Supplement 4. Foraging data matrix of the breeding bird assemblage in the European study site used in the data analysis. Foraging observations were collected in the period 1997−2000. Key: 1. Mean foraging height, 2. Standard deviation (SD) of foraging height, 3. Foraging maneuver on beech *Fagus sylvatica*, 4. Foraging maneuver on silver fir *Abies alba*, 5. Foraging maneuver on Norway spruce *Picea abies*, 6. Foraging maneuver on sycamore *Acer pseudoplatanus*, 7. Foraging maneuver on elm *Ulmus glabra*, 8. Foraging maneuver on rowan *Sorbus aucuparia*, 9. Foraging maneuver on hazel *Corylus avellana*, 10. Foraging maneuver on other live tree species, 11. Foraging maneuver on litter, 12. Foraging maneuver on bare ground, 13. Foraging maneuver herb layer, 14. Foraging maneuver on dead standing tree, 15. Foraging maneuver on fallen dead tree, 16. Foraging maneuver on or in water, 17. Foraging maneuver on rock, 18. Foraging maneuver in airspace, 19. Foraging movement in horizontal direction, 20. Foraging movement in vertical direction, 21. Glean from trunk, 22. Glean from leaf, 23. Glean from branch, 24. Glean from twig, 25. Glean in combination with other foraging substrate, 26. Hover at trunk, 27. Hover at leaf, 28. Hover at branch, 29. Hover at twig, 30. Hover in combination with other foraging substrate, 31. Probe or peck into trunk, 32. Probe or peck into branch, 33. Probe or peck into other foraging substrate, 34. Hawk or sally to trunk, 35. Hawk or sally to leaf, 36. Hawk or sally to branch, 37. Hawk or sally to twig, 38. Hawk or sally in combination with other substrate (usually air).

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Aeg cau	11.7	7.5	43.3	18.3	6.7	11.7	5.0	8.3	5.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	50.0	0.0	1.7
Cer fam	11.0	8.2	21.4	34.7	9.5	11.0	2.7	0.6	0.0	0.3	0.0	0.0	0.0	13.4	1.5	0.0	1.5	3.6	12.8	85.5	81.6
Cin cin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	58.2	31.3	0.0	0.0	0.0	3.0
Del urb	73.1	49.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Den leu	12.9	9.5	19.8	11.6	7.0	7.0	9.3	0.0	1.2	0.0	0.0	0.0	0.0	38.4	5.8	0.0	0.0	0.0	20.9	80.2	3.5
Eri rub	1.9	2.1	20.9	6.1	7.8	4.3	0.9	1.7	0.0	1.7	15.7	14.8	3.5	5.2	8.7	0.0	4.3	4.3	14.8	0.0	5.2
Fic alb	16.5	8.9	30.0	4.3	1.4	14.3	2.9	0.0	0.0	0.0	2.9	0.0	0.0	1.4	0.0	0.0	0.0	42.9	0.0	1.4	1.4
Fic par	6.3	4.6	25.7	11.2	0.6	6.1	1.7	0.6	3.4	1.1	2.8	4.5	4.5	3.4	8.4	0.0	0.0	26.3	6.1	0.6	2.2
Fri coe	12.8	8.2	43.0	27.5	6.9	4.2	2.4	0.6	1.5	0.9	0.9	3.9	0.6	0.3	1.5	0.0	0.0	6.0	74.0	0.3	1.5
Mot cin	0.8	1.1	0.8	0.0	0.0	0.8	0.0	0.0	0.0	0.0	4.1	2.5	2.5	0.0	9.1	9.9	44.6	25.6	2.5	0.0	0.8
Mus str	18.4	9.7	13.8	12.3	3.1	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	66.2	0.0	0.0	0.0
Per ate	15.4	9.6	28.3	42.2	21.2	1.6	0.5	0.7	0.0	0.5	0.0	0.0	0.2	2.7	0.0	0.0	0.0	1.8	93.8	1.5	2.0
Poe pal	11.6	7.3	39.7	20.1	6.7	11.2	3.9	1.1	5.6	1.1	0.0	0.0	0.6	8.9	0.0	0.0	0.6	0.6	88.8	1.1	0.6
Phy col	10.9	7.5	44.4	30.6	12.8	3.0	1.0	0.7	2.0	0.0	0.3	0.0	0.7	0.0	0.0	0.0	0.0	4.4	84.2	0.0	0.3
Phy sib	11.7	7.8	62.8	12.2	3.8	9.0	2.6	0.6	2.6	0.6	0.0	0.0	0.0	0.6	0.0	0.0	0.0	5.1	78.2	0.0	0.0
Phy tro	9.3	5.7	12.7	10.9	15.5	40.0	0.0	10.0	2.7	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	4.5	90.0	0.0	0.0
Pic tri	11.1	7.9	0.0	24.4	26.7	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.8	6.7	0.0	0.0	0.0	17.8	84.4	4.4
Pru mod	1.3	1.5	9.7	3.2	6.5	3.2	0.0	0.0	0.0	0.0	22.6	29.0	9.7	0.0	9.7	0.0	3.2	3.2	16.1	0.0	0.0
Pyr pyr	3.3	5.3	13.9	0.0	0.0	2.8	2.8	0.0	0.0	0.0	27.8	5.6	36.1	0.0	8.3	0.0	0.0	2.8	22.2	0.0	0.0
Reg reg	15.5	9.9	2.8	66.7	29.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	91.6	0.0	0.3
Sit eur	11.8	7.7	21.6	27.2	10.8	7.5	4.3	0.0	0.0	3.3	0.0	0.0	0.0	23.0	0.7	0.0	0.0	1.6	47.5	53.4	39.3

Syl atr	4.9	4.1	31.5	20.2	2.2	6.7	1.1	1.7	7.3	1.7	0.0	2.2	20.8	0.6	1.7	0.0	0.6	1.7	70.2	0.6	0.6
Tro tro	0.5	0.4	6.9	3.9	2.0	0.0	0.0	0.0	0.0	1.0	6.9	22.5	20.6	6.9	24.5	0.0	2.0	2.9	25.5	2.0	19.6
Tur mer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.6	16.7	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0
Tur phi	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	70.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tur tor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.9	57.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Species	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Aeg cau	46.7	11.7	30.0	0.0	0.0	36.7	0.0	6.7	0.0	0.0	0.0	0.0	1.7	5.0	0.0	0.0	0.0
Cer fam	4.2	21.1	4.5	1.8	0.3	1.2	0.0	0.6	0.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	3.6
Cin cin	0.0	0.0	0.0	97.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Del urb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Den leu	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.9	40.7	1.2	0.0	0.0	0.0	0.0	0.0
Eri rub	4.3	2.6	5.2	32.2	1.7	7.0	0.9	5.2	0.9	0.0	0.0	0.0	16.5	7.0	6.1	3.5	8.7
Fic alb	1.4	0.0	1.4	0.0	0.0	11.4	1.4	4.3	0.0	0.0	0.0	0.0	5.7	15.7	4.3	8.6	48.6
Fic par	1.1	1.1	1.1	1.7	1.1	16.2	0.6	0.6	0.0	0.0	0.0	0.0	11.7	24.0	2.8	10.6	34.1
Fri coe	46.3	7.5	35.2	6.3	0.6	30.1	0.9	8.4	0.3	0.0	0.3	0.0	0.6	0.9	0.9	0.3	6.0
Mot cin	0.8	0.0	0.8	72.7	0.0	0.8	0.0	0.0	4.1	0.0	0.0	0.0	0.8	0.8	0.0	0.0	22.3
Mus str	0.0	0.0	0.0	0.0	1.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	3.1	13.8	4.6	6.2	70.8
Per ate	85.4	9.0	61.8	0.5	0.0	11.7	0.0	6.8	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	1.8
Poe pal	54.2	22.3	31.3	2.8	0.0	12.3	0.0	2.8	0.0	0.0	3.4	0.0	0.0	0.6	0.0	0.0	0.6
Phy col	41.4	3.0	22.6	0.3	0.0	56.2	3.0	24.2	0.0	0.7	0.0	0.0	0.0	0.7	0.0	0.7	4.4
Phy sib	35.3	5.1	14.7	0.0	0.0	62.2	1.3	11.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1
Phy tro	67.3	3.6	27.3	0.0	0.0	61.8	2.7	16.4	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	4.5
Pic tri	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.3	15.6	0.0	0.0	0.0	0.0	0.0	0.0
Pru mod	19.4	12.9	12.9	64.5	0.0	3.2	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
Pyr pyr	22.2	2.8	2.8	69.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8
Reg reg	72.9	6.2	73.8	0.0	0.0	35.5	0.0	35.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.9
Sit eur	22.6	28.9	22.6	0.0	0.3	2.0	1.0	1.6	0.0	9.5	9.5	0.0	0.0	0.0	0.7	0.0	1.6
Syl atr	65.7	2.8	18.0	6.7	0.0	23.6	0.0	6.2	0.6	0.0	0.0	0.0	0.0	0.6	0.6	0.0	2.2
Tro tro	25.5	7.8	15.7	42.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0
Tur mer	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tur phi	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0
Tur tor	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Supplement 5. Probabilities $P(G^0 \leq G^*)$ generated in 10 000 random iterations of bootstrap resampling of the North American data matrix at 2−10 partition levels with increasing sample sizes of species (11−22). Four significantly different partitions at critical threshold level $\alpha = 0.1$ systematically reappeared in bootstrapped resampling with increasing sample size from 11 to 22 species, so we can consider four guild model as a stable, with low chance of type II error. Number of groups can be understood as a priori defined number of guilds.

Number of groups	Sample size											
	11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
2 groups	0.22	0.2152	0.2201	0.2211	0.2253	0.2355	0.2379	0.2376	0.2368	0.2437	0.2511	0.2424
3 groups	0.2646	0.2859	0.2997	0.3076	0.3188	0.3377	0.3479	0.3584	0.3694	0.3834	0.3825	0.3957
4 groups	0.2095	0.22	0.2272	0.2341	0.2401	0.2338	0.2392	0.2383	0.2464	0.2471	0.2473	0.2444
5 groups	0.0633	0.0673	0.0684	0.0766	0.071	0.072	0.0758	0.0771	0.0757	0.0766	0.0743	0.071
6 groups	0.0242	0.0269	0.0347	0.0353	0.0404	0.0463	0.0464	0.048	0.0509	0.0547	0.0574	0.0577
7 groups	0.0084	0.0158	0.0158	0.0199	0.0223	0.023	0.0251	0.03	0.0329	0.0369	0.0384	0.0395
8 groups	0.0057	0.0083	0.0111	0.0141	0.0143	0.0177	0.0206	0.0243	0.0263	0.0312	0.0342	0.0357
9 groups	0.0025	0.003	0.0045	0.0065	0.0094	0.0104	0.0132	0.0153	0.0186	0.0226	0.0236	0.0277
10 groups	0.0002	0.001	0.001	0.0019	0.0033	0.0049	0.0069	0.0101	0.0119	0.0166	0.0196	0.0198

Supplement 6. Probabilities $P(G^0 \leq G^*)$ generated in 10 000 random iterations of bootstrap resampling of the Australian data matrix at 2−10 partition levels with increasing sample size (11−41). Three significantly different partitions at critical threshold level $\alpha = 0.1$ systematically reappeared in bootstrapped resampling with increasing sample size from 11 to 41 species, so we can consider three guild model as a stable with low chance of type II error. Nine guild model (9 partitions) systematically reappeared in bootstrapped resampling from sample size 37 to 41, so this guild model has lower statistical stability and thus higher risk of type II error. Nevertheless, nine guild model is biologically the most meaningful (see Results). Number of groups can be understood as a priori defined number of guilds.

Number of	Sample size											
groups	11	12	13	14	15	16	17	18	19	20	21	22
2 groups	0.2517	0.2608	0.2673	0.2756	0.2792	0.2918	0.2961	0.2979	0.3124	0.3168	0.3255	0.3227
3 groups	0.1389	0.1496	0.1665	0.1844	0.1957	0.2096	0.2255	0.2433	0.2547	0.2617	0.2746	0.2811
4 groups	0.0099	0.0121	0.0119	0.0134	0.0123	0.0152	0.0181	0.016	0.0205	0.0212	0.0229	0.0241
5 groups	0.0134	0.0145	0.0155	0.0161	0.0178	0.0186	0.0202	0.0182	0.0203	0.0207	0.0238	0.0247
6 groups	0.0193	0.0213	0.0249	0.026	0.0275	0.0331	0.0322	0.0338	0.038	0.0399	0.0401	0.0438
7 groups	0.0097	0.0122	0.0152	0.0154	0.0168	0.0194	0.0201	0.0228	0.0212	0.0231	0.0258	0.0297
8 groups	0.0074	0.0088	0.0128	0.0147	0.0157	0.0199	0.0221	0.0264	0.0274	0.032	0.0355	0.039
9 groups	0.0033	0.0036	0.0065	0.0092	0.0136	0.014	0.0199	0.0233	0.0276	0.0335	0.0372	0.0416
10 groups	0.0003	0.0005	0.0009	0.0013	0.003	0.0036	0.0041	0.0071	0.0068	0.0098	0.0125	0.0137

Number of	Sample size											
groups	23	24	25	26	27	28	29	30	31	32	33	34
2 groups	0.3224	0.3351	0.3336	0.3418	0.3433	0.3453	0.3502	0.3542	0.3669	0.365	0.3686	0.371
3 groups	0.2949	0.3159	0.319	0.3304	0.3339	0.3386	0.3512	0.3605	0.3695	0.3651	0.3794	0.3826
4 groups	0.0264	0.0258	0.029	0.0292	0.0276	0.0302	0.0324	0.0344	0.0367	0.0349	0.0399	0.0428
5 groups	0.0283	0.0305	0.0304	0.0324	0.0344	0.0344	0.0384	0.0426	0.0396	0.0443	0.0474	0.0467
6 groups	0.0465	0.0476	0.053	0.0547	0.0578	0.0565	0.0617	0.0649	0.0652	0.0702	0.0677	0.0743
7 groups	0.0301	0.0321	0.0322	0.0339	0.0391	0.0381	0.0371	0.0378	0.0377	0.04	0.0436	0.0433
8 groups	0.0404	0.0419	0.0431	0.0492	0.0504	0.0509	0.0537	0.0559	0.059	0.0587	0.0592	0.0607
9 groups	0.0462	0.0501	0.0541	0.0609	0.0635	0.0714	0.0756	0.0756	0.0794	0.0809	0.0877	0.0919
10 groups	0.0185	0.0199	0.0263	0.0293	0.0333	0.0393	0.0407	0.0457	0.0526	0.0557	0.0617	0.0649

Supplement 6. Continued.

Number of	Sample size						
groups	35	36	37	38	39	40	41
2 groups	0.3753	0.3833	0.3807	0.3869	0.386	0.3897	0.397
3 groups	0.3886	0.3929	0.4024	0.4105	0.4119	0.4222	0.4204
4 groups	0.0447	0.044	0.0458	0.0472	0.0489	0.0534	0.0548
5 groups	0.0468	0.0504	0.0533	0.0539	0.0595	0.0622	0.0645
6 groups	0.075	0.0809	0.083	0.0845	0.0902	0.0891	0.092
7 groups	0.0428	0.0457	0.0473	0.0481	0.0486	0.0525	0.0521
8 groups	0.0621	0.0672	0.0679	0.0682	0.0739	0.071	0.074
9 groups	0.0994	0.0995	0.1022	0.1078	0.1165	0.1157	0.1135
10 groups	0.0721	0.0799	0.0835	0.0884	0.0961	0.1041	0.1113

Supplement 7. Probabilities $P(G^0 \leq G^*)$ generated in 10 000 random iterations of bootstrap resampling of the European data matrix at 2−10 partition levels with increasing sample size (11−26). Five significantly different partitions at critical threshold level $\alpha = 0.1$ systematically reappeared in bootstrapped resampling with increasing sample size from 11 to 26 species, so we can consider five guild model as a stable with low chance of type II error. However, we interpreted the emerged pattern on the level of eight significantly different groups reappearing in bootstrapped resampling only from the sample size 25 species. This interpretation seemed biologically most reasonable, yet we have to accept high risk of statistical type II error. Number of groups can be understood as a priori defined number of guilds.

Number of	Sample size											
groups	11	12	13	14	15	16	17	18	19	20	21	22
2 groups	0.2022	0.1901	0.1871	0.1937	0.1884	0.1936	0.1984	0.1965	0.1973	0.1951	0.2028	0.2055
3 groups	0.2286	0.226	0.2362	0.2418	0.2432	0.2532	0.263	0.2754	0.2802	0.2786	0.2924	0.2926
4 groups	0.308	0.3273	0.3495	0.3648	0.383	0.3986	0.4049	0.4171	0.4231	0.427	0.4352	0.4412
5 groups	0.1094	0.1271	0.1433	0.1577	0.1817	0.1975	0.2136	0.2297	0.241	0.2539	0.2748	0.285
6 groups	0.0525	0.0709	0.0856	0.1025	0.1215	0.1357	0.1535	0.1672	0.1893	0.2015	0.2138	0.2378
7 groups	0.0244	0.036	0.0445	0.0562	0.0691	0.0804	0.0949	0.1049	0.1134	0.1286	0.1391	0.1527
8 groups	0.0061	0.0089	0.0135	0.0179	0.0256	0.0348	0.0393	0.0463	0.0574	0.0648	0.0724	0.0799
9 groups	0.0009	0.002	0.0018	0.0033	0.0046	0.0093	0.0131	0.0146	0.017	0.0228	0.0254	0.0325
10 groups	0	0.0002	0.0001	0.0004	0.0007	0.0017	0.0029	0.0033	0.0047	0.006	0.0063	0.0083

Number of	Sample size			
groups	23	24	25	26
2 groups	0.2025	0.2066	0.2025	0.2093
3 groups	0.2978	0.3048	0.3098	0.3119
4 groups	0.4471	0.4551	0.4543	0.4569
5 groups	0.298	0.3035	0.3215	0.3242
6 groups	0.2521	0.2662	0.2708	0.2911
7 groups	0.1634	0.1773	0.1795	0.193
8 groups	0.0885	0.0926	0.1011	0.113
9 groups	0.0378	0.0421	0.0473	0.055
10 groups	0.0102	0.0109	0.0138	0.0186

Supplement 8. Eigenvalues, factor contribution to total variance (%), cumulative contribution, and correlation coefficients between the original variables and the first six ordination axes of bootstrapped principal coordinate analysis (BPCoA) from the foraging data matrix of the breeding bird assemblage in the North American site (Nearctic region). The scores of correlation coefficients (≥ 0.5) are indicated by bold letters.

	Axes (Factors)					
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Eigenvalues	3.02	2.57	0.90	0.62	0.51	0.29
Factor contribution to total variance (%)	34.48	29.38	10.26	7.11	5.85	3.27
Cumulative percent (%)	34.48	63.86	74.11	81.22	87.07	90.34
Variables						
1. Hover at leaf	-0.06	**0.77**	**0.51**	0.08	-0.29	-0.12
2. Glean from leaf	-0.02	**0.58**	-0.28	**-0.51**	0.37	-0.23
3. Hover at branch	0.26	-0.00	0.04	-0.08	0.10	-0.02
4. Glean from branch	0.38	-0.29	-0.49	-0.32	-0.07	-0.17
5. Probe (or drill) into branch	0.26	**-0.67**	-0.36	0.02	-0.40	0.01
6. Hover at twig	0.14	0.41	-0.11	-0.15	0.07	-0.15
7. Glean from twig	0.20	0.30	**-0.51**	-0.40	0.29	0.19
8. Hawk (sally) in air	0.16	**0.53**	0.13	0.12	-0.05	-0.38
9. Glean from ground (litter)	-0.83	-0.16	0.32	-0.36	-0.05	0.17
10. Probe into ground (litter)	**-0.70**	-0.20	-0.11	**0.50**	0.43	0.04
11. Hover at trunk	0.14	-0.05	0.14	-0.10	0.14	-0.06
12. Glean from trunk	0.20	-0.46	-0.49	-0.24	-0.09	-0.24
13. Probe (or drill) into trunk	0.26	**-0.66**	-0.33	0.06	-0.41	0.03
14. Probe into fallen dead wood	**-0.60**	-0.15	-0.26	-0.25	0.07	**-0.56**
15. Maneuver proximal to trunk	**0.73**	**-0.54**	0.38	-0.05	0.16	-0.05
16. Maneuver distal to trunk	0.38	**0.89**	0.09	0.05	0.13	0.07
17. Maneuver on beech	**-0.54**	-0.04	-0.05	0.08	0.00	**-0.77**
18. Maneuver on *Acer saccharum*	-0.13	0.00	0.00	**0.61**	-0.42	-0.19
19. Maneuver on *Betula* ssp.	**0.69**	0.27	**-0.50**	-0.27	0.02	0.09
20. Maneuver on *Fraxinus americana*	0.32	0.08	-0.16	0.00	-0.18	0.09
21. Maneuver on other maple*	**-0.84**	-0.01	0.13	-0.28	-0.31	0.05
22. Maneuver on *Viburnum alnifolium*	**-0.78**	-0.21	0.25	-0.33	0.10	-0.21
23. Maneuver on conifer	-0.05	0.20	-0.27	-0.46	0.30	0.13
24. Maneuver on herbs and ferns	**-0.76**	-0.20	0.11	-0.21	0.33	0.02
25. Mean foraging height	**0.78**	0.45	-0.27	0.01	-0.13	0.06
26. Standard deviation (SD) of foraging height	**0.74**	0.41	0.28	-0.00	0.07	-0.08

* *Acer spicatum* or *A. pensylvanicum*

Supplement 9. Eigenvalues, factor contribution to total variance (%), cumulative contribution, and correlation coefficients between the original variables and the first six ordination axes of bootstrapped principal coordinate analysis (BPCoA) from the foraging data matrix of the breeding bird assemblage in the Australian site (Australasian region). The scores of correlation coefficients (≥ 0.5) are indicated by bold letters.

	Axes (Factors)					
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Eigenvalues	5.52	3.66	3.22	2.55	2.26	1.84
Factor contribution to total variance (%)	21.49	14.26	12.52	9.91	8.79	7.15
Cumulative percent (%)	21.49	35.75	48.27	58.19	66.98	74.12
Variables						
1. Hover leaf	-0.30	0.22	0.14	-0.20	0.27	-0.29
2. Glean leaf	-0.41	**0.68**	0.27	-0.23	0.28	-0.39
3. Snatch leaf	-0.31	-0.46	-0.30	-0.17	0.48	0.08
4. Glean flower	0.21	0.47	**-0.69**	0.43	0.11	0.00
5. Glean twig	-0.29	0.43	0.20	-0.10	0.21	-0.18
6. Glean eucalypt capsules	-0.09	-0.05	0.02	-0.07	-0.07	0.26
7. Glean loose bark	-0.09	0.27	0.18	0.06	-0.28	**0.62**
8. Hawk	-0.26	**-0.61**	-0.32	-0.06	0.24	-0.14
9. Glean branch	-0.24	0.34	0.17	0.02	-0.06	0.18
10. Snatch branch	-0.27	-0.42	-0.17	-0.07	0.26	0.13
11. Glean trunk	-0.13	0.01	0.11	0.00	-0.20	0.48
12. Snatch trunk	-0.23	**-0.56**	-0.33	0.02	-0.25	-0.32
13. Glean ground	0.48	-0.20	**0.61**	**0.55**	0.21	-0.10
14. Pounce ground	-0.13	-0.34	-0.16	0.06	**-0.71**	**-0.51**
15. Probe ground	**0.81**	-0.03	0.09	**-0.55**	-0.02	-0.02
16. Rough-barked eucalypts	**-0.83**	-0.19	0.29	-0.03	0.00	0.11
17. Forest gums	-0.27	0.37	-0.08	-0.07	-0.22	0.15
18. Woodland gums	-0.36	0.14	0.18	0.26	-0.36	-0.15
19. *Acacia*	-0.13	-0.36	-0.01	-0.03	0.41	0.16
20. Waratah	0.22	0.43	**-0.70**	0.45	0.16	-0.01
21. Other shrubs	-0.05	-0.36	-0.05	0.12	0.36	-0.17
22. Ground vegetation	0.12	-0.20	0.22	0.35	0.30	-0.16
23. Mean foraging height	**-0.68**	0.32	0.03	-0.32	0.14	0.23
24. Standard deviation (SD) of foraging height	**-0.72**	0.18	0.00	-0.29	0.21	0.11

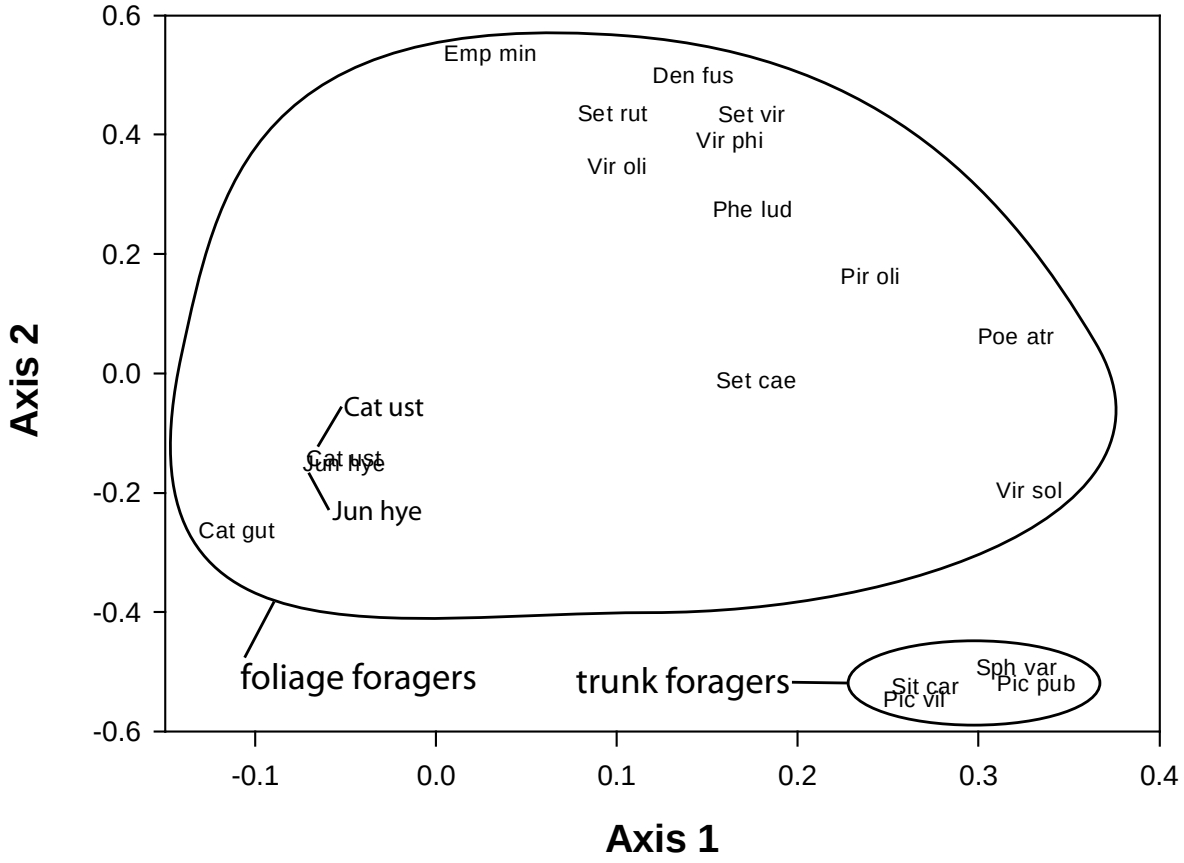
Supplement 10. Eigenvalues, factor contribution to total variance (%), cumulative contribution, and correlation coefficients between the original variables and the first six ordination axes of bootstrapped principal coordinate analysis (BPCoA) from the foraging data matrix of the breeding bird assemblage in the European site (Palearctic region). The scores of correlation coefficients (≥ 0.5) are indicated by bold letters.

	Axes (Factors)					
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Eigenvalues	6.17	3.82	2.74	0.77	0.73	0.59
Factor contribution to total variance (%)	37.42	23.14	16.63	4.65	4.44	3.57
Cumulative percent (%)	37.42	60.55	77.18	81.83	86.27	89.84
Variables						
1. Mean foraging height	-0.35	**0.70**	-0.21	0.11	-0.11	-0.31
2. SD of foraging height	-0.32	**0.66**	-0.18	0.10	-0.10	-0.30
3. Foraging on beech *Fagus sylvatica*	**-0.59**	0.02	-0.32	-0.43	0.33	0.40
4. Foraging on fir *Abies alba*	**-0.77**	-0.05	0.19	-0.17	-0.17	-0.10
5. Foraging on spruce *Picea abies*	**-0.52**	-0.14	0.37	0.04	0.04	-0.12
6. Foraging on sycamore *Acer pseudoplatanus*	-0.44	0.14	-0.12	-0.19	0.20	0.23
7. Foraging on elm *Ulmus glabra*	-0.36	0.18	0.28	-0.24	0.27	0.25
8. Foraging on rowan *Sorbus aucuparia*	-0.37	-0.20	-0.19	-0.04	0.17	0.17
9. Foraging on hazel *Corylus avellana*	**-0.51**	-0.10	-0.26	-0.06	0.23	0.23
10. Foraging on other live tree species	0.08	-0.14	0.04	-0.48	0.12	-0.01
11. Foraging on or in litter	**0.72**	-0.34	-0.06	-0.20	0.38	-0.32
12. Foraging on bare ground	**0.60**	-0.36	-0.08	-0.35	0.20	-0.21
13. Foraging on herb or forb layers	0.19	-0.32	-0.13	-0.23	-0.10	-0.06
14. Foraging on standing dead wood	-0.14	0.25	**0.84**	-0.08	0.15	0.07
15. Foraging on fallen dead wood	0.33	-0.15	-0.01	-0.29	-0.16	0.26
16. Foraging on or in water	0.34	-0.07	0.01	0.39	-0.41	**0.58**
17. Foraging on rocks	0.44	-0.03	-0.08	0.32	-0.44	**0.57**
18. Foraging in airspace	0.10	**0.84**	**-0.50**	0.01	-0.11	-0.08
19. Foraging movement in horizontal direction	**-0.82**	**-0.53**	-0.11	0.01	0.00	0.10
20. Foraging movement in vertical direction	-0.14	0.30	**0.92**	-0.15	-0.03	0.04
21. Glean from trunk	-0.08	0.10	**0.51**	**-0.67**	-0.47	0.05
22. Glean from leaf	**-0.71**	**-0.59**	-0.22	0.04	-0.14	-0.14
23. Glean from branch	-0.35	-0.23	0.33	**-0.53**	-0.34	-0.05
24. Glean from twig	**-0.69**	**-0.50**	-0.14	-0.01	-0.23	-0.21
25. Glean from other substrates*	**0.89**	-0.43	-0.08	-0.01	-0.04	0.08
26. Hover at trunk	0.10	0.19	-0.22	**-0.52**	0.11	0.18
27. Hover at leaf	**-0.67**	-0.19	-0.40	0.01	0.33	0.31
28. Hover at branch	-0.32	0.25	-0.36	-0.20	0.28	0.26
29. Hover at twig	**-0.58**	-0.30	-0.28	0.08	0.13	0.04
30. Hover at other substrates*	0.25	-0.02	-0.14	0.12	-0.20	0.42
31. Probe or peck into trunk	-0.06	0.26	**0.77**	0.34	0.36	0.03
32. Probe or peck into branch	-0.11	0.22	**0.72**	0.23	0.29	0.05
33. Probe or peck into other substrates*	0.32	-0.11	0.07	0.01	0.24	-0.21
34. Hawk or sally to trunk	0.09	0.22	-0.27	-0.45	0.32	0.31
35. Hawk or sally to leaf	-0.00	**0.55**	-0.40	-0.36	0.27	0.25
36. Hawk or sally to branch	0.09	0.34	-0.31	-0.45	0.24	0.21
37. Hawk or sally to twig	0.02	**0.57**	-0.39	-0.36	0.27	0.23
38. Hawk or sally to other substr.* (mainly air)	0.09	**0.84**	**-0.51**	-0.06	-0.04	-0.04

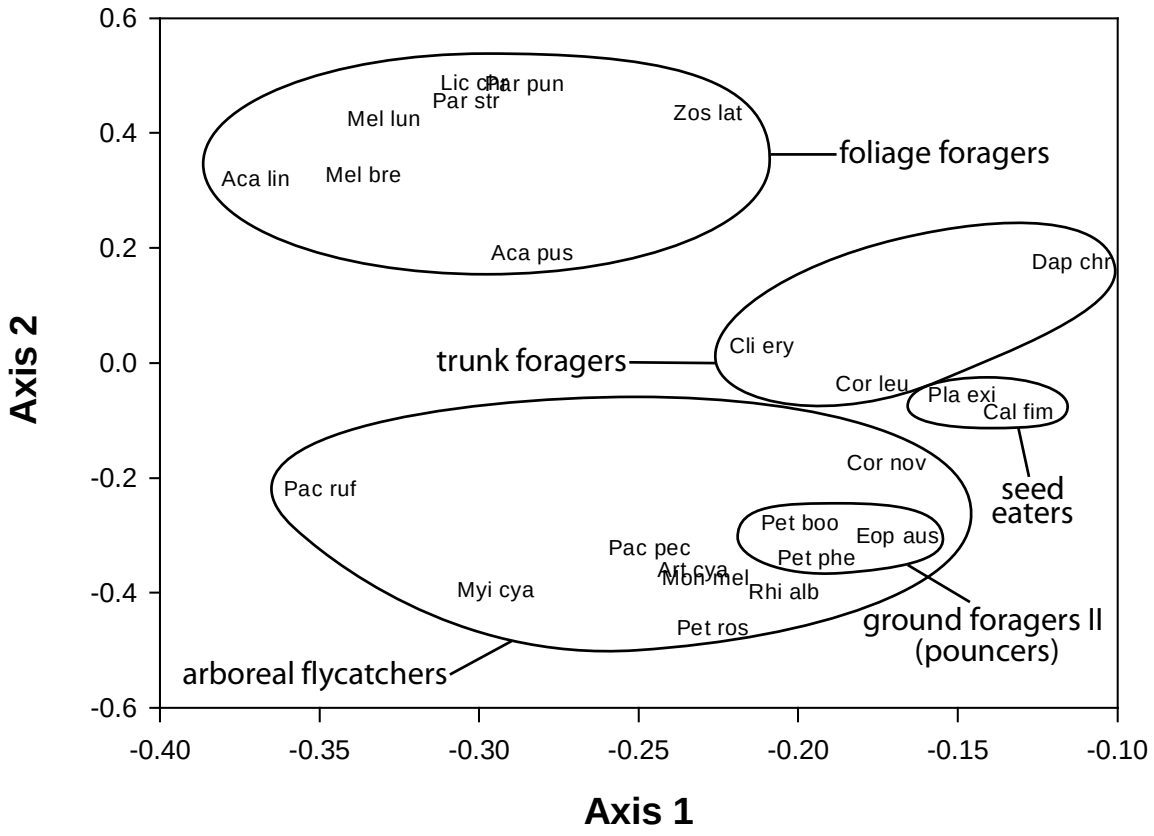
* in combination with one of the listed foraging substrates

Supplement 11. Vizualization of clumped parts in Fig. 2a−c showing guild structure of breeding bird assemblages of three forests: North America (a), Australia (b), and Europe (c).

a)



b)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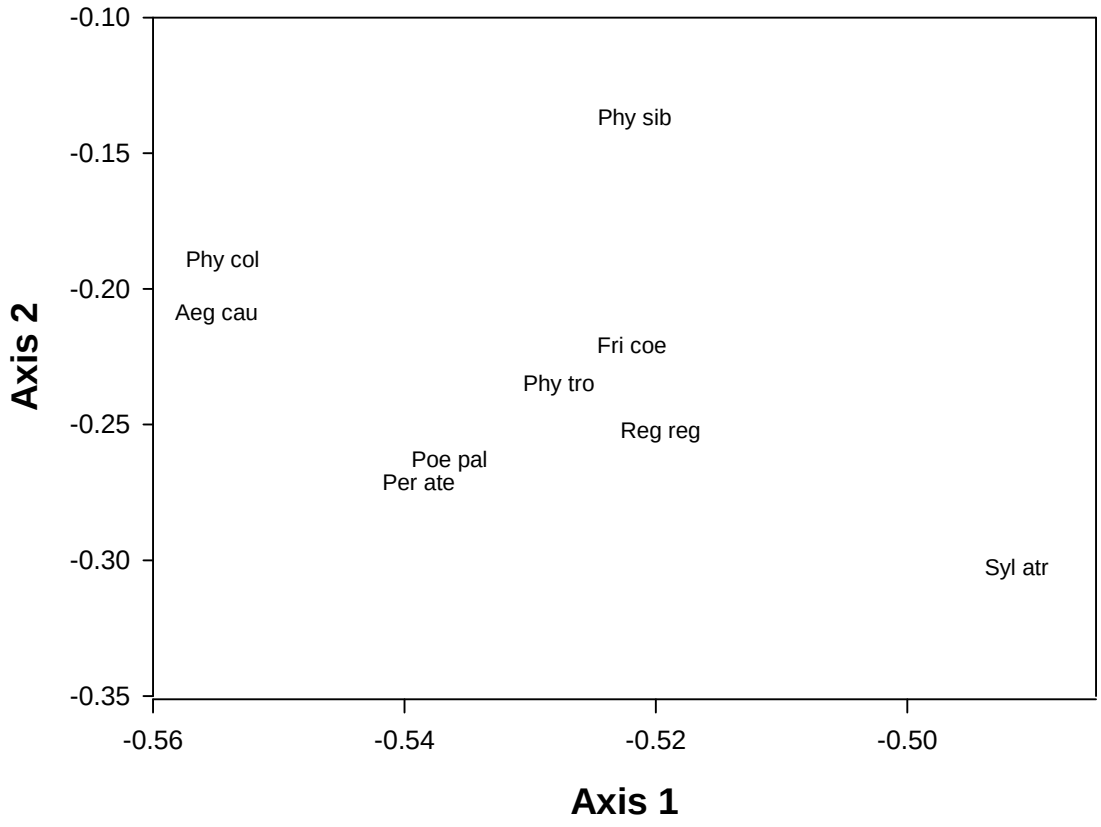
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
Axis 2
Axis 1
Lic cha
Par pun
Par str
Mel lun
Zos lat
Aca lin
Mel bre
Aca pus
foliage foragers
Dap chr
Cli ery
trunk foragers
Cor leu
Pla exi
Cal fim
seed
eaters
Cor nov
Pac ruf
Pet boo
Eop aus
Pac pec
Pet phe
Art cya
Mon mel
Rhi alb
Myi cya
Pet ros
ground foragers II
(pouncers)
arboreal flycatchers

c)


-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
Axis 2
Phy sib
Phy col
Aeg cau
Fri coe
Phy tro
Reg reg
Poe pal
Per ate
Syl atr
-0.56
-0.54
-0.52
-0.50
Axis 1

Supplement 12. List of species from three study sites that were included in the analysis and abbreviations of their latin names used in the figures. The nomenclature follows Dickinson (2003) and its updates.

NORTH AMERICAN SITE: HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE, USA

LATIN NAME	ABBREVIATION	COMMON NAME
Catharus fuscescens	*Cat fus*	Veery
Catharus guttatus	*Cat gut*	Hermit Thrush
Catharus ustulatus	*Cat ust*	Swainson's Thrush
Dendroica fusca	*Den fus*	Blackburnian Warbler
Empidonax minimus	*Emp min*	Least Flycatcher
Hylocichla mustelina	*Hyl mus*	Wood Thrush
Junco hyemalis	*Jun hye*	Dark-eyed Junco
Pheucticus ludovicianus	*Phe lud*	Rose-breasted Grosbeak
Picoides pubescens	*Pic pub*	Downy Woodpecker
Picoides villosus	*Pic vil*	Hairy Woodpecker
Piranga olivacea	*Pir oli*	Scarlet Tanager
Poecile atricapillus	*Poe atr*	Black-capped Chickadee
Seiurus aurocapilla	*Sei aur*	Ovenbird
Setophaga caerulescens	*Set cae*	Black-throated Blue Warbler
Setophaga ruticilla	*Set rut*	American Redstart
Setophaga virens	*Set vir*	Black-throated Green Warbler
Sitta carolinensis	*Sit car*	White-breasted Nuthatch
Sphyrapicus varius	*Sph var*	Yellow-bellied Sapsucker
Troglodytes hiemalis	*Tro hie*	Winter Wren
Vireo olivaceus	*Vir oli*	Red-eyed Vireo
Vireo philadelphicus	*Vir phi*	Philadelphia Vireo
Vireo solitaries	*Vir sol*	Blue-headed Vireo

AUSTRALIAN SITE: BONDI STATE FOREST, NEW SOUTH WALES, AUSTRALIA

LATIN NAME	ABBREVIATION	COMMON NAME
Acanthiza chrysorrhoa	*Aca chr*	Yellow-rumped Thornbill
Acanthiza lineata	*Aca lin*	Striated Thornbill
Acanthiza pusilla	*Aca pus*	Brown Thornbill
Acanthiza reguloides	*Aca reg*	Buff-rumped Thornbill
Acanthorhynchus tenuirostris	*Aca ten*	Eastern Spinebill
Anthochaera carunculata	*Ant car*	Red Wattlebird
Artamus cyanopterus	*Art cya*	Dusky Woodswallow
Cacomantis flabelliformis	*Cac fla*	Fan-tailed Cuckoo
Callocephalon fimbriatum	*Cal fim*	Gang-gang Cockatoo
Climacteris erythrops	*Cli ery*	Red-browed Treecreeper
Colluricincla harmonica	*Col har*	Grey Shrike-thrush
Coracina novaehollandiae	*Cor nov*	Black-faced Cuckoo-shrike
Corcorax melanorhamphos	*Cor mel*	White-winged Chough
Cormobates leucophaea	*Cor leu*	White-throated Treecreeper
Daphoenositta chrysoptera	*Dap chr*	Varied Sittela
Eopsaltria australis	*Eop aus*	Eastern Yellow Robin
Falcunculus frontatus	*Fal fro*	Eastern Shrike-tit
Gymnorhina tibicen	*Gym tib*	Australian Magpie
Lichenostomus chrysops	*Lic chr*	Yellow-faced Honeyeater
Lichenostomus leucotis	*Lic leu*	White-eared Honeyeater
Malurus cyaneus	*Mal cya*	Superb Fairy-Wren
Melithreptus brevirostris	*Mel bre*	Brown-headed Honeyeater
Melithreptus lunatus	*Mel lun*	White-naped Honeyeater
Menura novaehollandiae	*Men nov*	Superb Lyrebird
Monarcha melanopsis	*Mon mel*	Black-faced Monarch
Myiagra cyanoleuca	*Myi cya*	Satin Flycatcher
Pachycephala pectoralis	*Pac pec*	Golden Whistler
Pachycephala rufiventris	*Pac ruf*	Rufous Whistler
Pardalotus punctatus	*Par pun*	Spotted Pardalote
Pardalotus striatus	*Par str*	Striated Pardalote
Petroica boodang	*Pet boo*	Scarlet Robin
Petroica pheonicea	*Pet phe*	Flame Robin
Petroica rosea	*Pet ros*	Rose Robin
Phylidonyris pyrrhopterus	*Phy pyr*	Crescent Honeyeater
Platycercus eximius	*Pla exi*	Eastern Rosella
Psophodes olivaceus	*Pso oli*	Eastern Whipbird
Rhipidura albiscapa	*Rhi alb*	Grey Fantail
Rhipidura rufifrons	*Rhi ruf*	Rufous Fantail
Sericornis frontalis	*Ser fro*	White-browed Scrubwren
Zoothera lunulata	*Zoo lun*	Bassian (Ground) Thrush
Zosterops lateralis	*Zos lat*	Silvereye

EUROPEAN SITE: ŠRÁMKOVÁ NATIONAL NATURE RESERVE, SLOVAKIA

LATIN NAME	ABBREVIATION	COMMON NAME
Aegithalos caudatus	*Aeg cau*	Long-tailed Tit
Certhia familiaris	*Cerf am*	Eurasian Treecreeper
Cinclus cinclus	*Cin cin*	White-throated Dipper
Delichon urbica	*Del urb*	Northern House Martin
Dendrocopos leucotos	*Den leu*	White-backed Woodpecker
Erithacus rubecula	*Eri rub*	European Robin
Ficedula albicollis	*Fic alb*	Collared Flycatcher
Ficedula parva	*Fic par*	Red-breasted Flycatcher
Fringilla coelebs	*Fri coe*	Chaffinch
Motacilla cinerea	*Mot cin*	Grey Wagtail
Muscicapa striata	*Mus str*	Spotted Flycatcher
Periparus ater	*Per ate*	Coal Tit
Phylloscopus collybita	*Phy col*	Common Chiffchaff
Phylloscopus sibilatrix	*Phy sib*	Wood Warbler
Phylloscopus trochilus	*Phy tro*	Willow Warbler
Picoides tridactylus	*Pic tri*	Tree-toed Woodpecker
Poecile palustris	*Poe pal*	Marsh Tit
Prunella modularis	*Pru mod*	Dunnock
Pyrrhula pyrrhula	*Pyr pyr*	Eurasian Bullfinch
Regulus regulus	*Reg reg*	Goldcrest
Sitta europaea	*Sit eur*	Eurasian Nuthatch
Sylvia atricapilla	*Syl atr*	Blackcap
Troglodytes troglodytes	*Tro tro*	Eurasian Wren
Turdus merula	*Tur mer*	Eurasian Blackbird
Turdus philomelos	*Tur phi*	Song Thrush
Turdus torquatus	*Tur tor*	Ring Ouzel