>L. sibilus</i>	6	1.48-2.37 (1.78)	0.11-0.28 (0.17)	2156-2541 (2451)	8-11 (9)	15-46 (26)	2.30-6.45 (4.82)	98.91- 175.17 (147.04)	Tent	End	Beginning
<i>L. calliscelis</i>	59	1.57-5.66 (3.35)	0.09-0.23 (0.16)	2063-2809 (2444)	7-32 (16)	10-42 (19)	2.72-7.62 (4.60)	43.02- 192.68 (112.18)	Other	End	Beginning

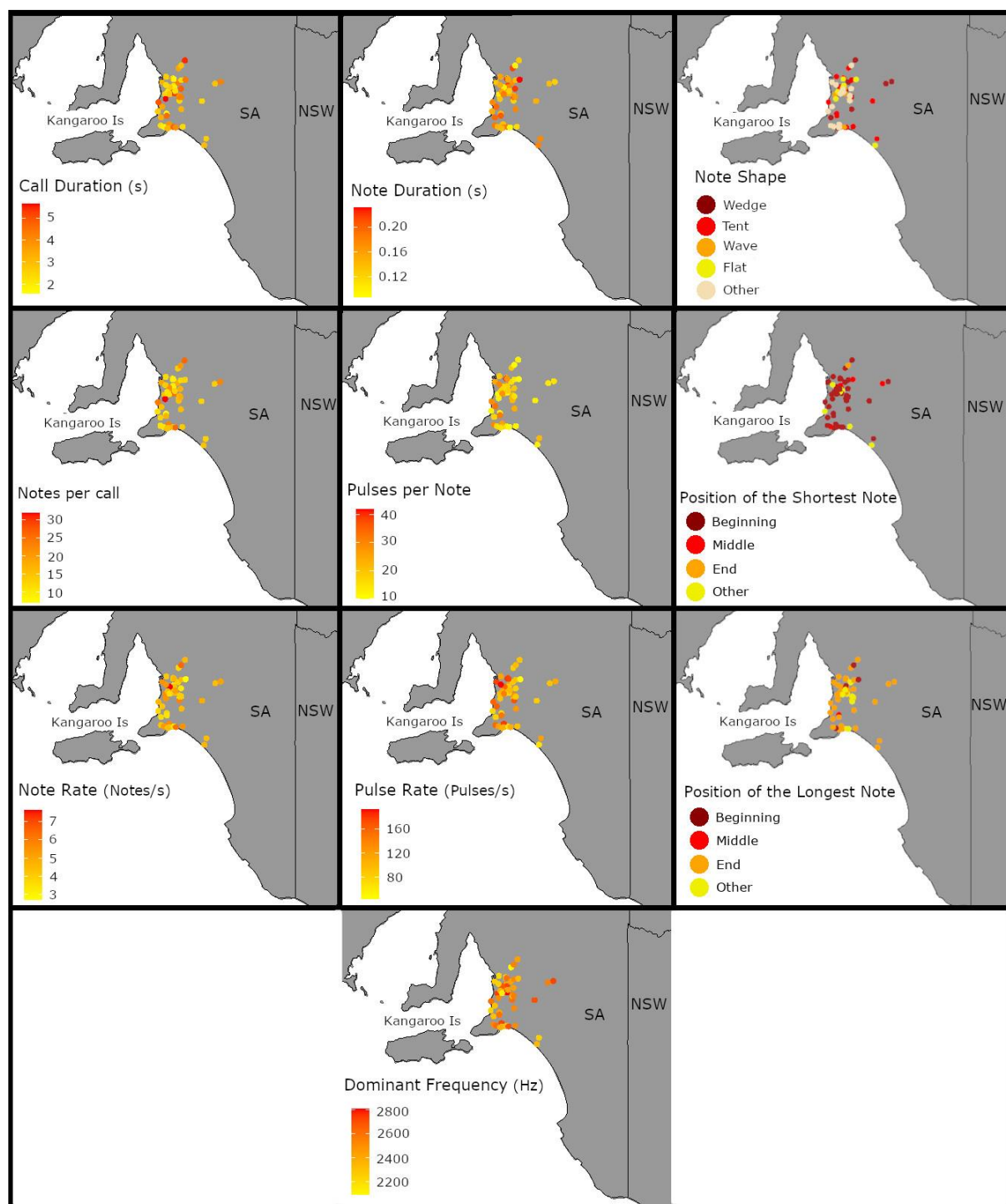
**Table S3.** List of *Litoria ewingii*, *Litoria verreauxii*, *Litoria paraewingii*, *Litoria sibilus* and *Litoria calliscelis* outliers (above the 3rd quartile + 1.5x interquartile range or below the 1st quartile - 1.5x interquartile range) that were identified and removed during data analysis to create Figure 4 and Table 2. Bolded fields indicate the reason/s why a recording was identified as an outlier.

ID	Species	State	Call duration	Note duration	Dom frequency	Notes/call	Pulses/note	Note rate	Pulse rate	Note shape	Longest note	Shortest note	Reason
242477	<i>Lewingi</i>	TAS	<b>4.45</b>	0.23	2789	15	25	3.15	105.53	Wedge	Beginning	Beginning	Call duration
16892	<i>Lewingi</i>	NSW	2.68	0.13	2273	<b>15</b>	25	5.23	185.31	Wave	Middle	Beginning	Notes per call
112868	<i>Lewingi</i>	VIC	2.93	0.11	2635	<b>18</b>	13	5.79	104.16	Wedge	End	Beginning	Notes per call
26197	<i>Lewingi</i>	NSW	2.68	0.22	<b>1875</b>	8	16	2.61	67.75	Wedge	End	Beginning	Dominant frequency
5554	<i>Lewingi</i>	NSW	3.5	0.14	2098	<b>15</b>	19	4	124.28	Wave	End	Beginning	Notes per call
12279	<i>Lewingi</i>	NSW	3.02	0.14	2256	<b>15</b>	23	4.63	153.62	Wave	End	Beginning	Notes per call
10563	<i>Lewingi</i>	NSW	2.36	0.12	2239	16	23	<b>6.35</b>	178.55	Other	End	Beginning	Note rate
7574	<i>Lewingi</i>	NSW	3.2	0.15	2449	<b>16</b>	22	4.68	135.91	Wave	Other	Beginning	Notes per call
240261	<i>Lewingi</i>	TAS	<b>4.56</b>	0.26	2672	13	23	2.63	84.79	Wedge	Beginning	Middle	Call duration
75848	<i>Lewingi</i>	TAS	2.78	<b>0.48</b>	2219	5	57	1.44	119.84	Wedge	Beginning	Middle	Note duration
75848	<i>Lewingi</i>	TAS	2.78	0.48	2219	5	<b>57</b>	1.44	119.84	Wedge	Beginning	Middle	Pulses per note
46735	<i>Lewingi</i>	TAS	<b>4.92</b>	0.34	2531	11	29	2.03	84.87	Wedge	Beginning	Middle	Call duration
237279	<i>Lewingi</i>	VIC	1.79	0.28	2719	5	<b>53</b>	2.23	192.69	Wave	Beginning	Middle	Pulses per note
87684	<i>Lewingi</i>	TAS	3.08	<b>0.43</b>	2156	6	33	1.62	74.51	Flat	Beginning	Middle	Note duration
29402	<i>Lewingi</i>	TAS	<b>5.84</b>	0.41	2221	12	36	1.88	84.56	Other	Beginning	Middle	Call duration
27094	<i>Lewingi</i>	TAS	<b>5.07</b>	0.31	2625	11	20	1.97	63.66	Wedge	End	Middle	Call duration
109843	<i>Lewingi</i>	TAS	<b>5.06</b>	0.17	2576	22	23	4.15	129.97	Wave	Beginning	End	Call duration
87875	<i>Lewingi</i>	TAS	<b>4.65</b>	0.28	2438	12	20	2.37	68.75	Wedge	Beginning	Other	Call duration
48001	<i>Lewingi</i>	TAS	3.32	0.16	2420	<b>15</b>	14	4.21	86.3	Wedge	Beginning	Other	Notes per call
144191	<i>Lewingi</i>	TAS	<b>5.85</b>	0.42	1817	12	47	1.88	112.03	Wedge	Beginning	Other	Call duration
129171	<i>Lewingi</i>	VIC	<b>6.66</b>	0.25	2510	18	15	2.55	54.27	Tent	Beginning	Other	Call duration
401009	<i>Lewingi</i>	VIC	2.56	0.25	<b>3167</b>	8	26	2.73	99.8	Wave	Beginning	Other	Dominant frequency
70749	<i>Lewingi</i>	TAS	3.43	0.38	2188	8	<b>51</b>	2.04	133.13	Flat	Beginning	Other	Pulses per note
237076	<i>L.verreauxii</i>	NSW	5.02	0.17	2885	<b>21</b>	21	3.98	118.3	Wave	Beginning	Beginning	Notes per call
30003	<i>L.verreauxii</i>	QLD	3.79	0.43	2563	8	<b>76</b>	1.85	169.2	Wave	End	Beginning	Pulses per note
236028	<i>L.verreauxii</i>	NSW	0.89	0.16	2738	4	38	3.38	<b>234.21</b>	Wave	End	Beginning	Pulse rate
111936	<i>L.verreauxii</i>	NSW	2.63	0.21	3148	11	51	3.81	<b>230.72</b>	Wave	End	Beginning	Pulse rate
33461	<i>L.verreauxii</i>	NSW	5.53	0.19	2682	<b>22</b>	17	3.8	87.17	Wedge	End	Beginning	Notes per call
81885	<i>L.verreauxii</i>	NSW	4.83	0.18	2406	<b>20</b>	22	3.94	115.2	Wedge	End	Beginning	Notes per call
39200	<i>L.verreauxii</i>	QLD	2.69	0.24	3034	10	63	3.35	<b>256.78</b>	Wave	Middle	Beginning	Pulse rate
39200	<i>L.verreauxii</i>	QLD	2.69	0.24	3034	10	<b>63</b>	3.35	256.78	Wave	Middle	Beginning	Pulses per note
26562	<i>L.verreauxii</i>	NSW	4.43	<b>0.49</b>	2688	8	37	1.58	75.2	Wave	Middle	Beginning	Note duration
57	<i>L.verreauxii</i>	QLD	4.36	0.44	2635	8	<b>68</b>	1.6	153.19	Wave	Middle	Beginning	Pulses per note
139272	<i>L.verreauxii</i>	QLD	3.6	0.36	2925	9	<b>76</b>	2.23	210.45	Wave	Middle	Beginning	Pulses per note
28618	<i>L.verreauxii</i>	NSW	<b>6.36</b>	0.34	2044	14	32	2.04	91.27	Wedge	Other	Beginning	Call duration
66	<i>L.verreauxii</i>	VIC	<b>6.24</b>	0.29	2270	18	55	2.73	188.04	Wave	Beginning	Other	Call duration
25165	<i>L.verreauxii</i>	NSW	4.7	0.2	2882	<b>22</b>	29	4.47	143.34	Wave	Beginning	Other	Notes per call
230826	<i>L.paraewingii</i>	VIC	1.23	0.19	3094	5	<b>54</b>	3.26	280.07	Flat	Beginning	End	Pulses per note
250234	<i>L.paraewingii</i>	VIC	1.68	0.54	2461	3	<b>63</b>	1.19	115.39	Other	Beginning	Middle	Pulses per note
251455	<i>L.paraewingii</i>	VIC	3.07	0.59	2250	5	<b>81</b>	1.3	137.33	Wave	Beginning	Middle	Pulses per note
400389	<i>L.paraewingii</i>	VIC	2.13	0.29	2638	6	55	2.34	<b>189.91</b>	Wave	Beginning	Middle	Pulse rate
25993	<i>L.paraewingii</i>	VIC	<b>4.98</b>	0.49	3167	8	36	1.41	70.7	Flat	Beginning	Other	Call duration
71207	<i>L.sibilus</i>	SA	2.34	0.28	<b>2156</b>	8	46	3	160.27	Tent	End	Beginning	Dominant frequency
136741	<i>L.calliscelis</i>	SA	5.46	0.13	2441	<b>26</b>	13	4.58	91.61	Wedge	End	Beginning	Notes per call
4229	<i>L.calliscelis</i>	SA	2.76	0.1	2682	22	16	<b>7.62</b>	156.39	Wedge	End	Beginning	Note rate
89081	<i>L.calliscelis</i>	SA	5.66	0.13	2517	<b>32</b>	13	5.47	89.72	Flat	End	Beginning	Notes per call
163312	<i>L.calliscelis</i>	SA	3.47	0.22	2288	14	<b>42</b>	3.74	186.44	Flat	End	Beginning	Pulses per note
67590	<i>L.calliscelis</i>	SA	3.99	0.09	2691	<b>26</b>	10	6.26	108.67	Tent	Other	Beginning	Notes per call
239047	<i>L.calliscelis</i>	SA	5.1	0.13	2378	<b>26</b>	12	4.91	79.68	Wave	End	Other	Notes per call

**Figure S2.** Geographic variation in call duration (s), note duration (s), dominant frequency (Hz), note rate, notes per call, pulses per note, pulse rate, note shape and the positions of the longest and shortest notes present within the male advertisement call of *Litoria paraewingi*.

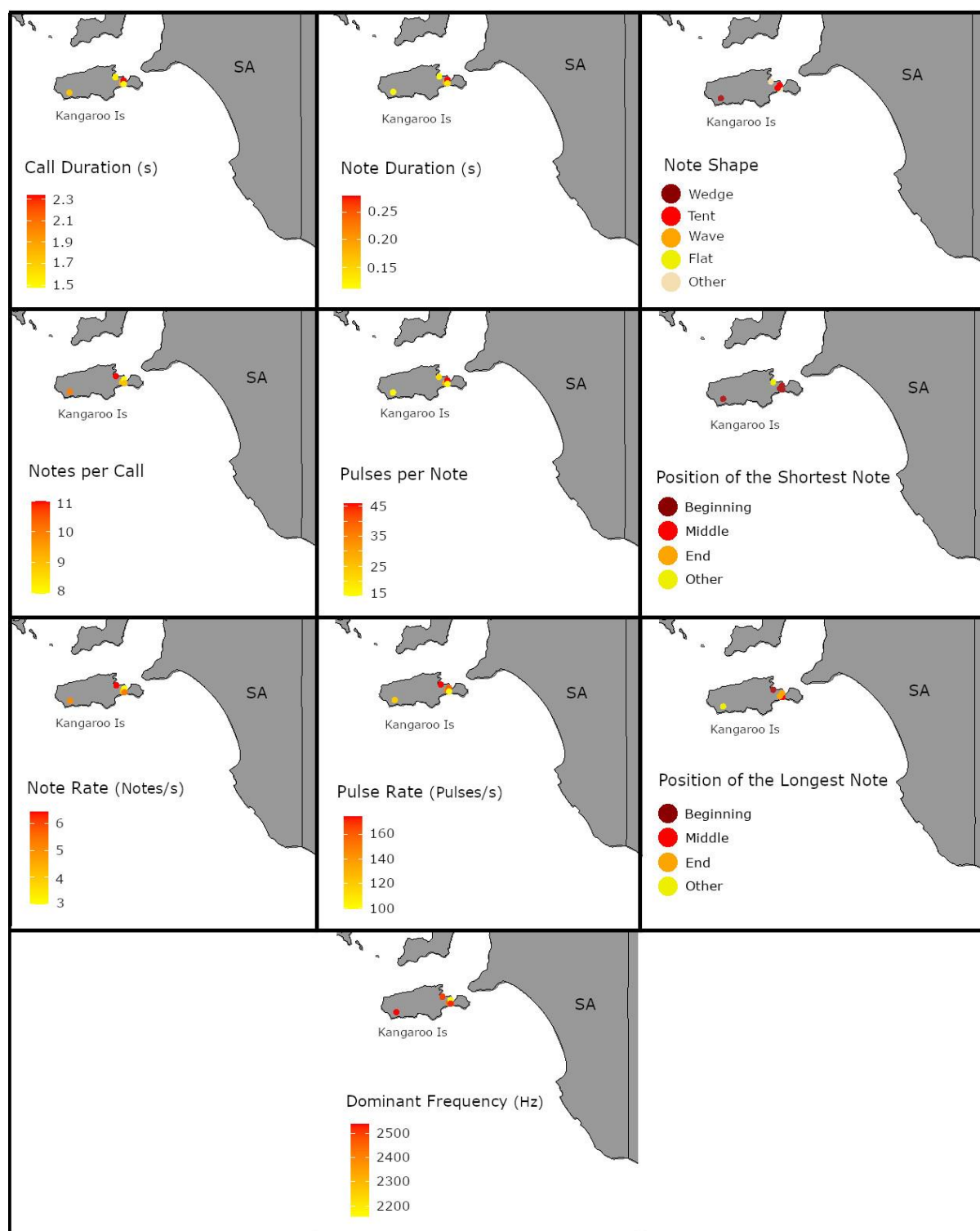


**Figure S3.** Geographic variation in call duration (s), note duration (s), dominant frequency (Hz), note rate, notes per call, pulses per note, pulse rate, note shape, positions of the longest and shortest notes present within the male advertisement call of *Litoria calliscelis*.

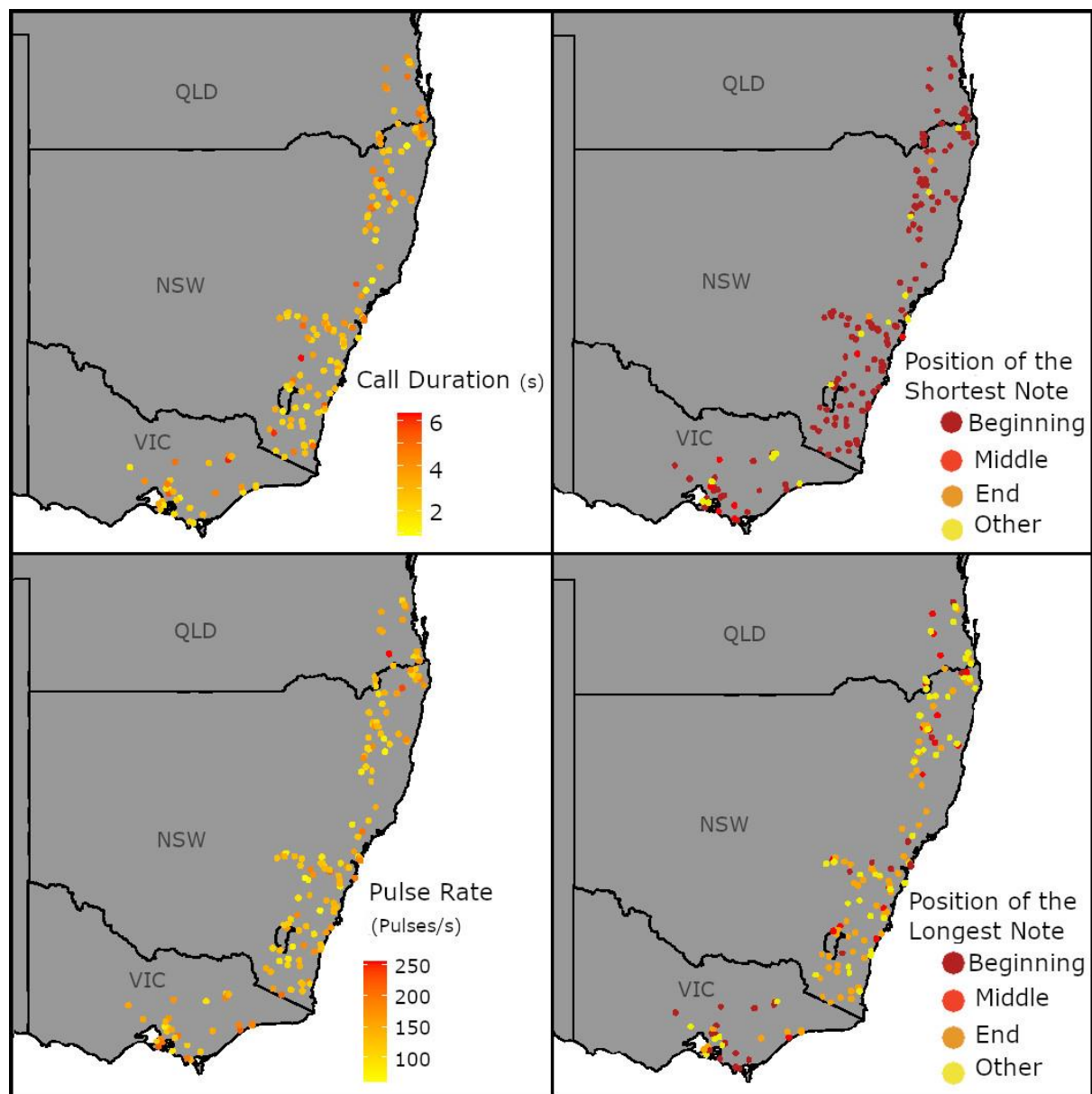




**Figure S4.** Geographic variation in call duration (s), note duration (s), dominant frequency (Hz), note rate, notes per call, pulses per note, pulse rate, note shape, positions of the longest and shortest notes present within the male advertisement call of *Litoria sibilus*.



**Figure S5.** Geographic variation in call duration (s), positions of the longest and shortest notes and pulse rate present within the male advertisement call of *Litoria verreauxii*.



**Table S4.** Male advertisement call parameters for the subspecies of *Litoria verreauxii*, *Litoria verreauxii verreauxii* and *Litoria verreauxii alpina*. The data table shows the maximum, minimum and mean of each temporal call parameter, inclusive of outliers.

	Number of calls (n)	Call duration (s)	Note duration (s)	Dominant frequency (Hz)	Notes / call	Pulses / note	Note rate (notes/s)	Pulse rate (pulses/s)	Frequency pattern *	Note shape *	Longest note *	Shortest note *
<i>L. v. alpina</i>	13	1.46-6.24 (3.14)	0.13-0.33 (0.21)	1781-2560 (2174)	7-18 (11)	18-55 (28)	2.45-5.35 (3.5)	91.58-188 (129)	Up and down (30.77%)	Wave (76.92%)	End (38.34%)	Beginning (69.23)
<i>L. v. verreauxii</i>	197	0.9-6.36 (3.09)	0.1-0.49 (0.23)	1833-3153 (2530)	4-22 (11)	13-76 (31)	1.38-6.56 (3.43)	60.55- 256.78 (137.09)	Increasing (42.64%)	Wave (70.05%)	End (44.15%)	Beginning (88.83%)

**Figure S6.** Geographic variation in call duration (s), note duration (s) dominant frequency (Hz), pulses per note and note shape present within the male advertisement call of *Litoria ewingii*.

