
Supplementary information

**Ecology and spread of the North American
H5N1 epizootic**

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authors and unedited

Supplemental Material: Ecology and spread of the North American H5N1 epizootic

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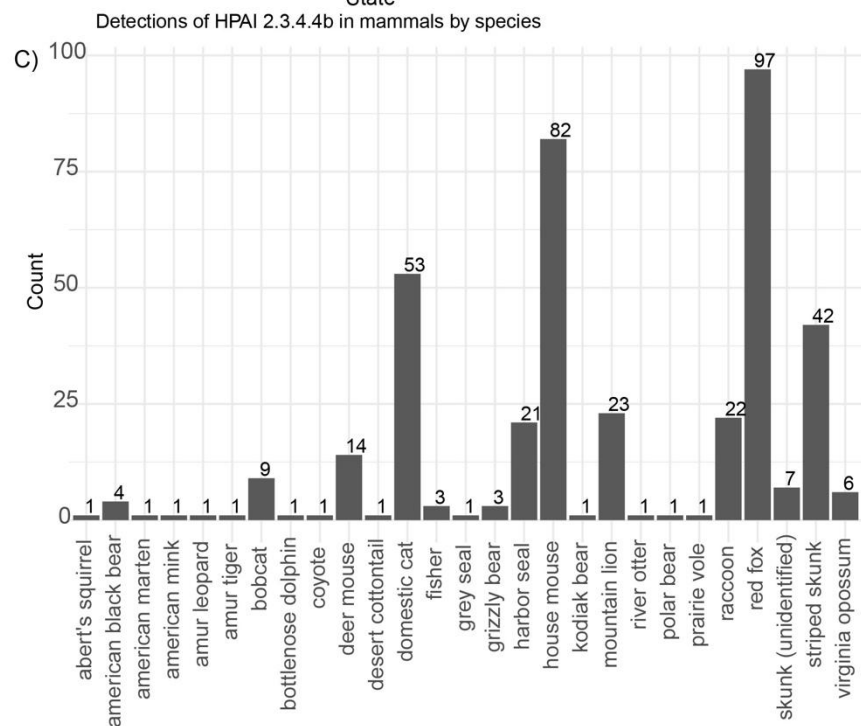
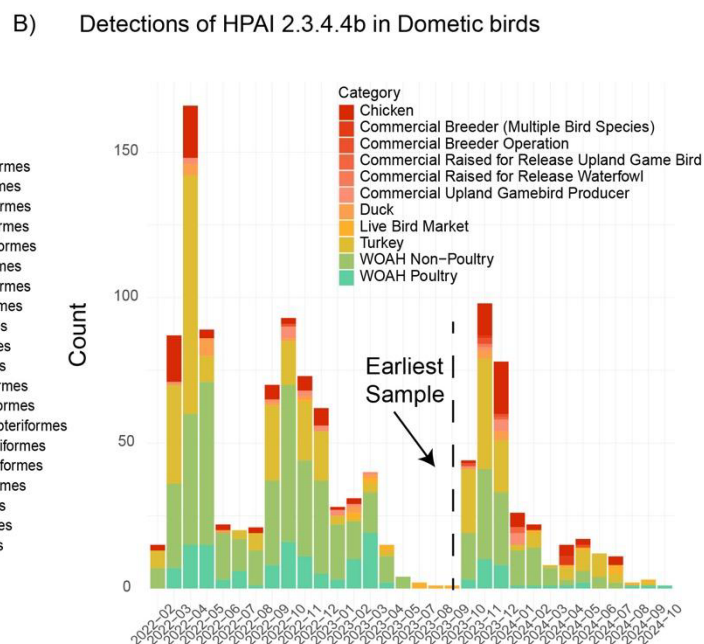
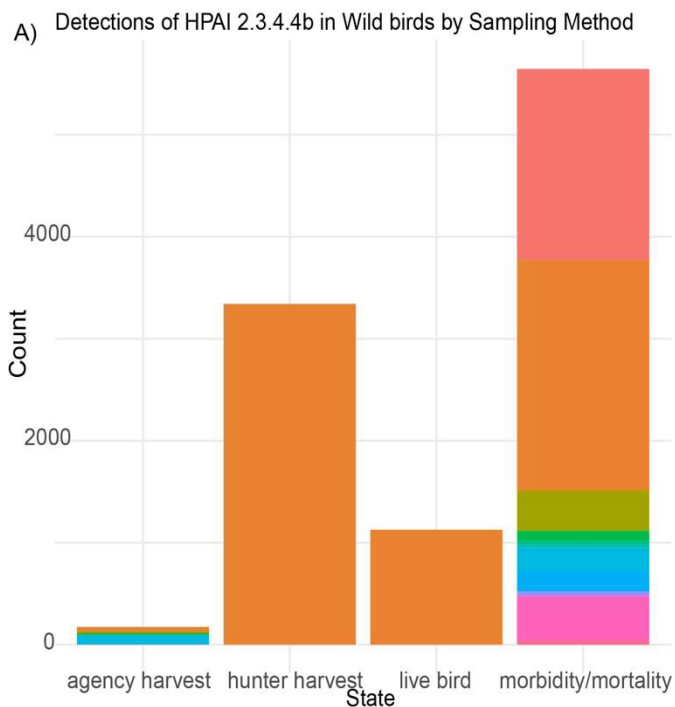
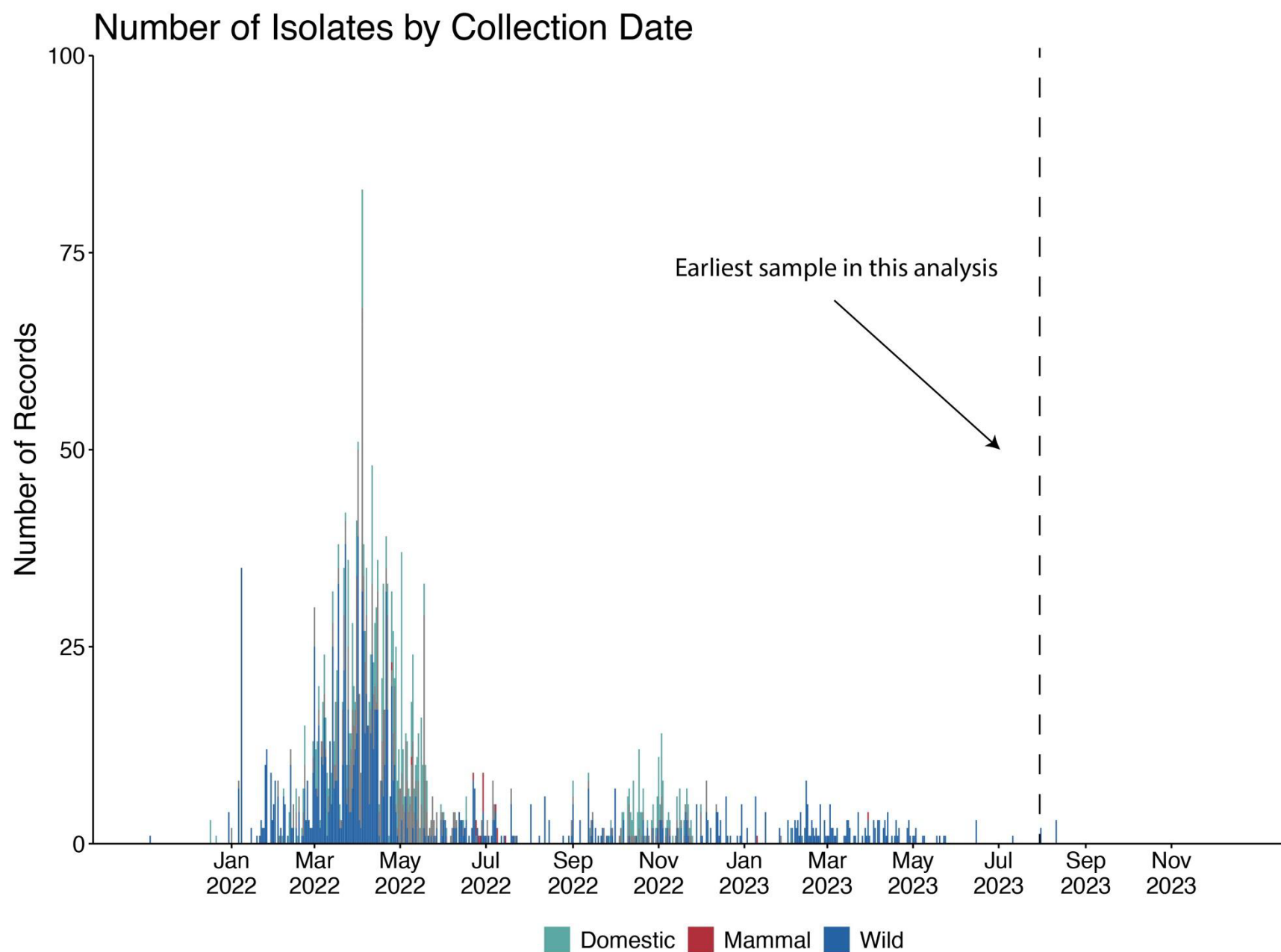


Figure S1. A) Number of detections of HPAI in North American wild birds by collection method. Morbidity and mortality refer to sick or dead birds. B) Domestic bird detections of HPAI in North America on a monthly basis colored by production type. C) Number of detections in mammals by species.



Source: GISAID

Figure S2. Number of HA isolates for HPAI in North America by collection date available in GISAID.

SkyGrid effective population size estimates HPAI H5Nx

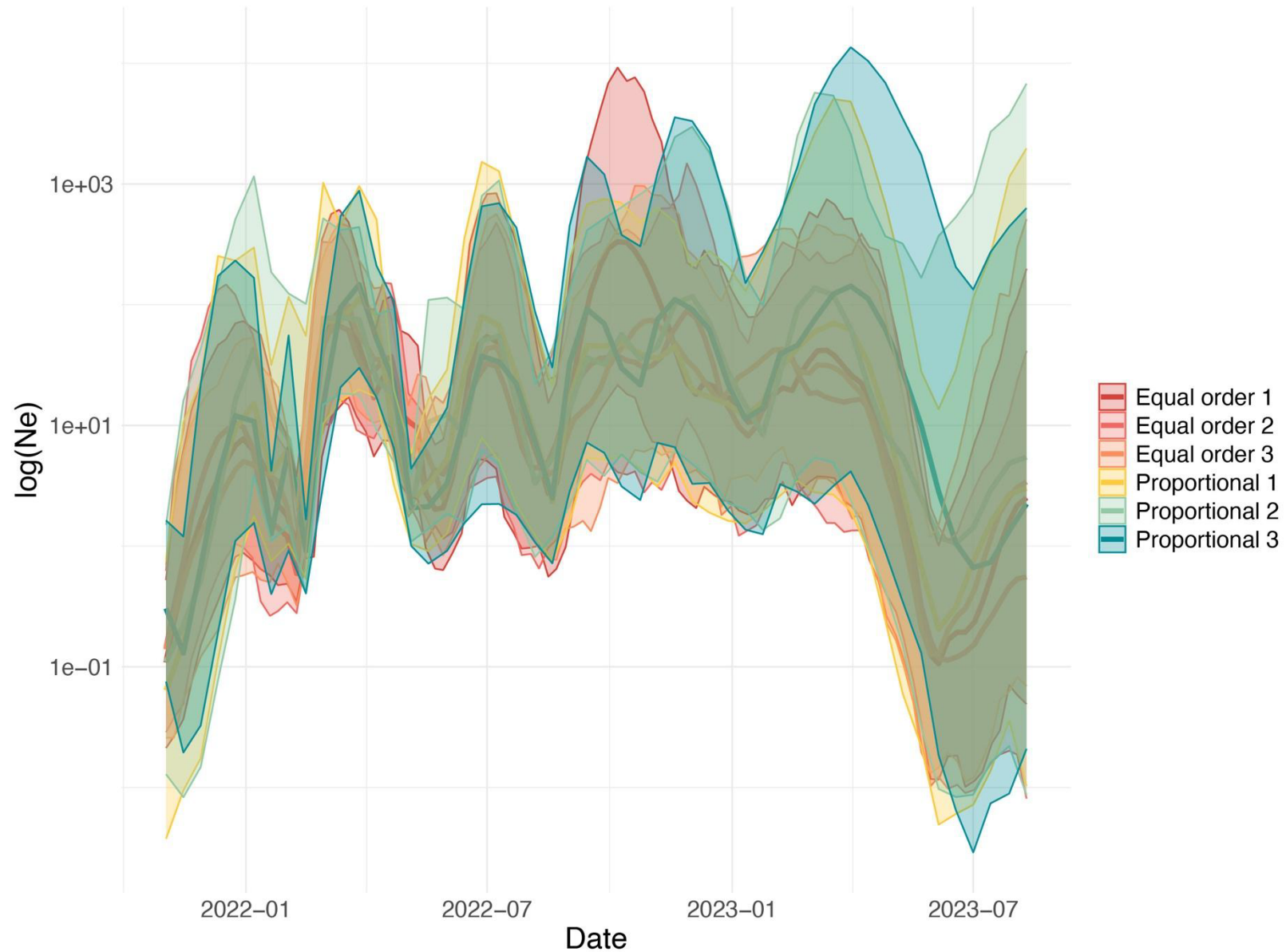


Figure S3. A) SkyGrid Coalescent effective population size reconstructions for six different subsamples of HPAI in North America between 2021 and 2023. Three subsamples with equal proportions of host orders and three subsamples with number of sequences proportional to detections in those hosts.

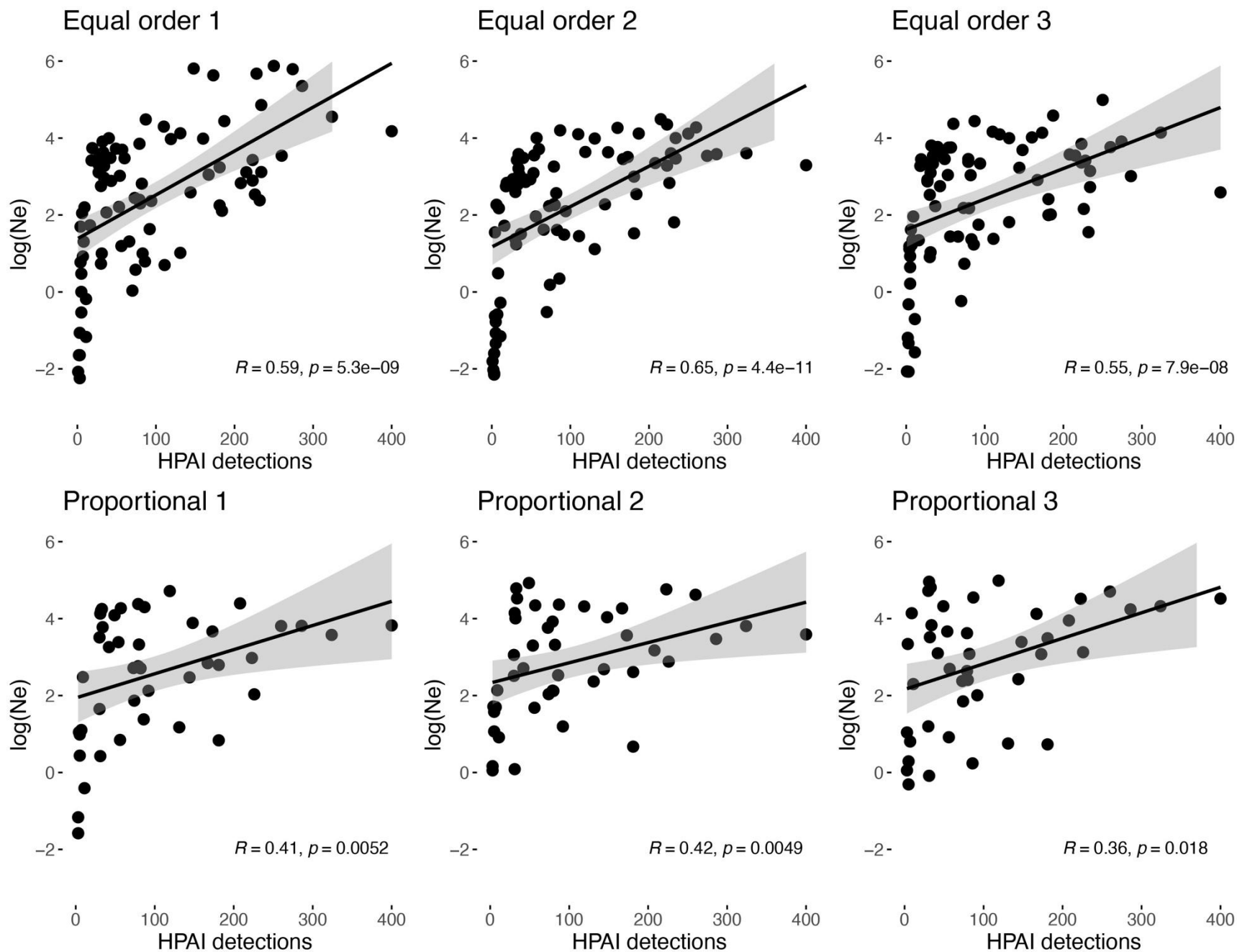


Figure S4. Spearman correlation plot of effective population size estimates vs detections at corresponding timepoints.

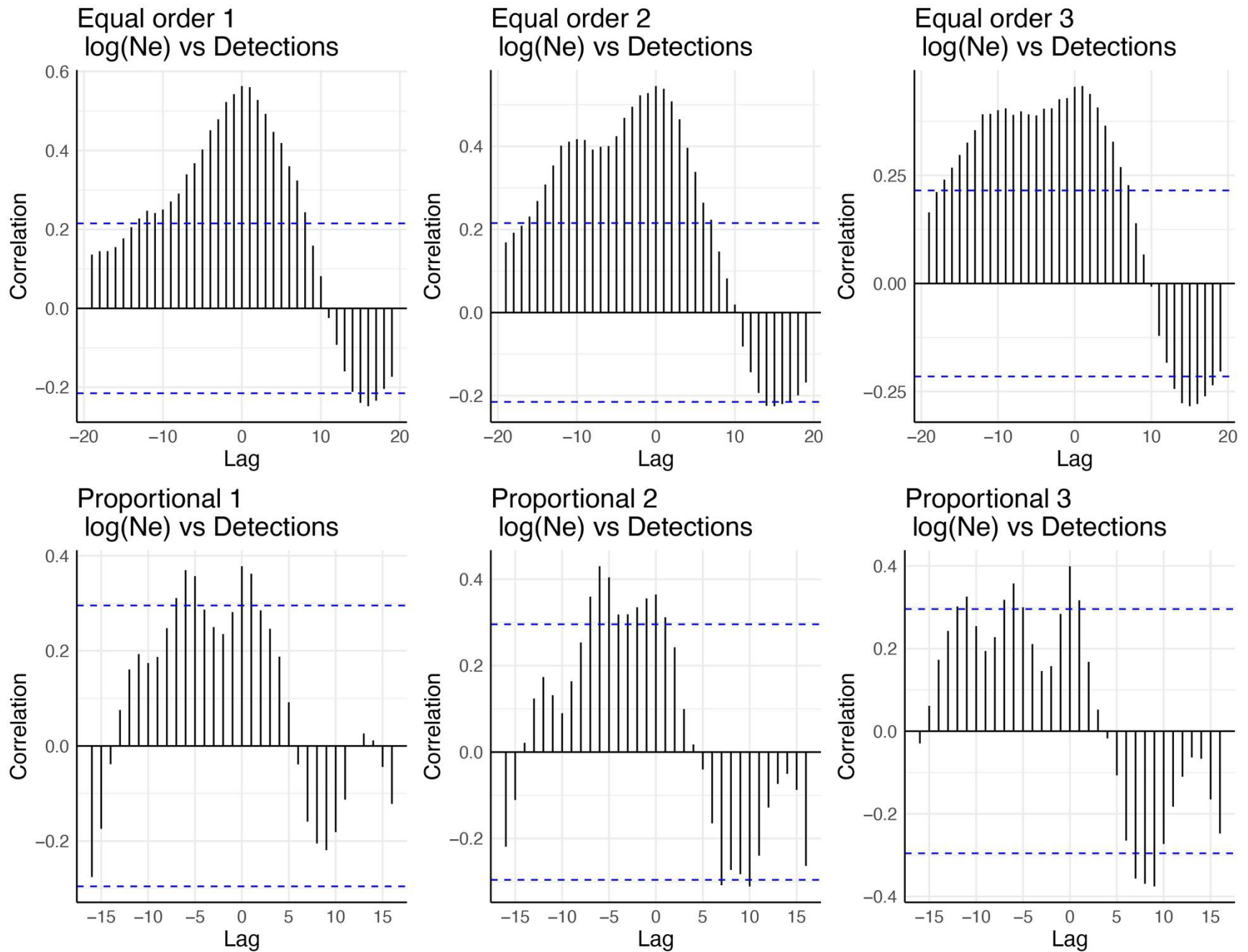


Figure S5. Cross correlation plot of effective population size estimates and detections of HPAI. The x-axis represents the time lag in weeks and the y-axis represents the correlation. Dotted lines represent the significance thresholds.

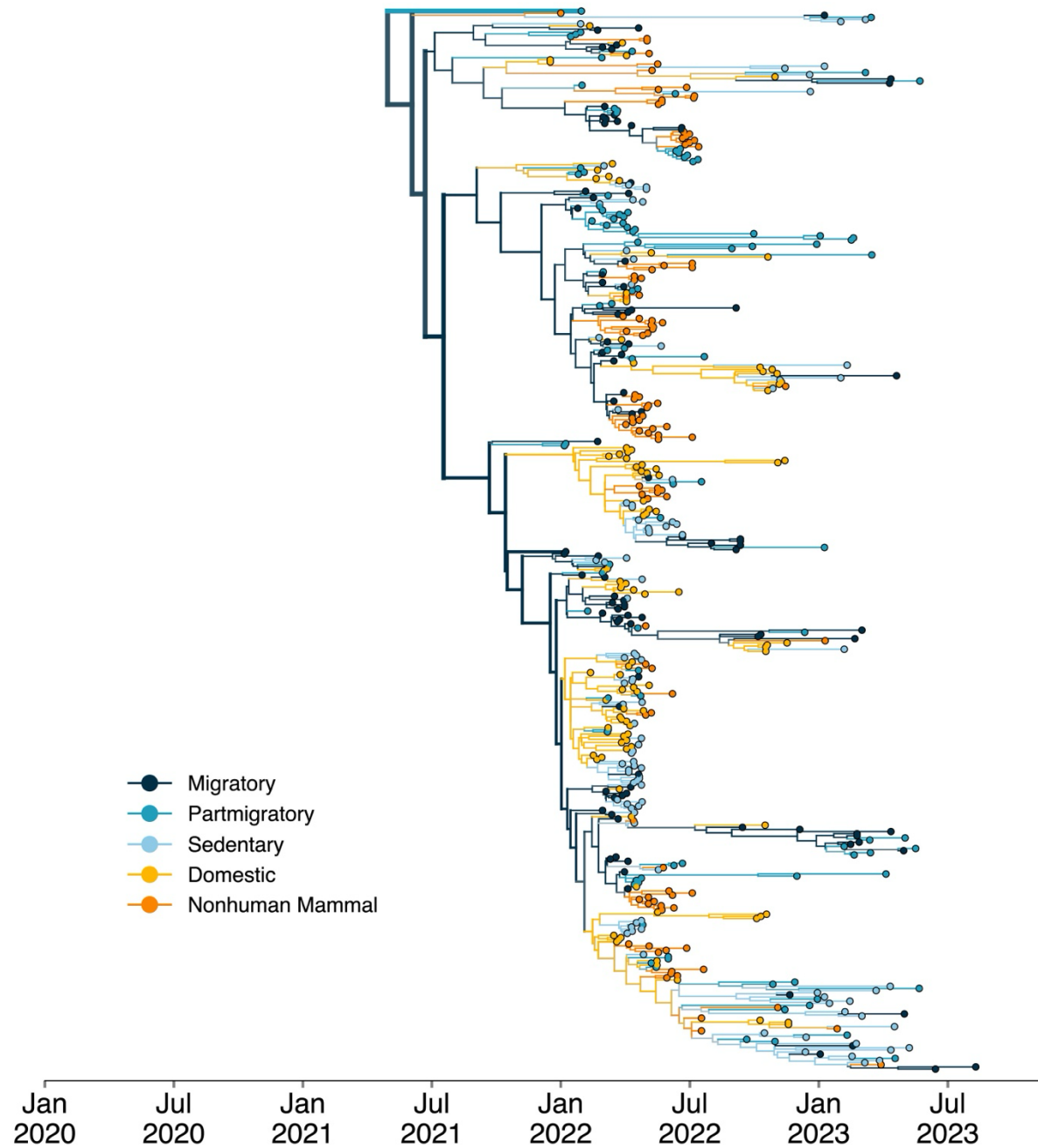


Figure S6.
Phylogenetic reconstruction of $n=1000$ sequences colored by Migratory behavior of host (Determined using AVONET). Color corresponds to the migratory behavior of the host inferred for the branches and for the host of the tip.

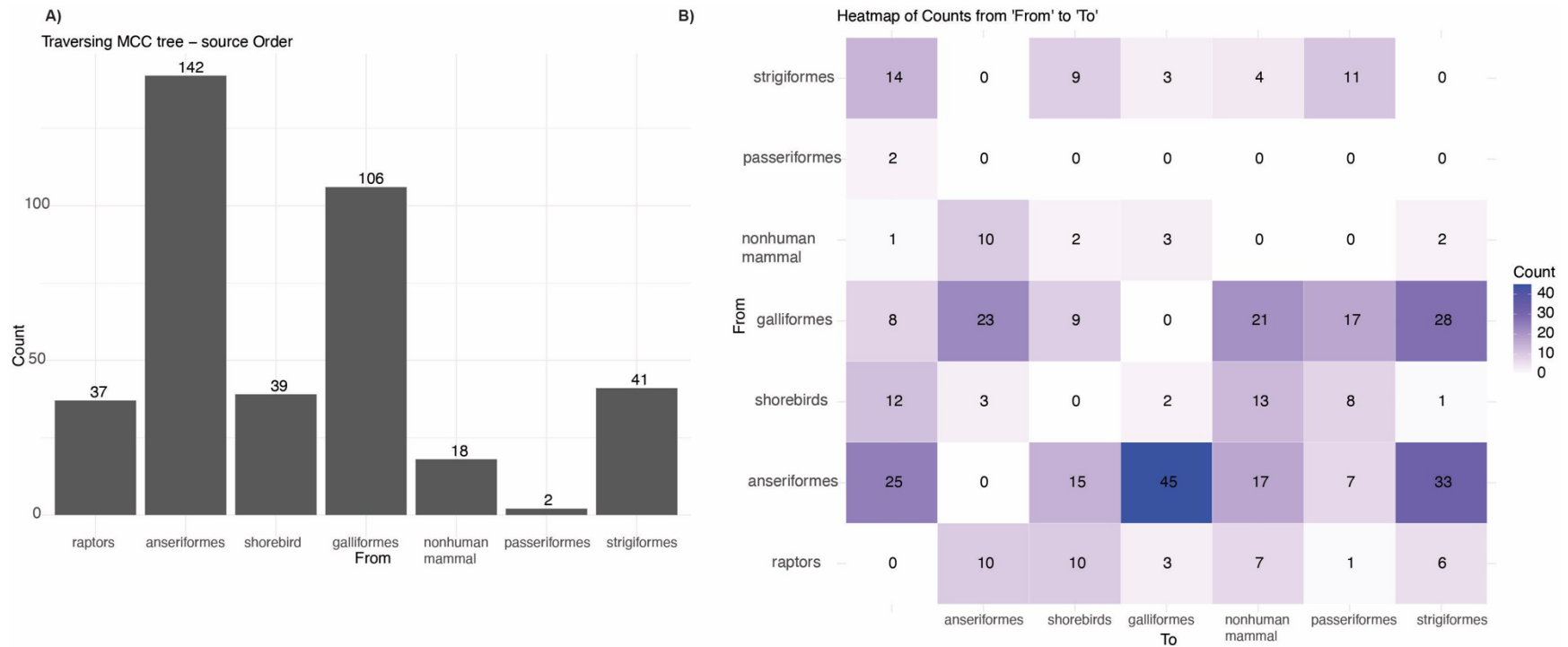
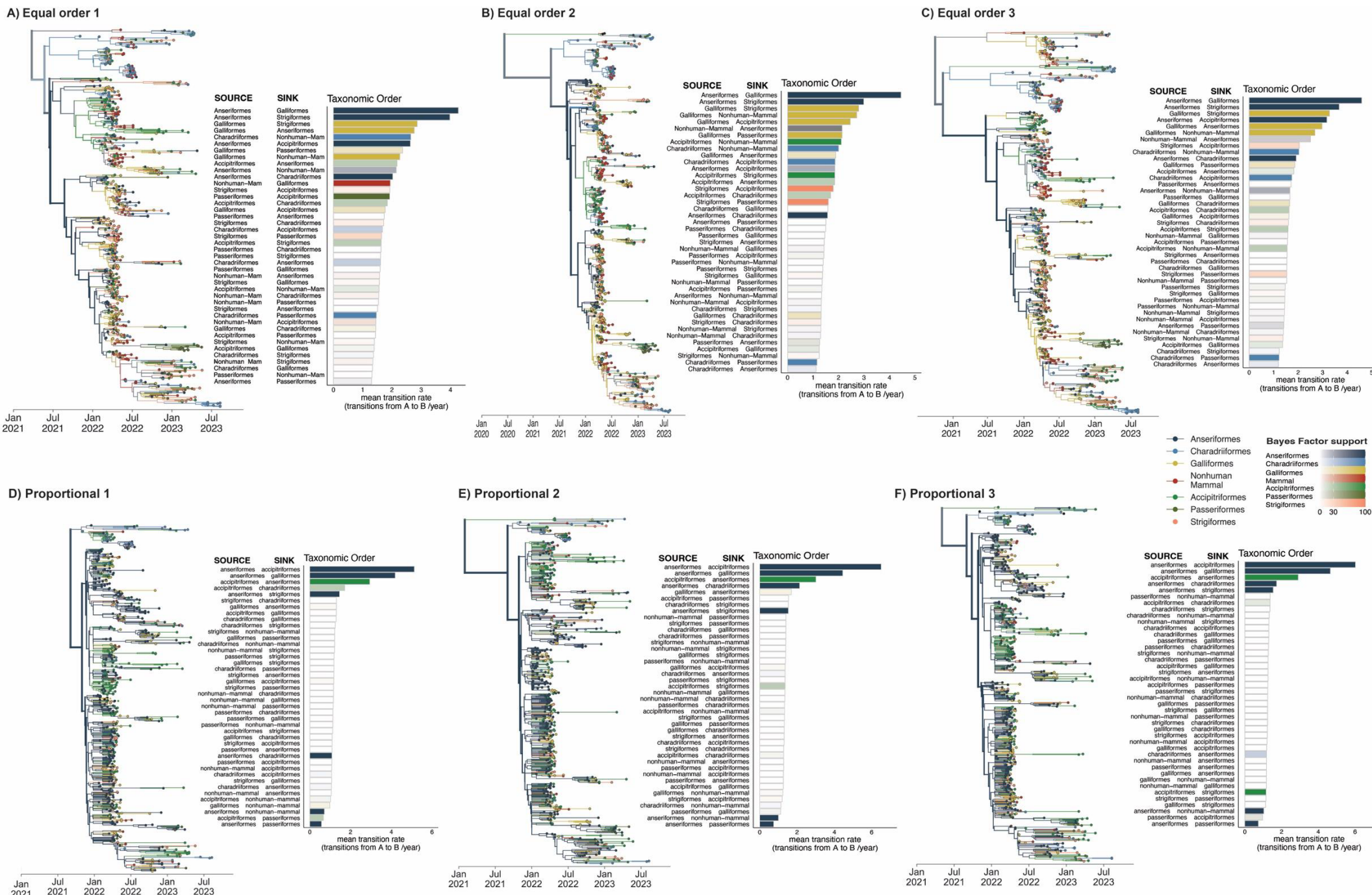
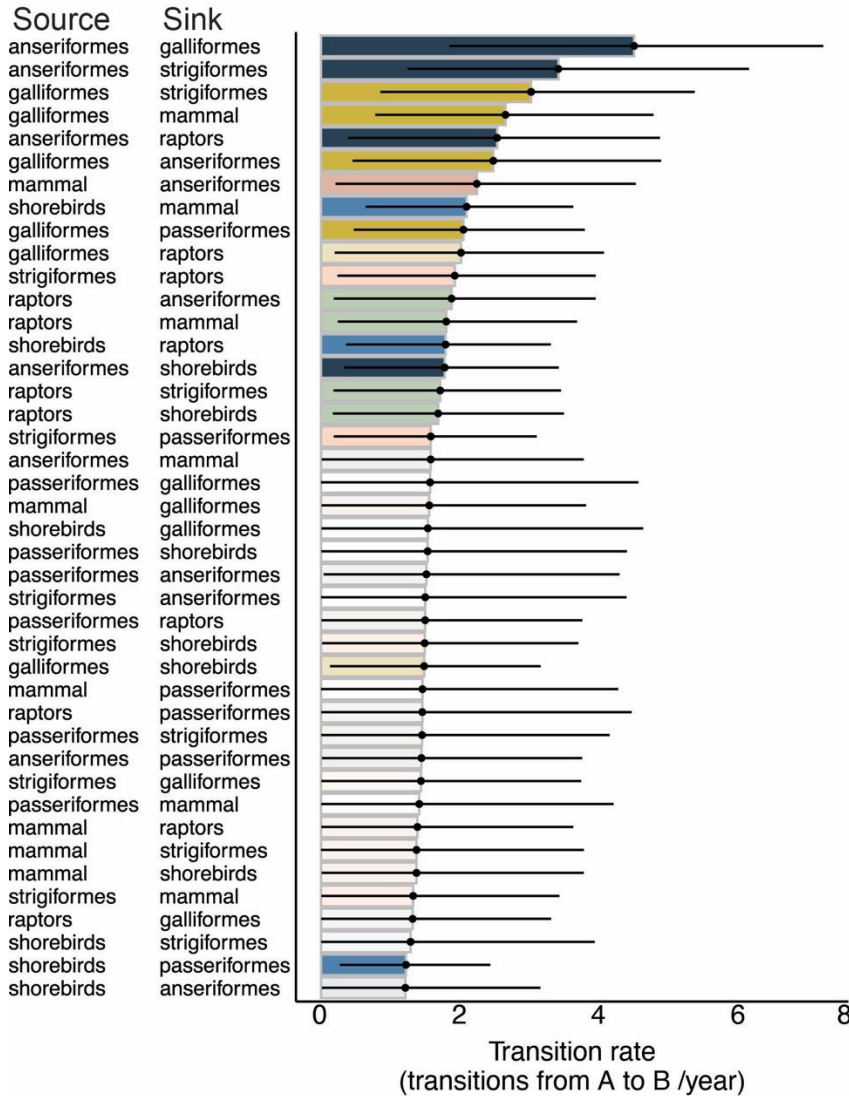


Figure S7. Results from traversing MCC tree and enumerating number of transitions between host orders. A) Number of times a given host order transition to another host order. B) Number of transitions between each host order pair. Transitions calculated using the BALTIC python package.



Equal orders combined



Proportional combined

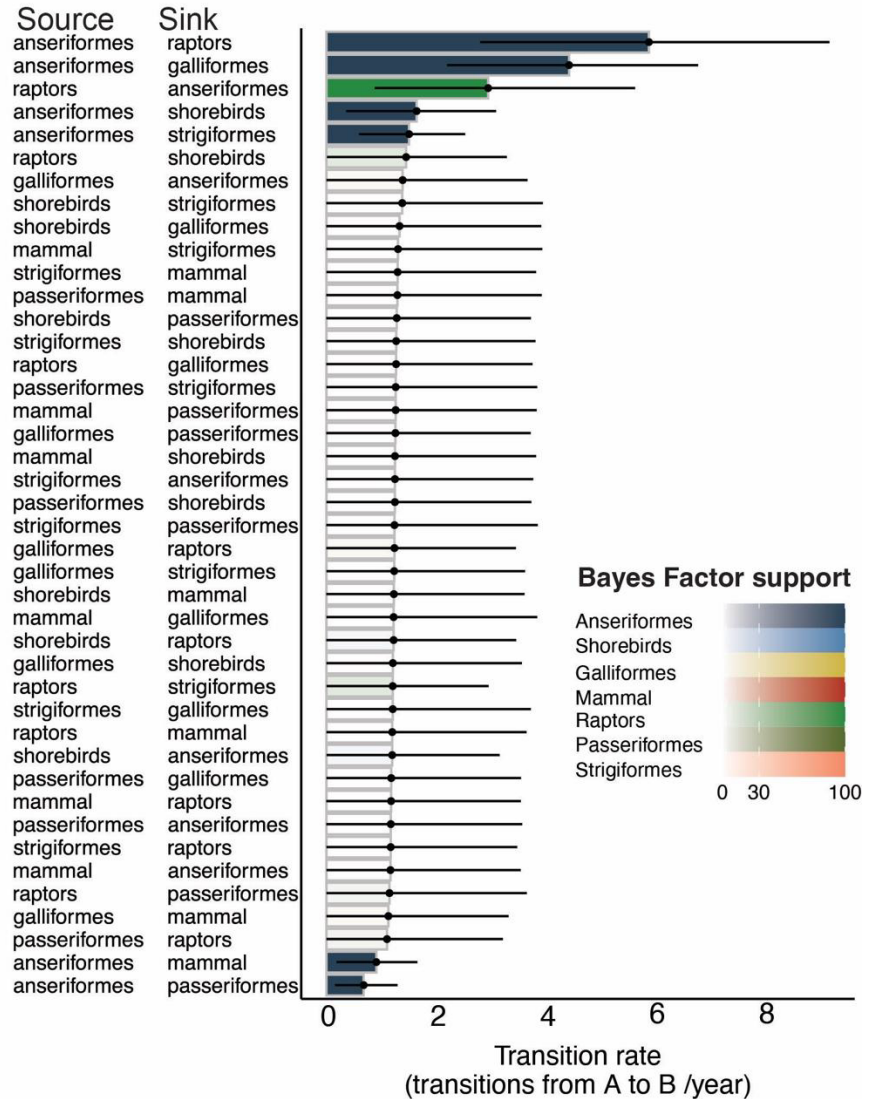


Figure S9. Transition rates (dot represents mean transition and bars represent 95% HPD) from combined results of the BSSVS of combined results for equal orders schema (Left) and proportional scheme (left) where color of the bar corresponds to the source population and the opacity corresponds to the bayes factor support (where white corresponds to BF < 3 and full color corresponds to BF > 100).

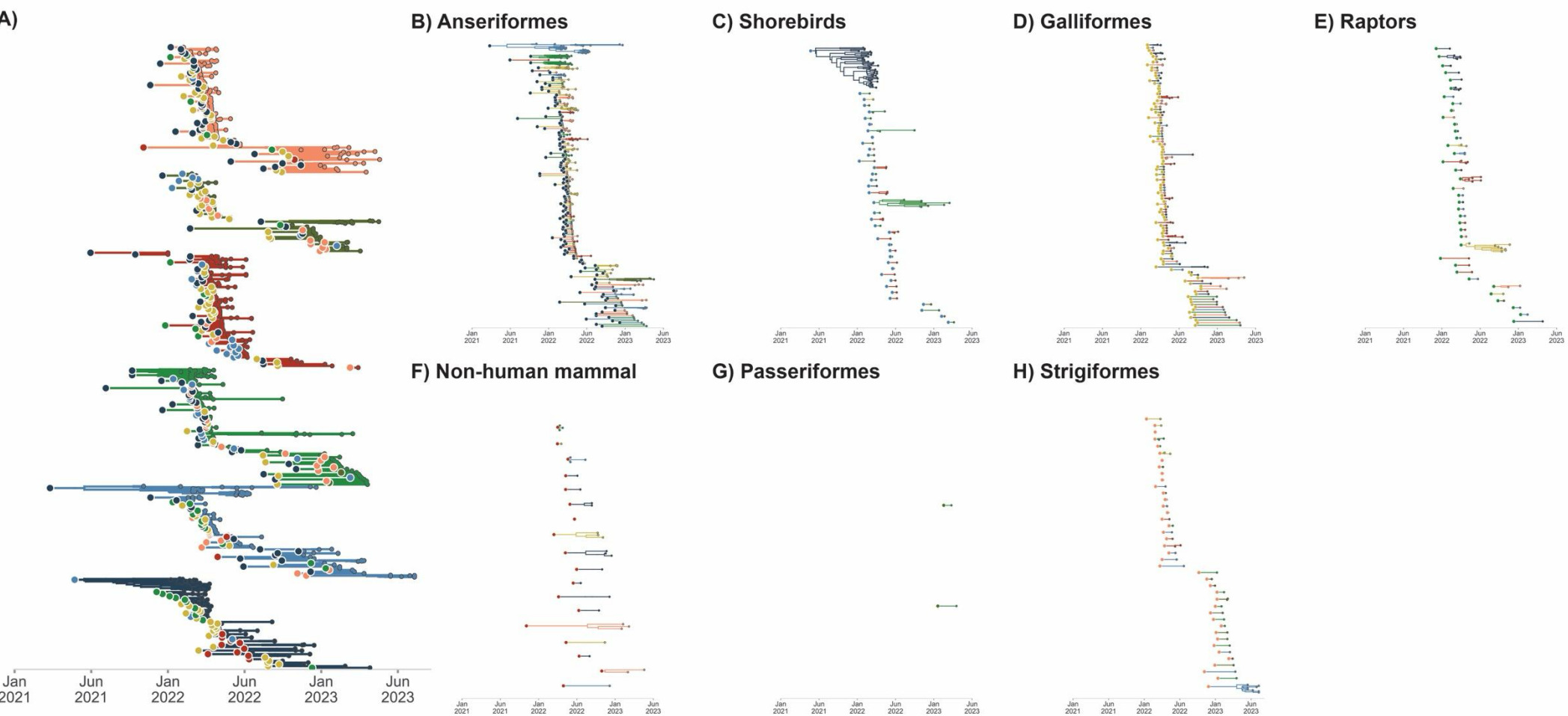
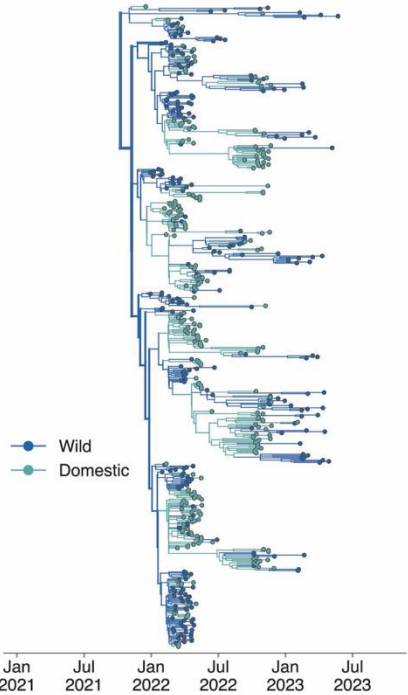
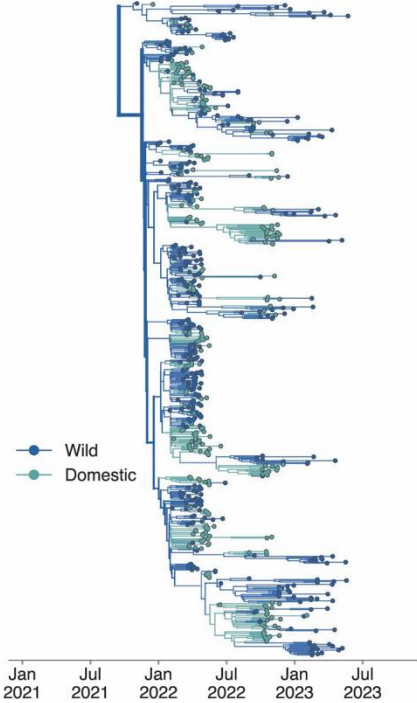


Figure S10: A) Exploded tree view of the MCC tree of equal order phylogenetic reconstruction where subtrees represent the traversal of a tree from the root to the tip where the state is unchanged from the initial state (given by the large dot on left) to the tips represented by the smaller dots representing continuous chains of transmission within a given state. Colors correspond to the state of a given tip, branch node. B-H represent the exploded trees faceted by taxonomic host at the origin: B) Anseriformes, C) Shorebirds, D) Galliformes, E) Raptors, F) Non-human mammal, G) Passeriformes, H) Strigiformes.

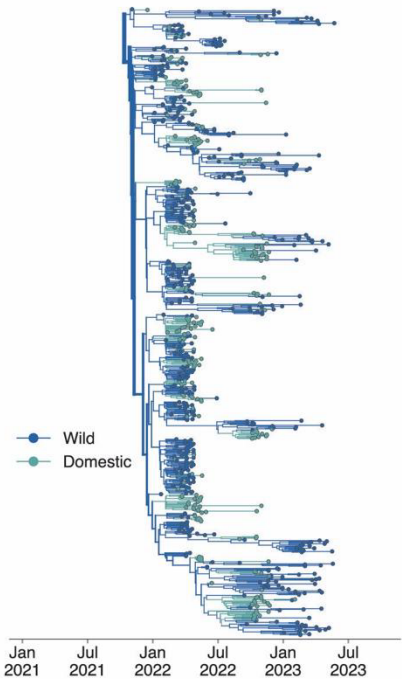
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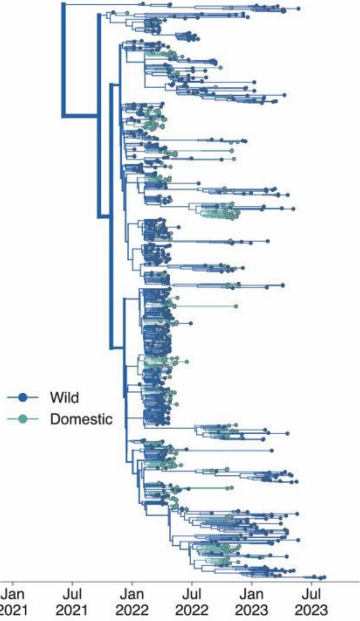
B) 1:1.5



C) 1:2



D) 1:2.5



E) 1:3

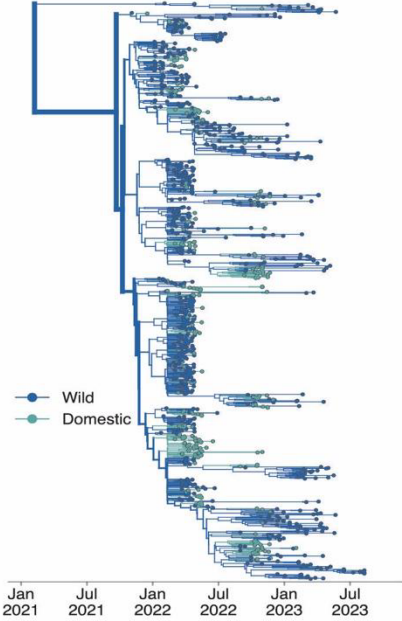
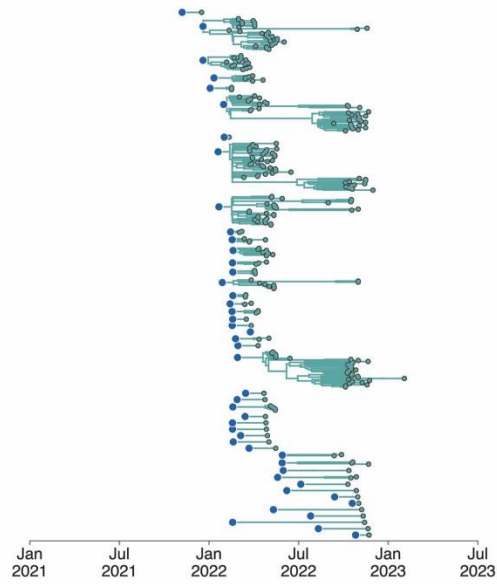
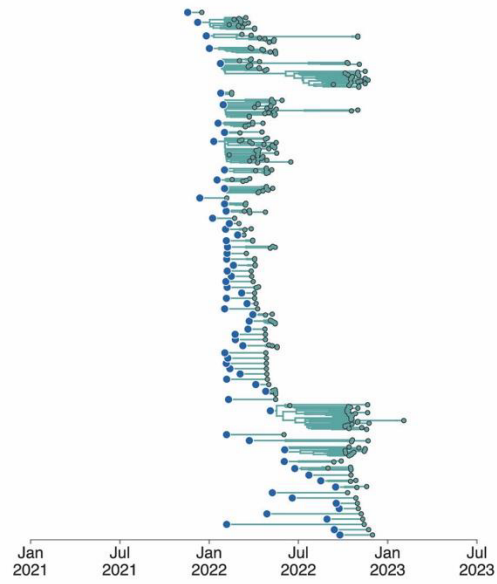


Figure S11: Two-state rarefaction analysis (domestic:wild MCC trees A-E) show the ratios of domestic to wild in increasing order of the number of wild bird sequences. Tips and branches are colored by the state (wild or domestic) of the sample and inferred state respectively.

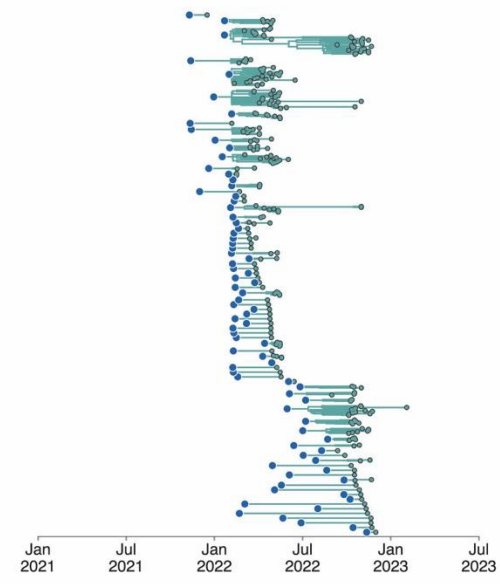
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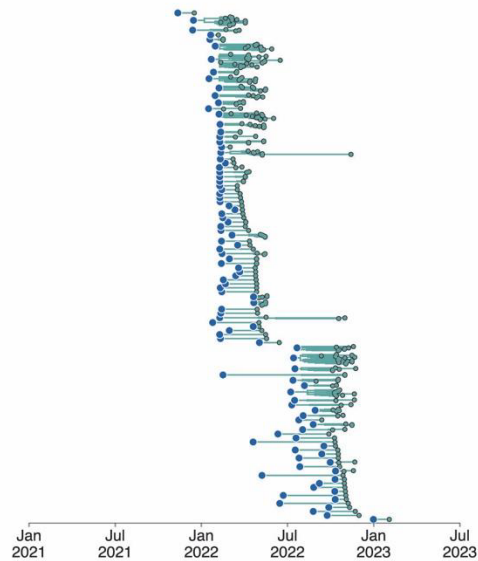
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1:2



1:2.5



1:3

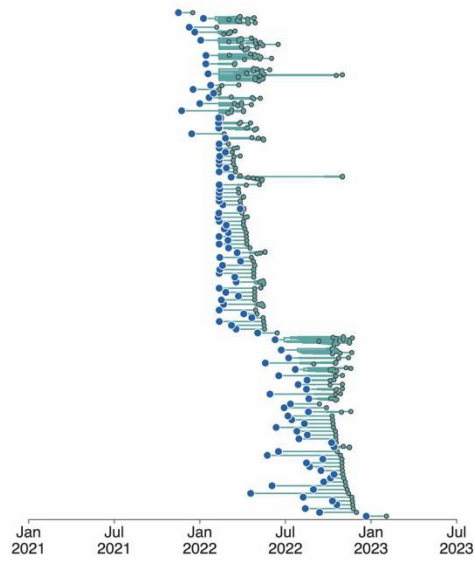
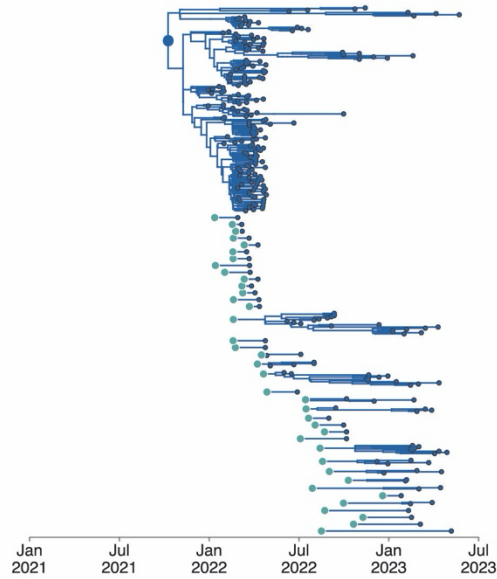
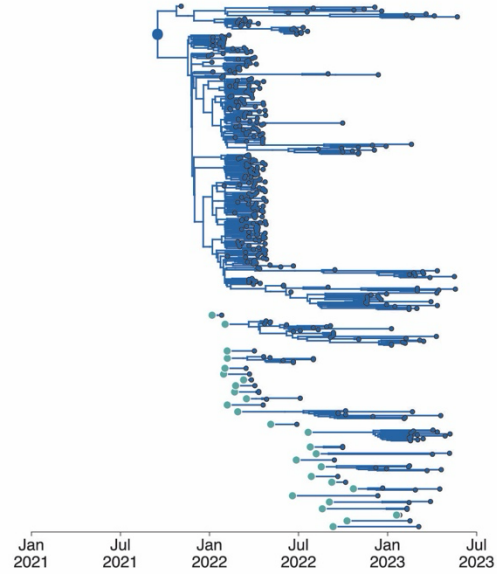


Figure S12: A) Exploded tree view of the MCC tree of two state rarefaction for wild to domestic transitions. Colors correspond to the state of a given tip, branch node.

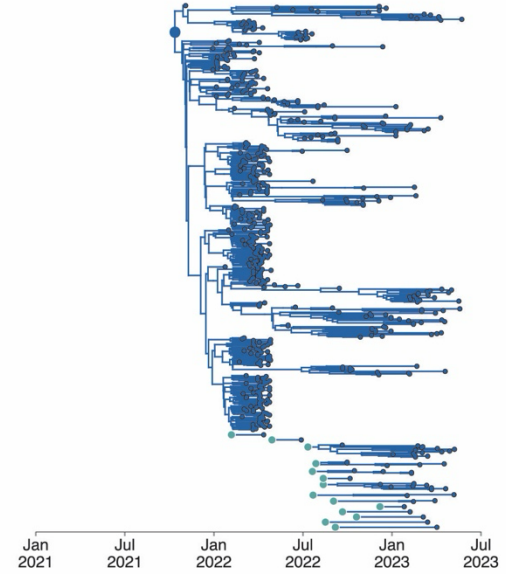
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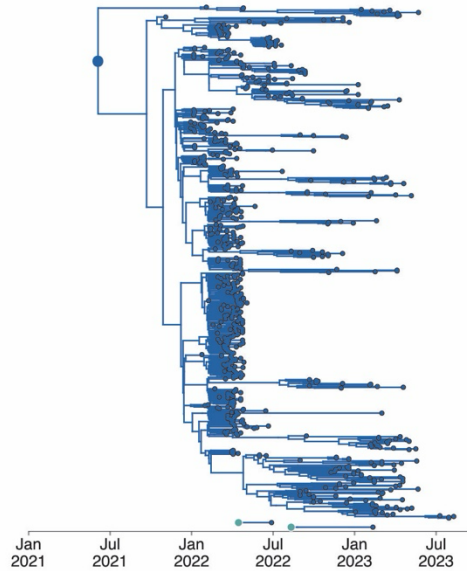
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1:2



1:2.5



1:3

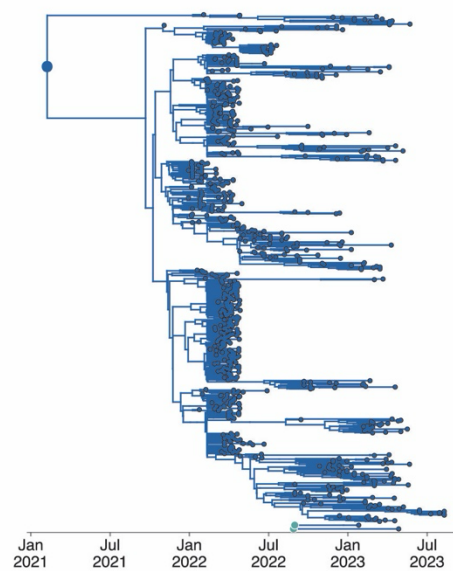


Figure S13: A) Exploded tree view of the MCC tree of two state rarefactions for domestic to wild transitions. Colors correspond to the state of a given tip, branch node.

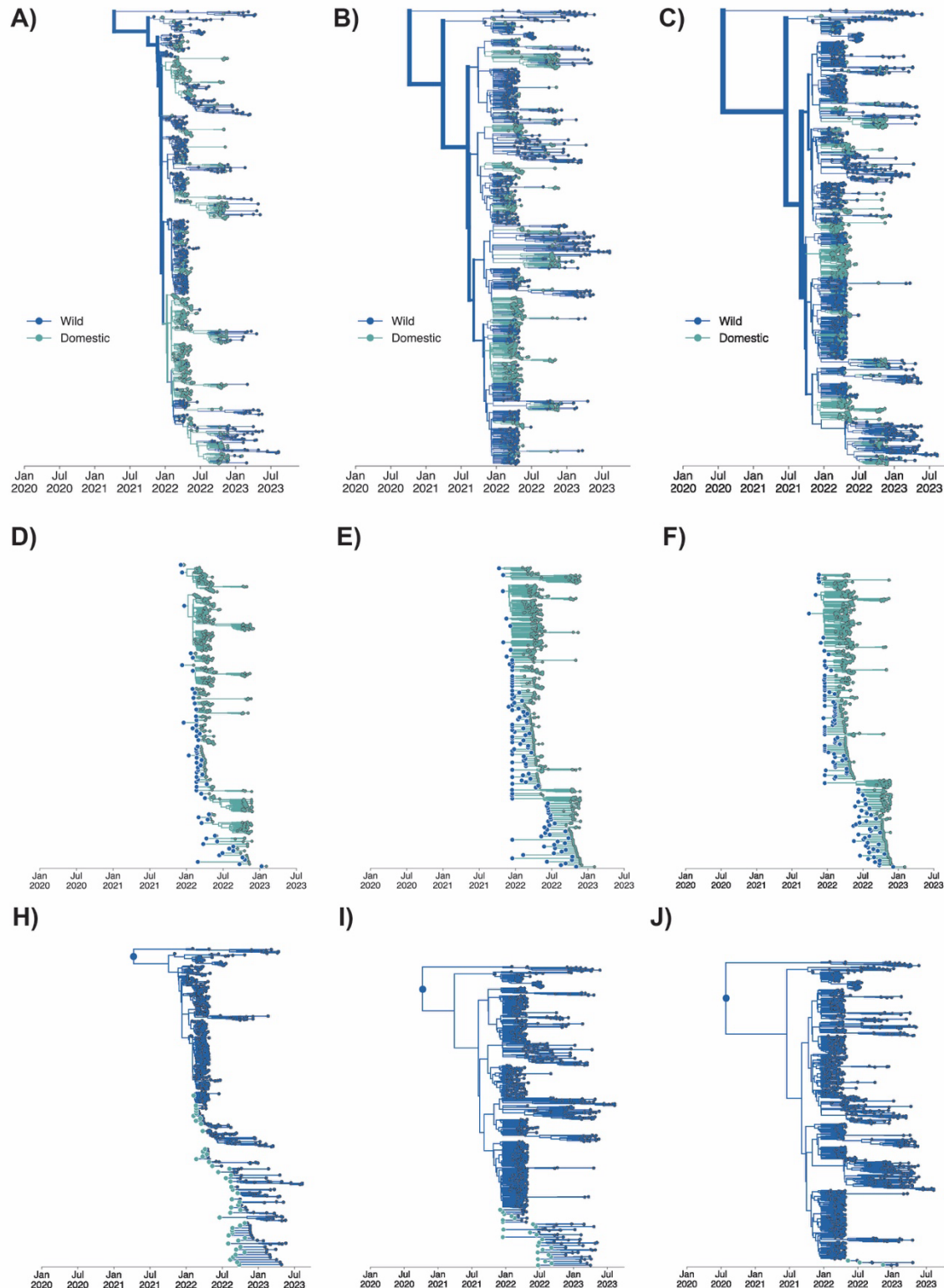


Figure S14: A-C) MCC trees of the ratios of domestic to wild including turkey sequences in increasing order of the number of wild bird sequences. Tips and branches are colored by the state (wild or domestic) of the sample and inferred state respectively. D-F) Exploded tree views of the MCC trees for each titration of two state rarefactions including turkey for wild to domestic transitions. G-J) Exploded tree views of the MCC trees for each titration of two state rarefactions including turkey for domestic to wild transitions. Colors correspond to the state of a given tip, branch node.

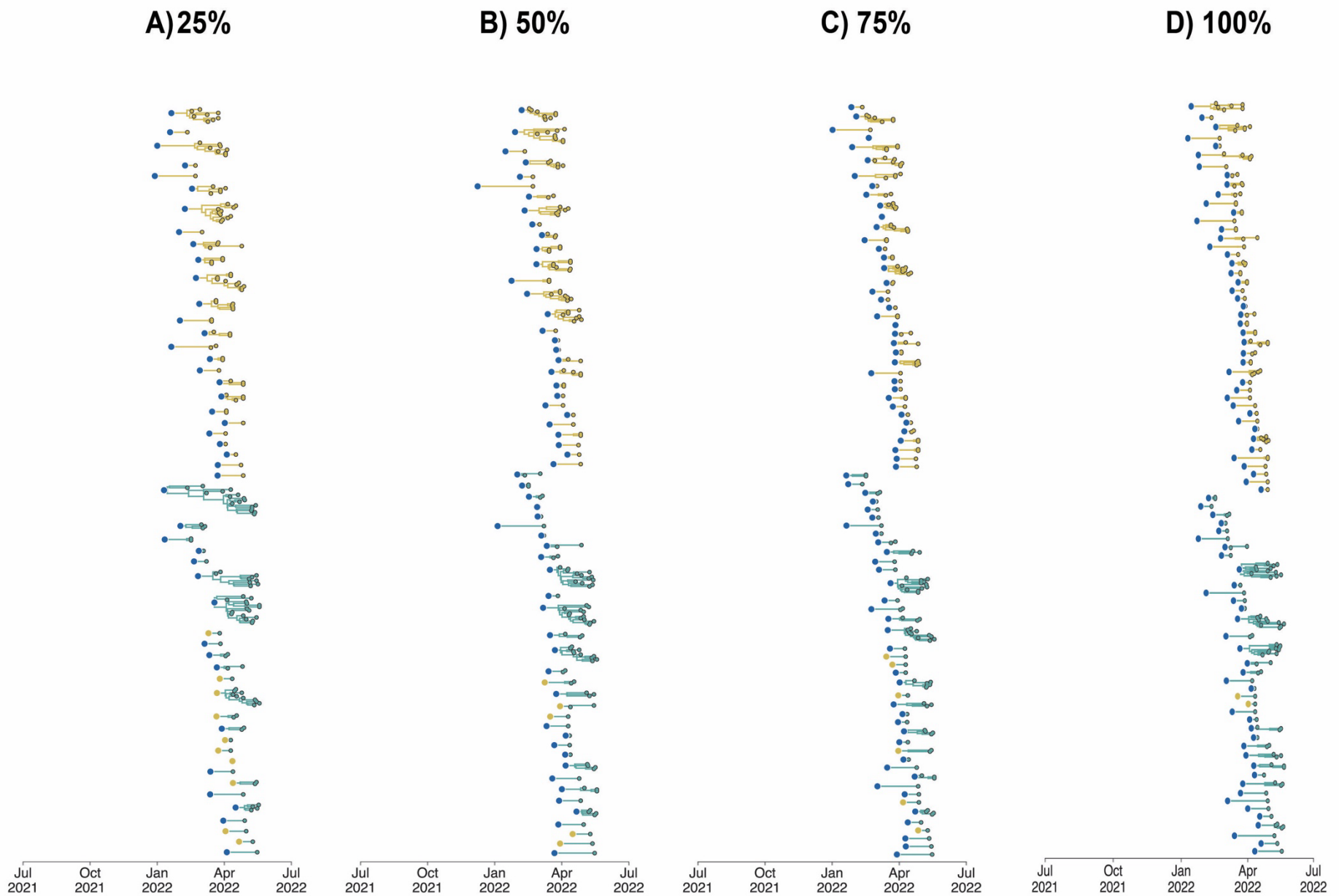
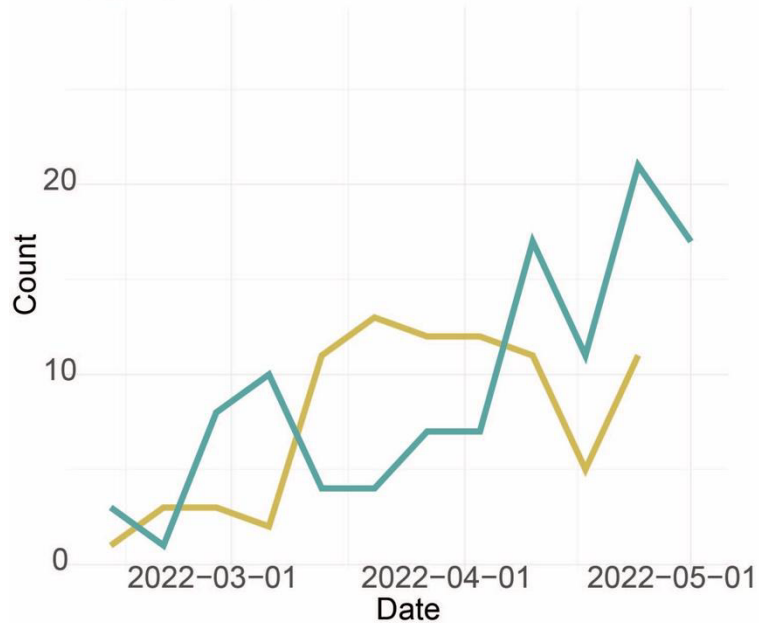
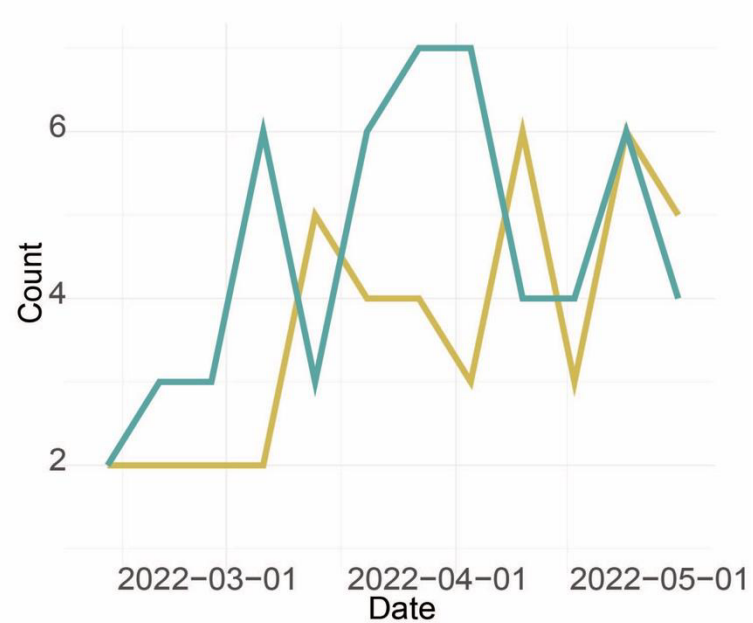


Figure S15: Exploded tree view of MCC trees for each tree in the three-state titration analysis. Percentage refers to the percentage of all available wild sequences used in the given analysis. Subtrees represent the traversal of a tree from the root to the tip where the state is unchanged from the initial state (given by the large dot on left) to the tips represented by the smaller dots representing continuous chains of transmission within a given state. Colors correspond to the state of a given tip, branch node where blue = wild bird, green = commercial bird, yellow = backyard bird.

A) Sequences Over Time
Aggregated by week



B) Detections over Time
Aggregated by week



■ Backyard bird
■ Commercial

Figure S16. A) Number of sequences over time aggregated by week from Backyard birds (yellow) and commercial birds (Green) between 2022-02-12 and 2022-05-01. B) Number of detections (farms/premises) over time aggregated by week from WOAHP Non-Poultry (Backyard birds) and WOAHP Poultry (commercial birds) between 2022-02-12 and 2022-05-01. C) Number of times that a given record production type for a detection transitioned to a different production type for the next record in chronological order for all available detections.

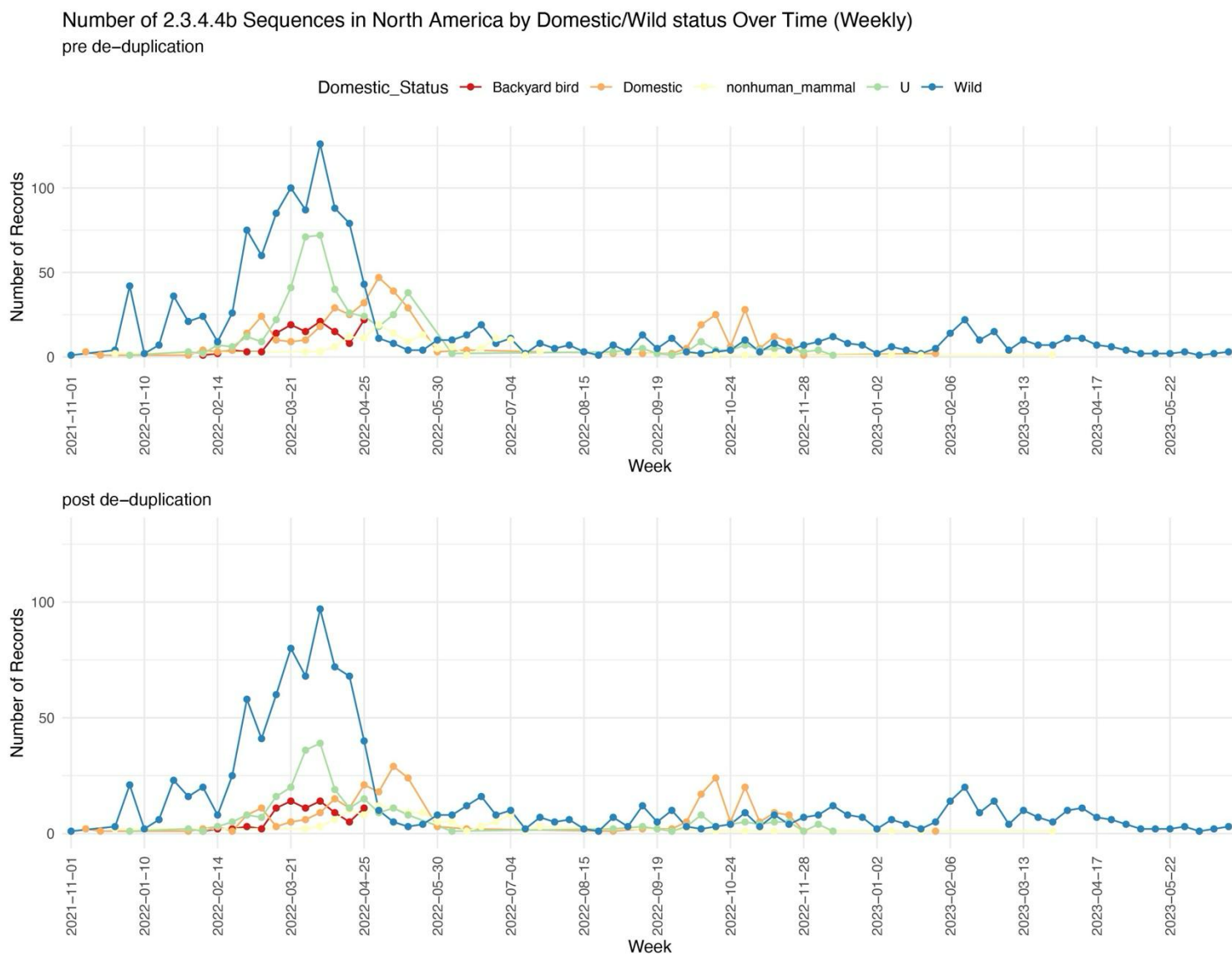


Figure S17. Number of sequences by week by domestic/wild status determined by available metadata before and after deduplication of identical sequences occurring on the same day. Post de-duplication total number of sequences 1818.

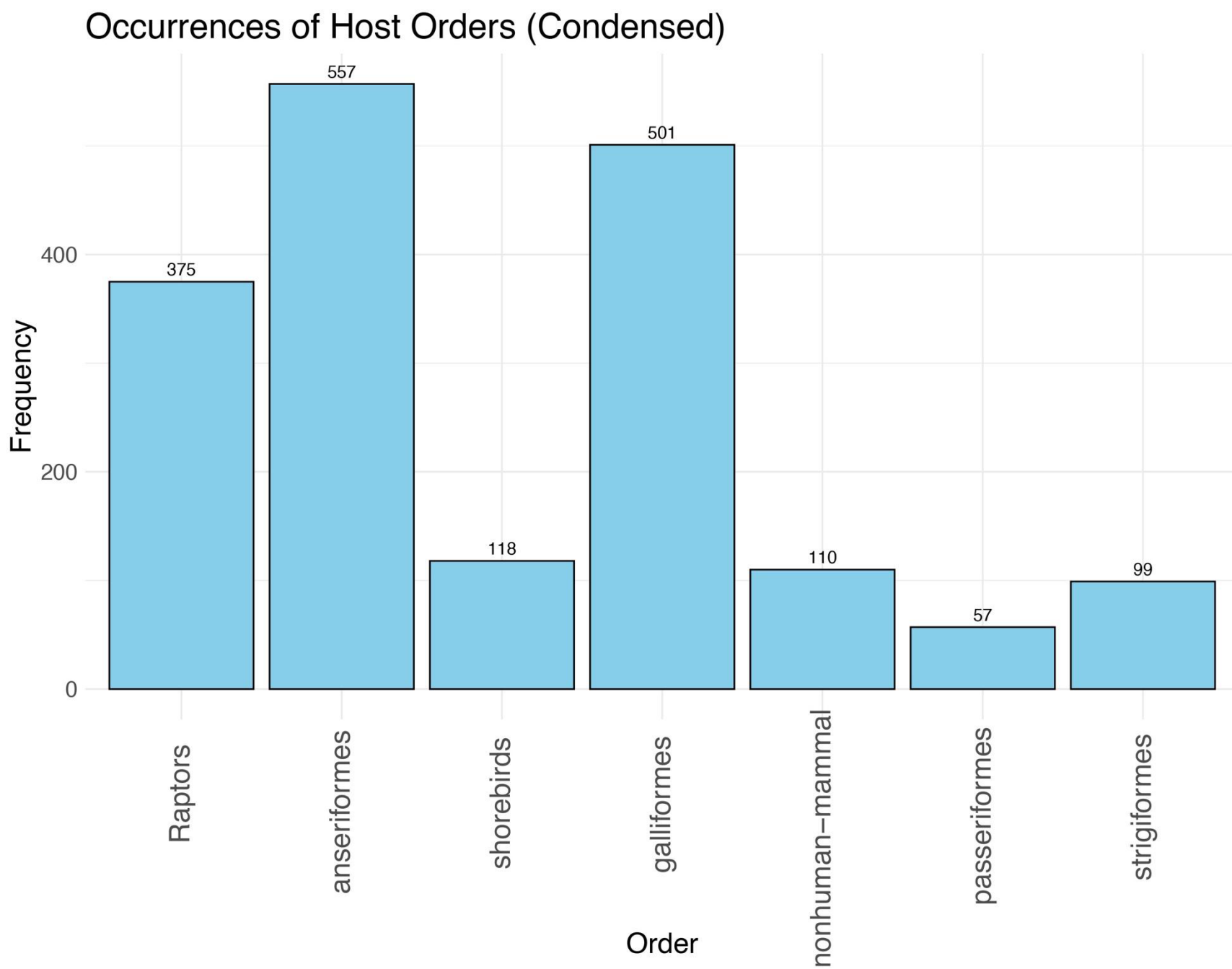


Figure S18. Number of sequences for each host taxonomic order for available sequence data.

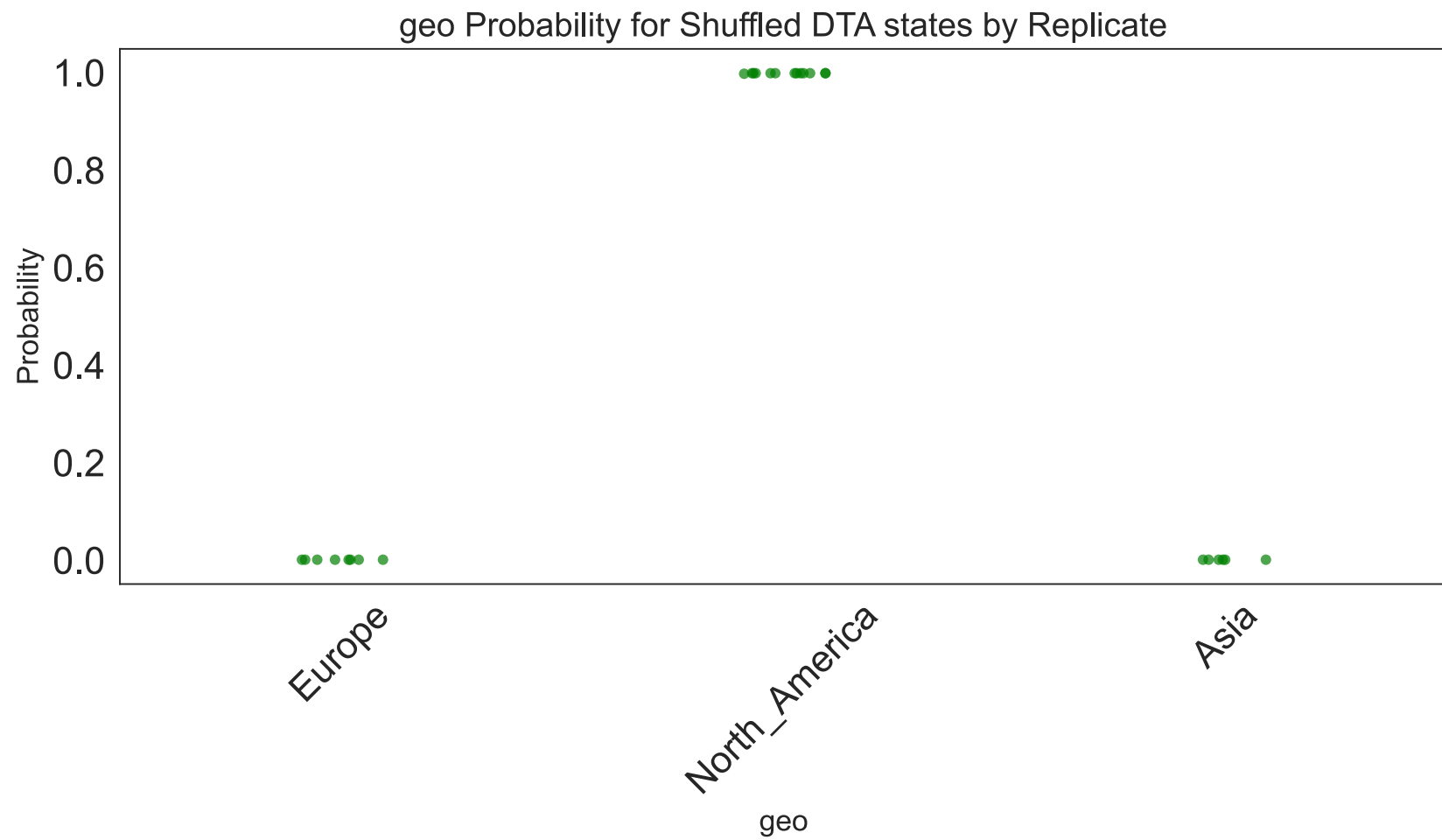


Figure S19 Root state probabilities for 100 replicates of tip shuffle test for Global introduction dataset.

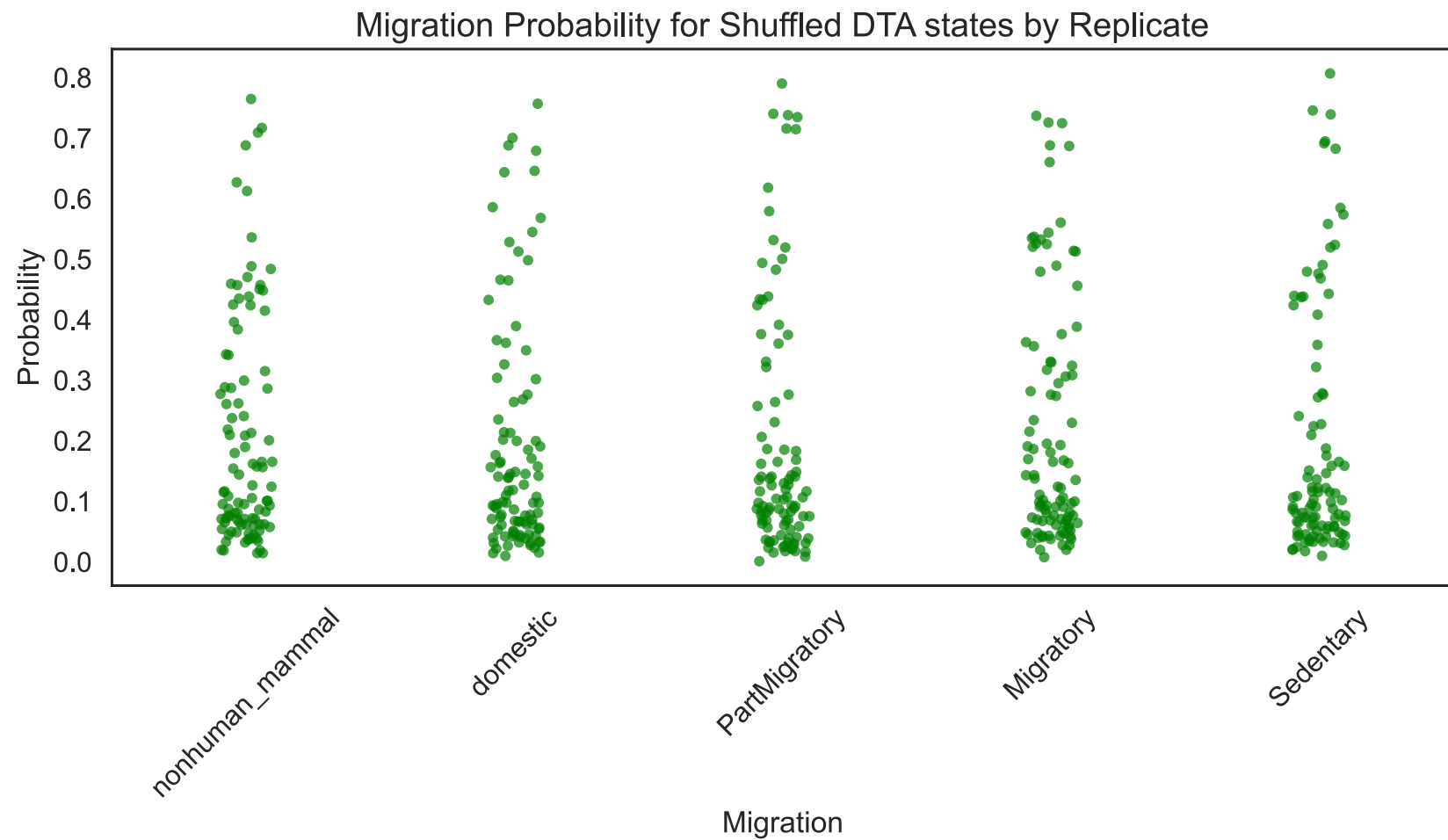


Figure S20 Root state probabilities for 100 replicates of tip shuffle test for Migratory behavior dataset.

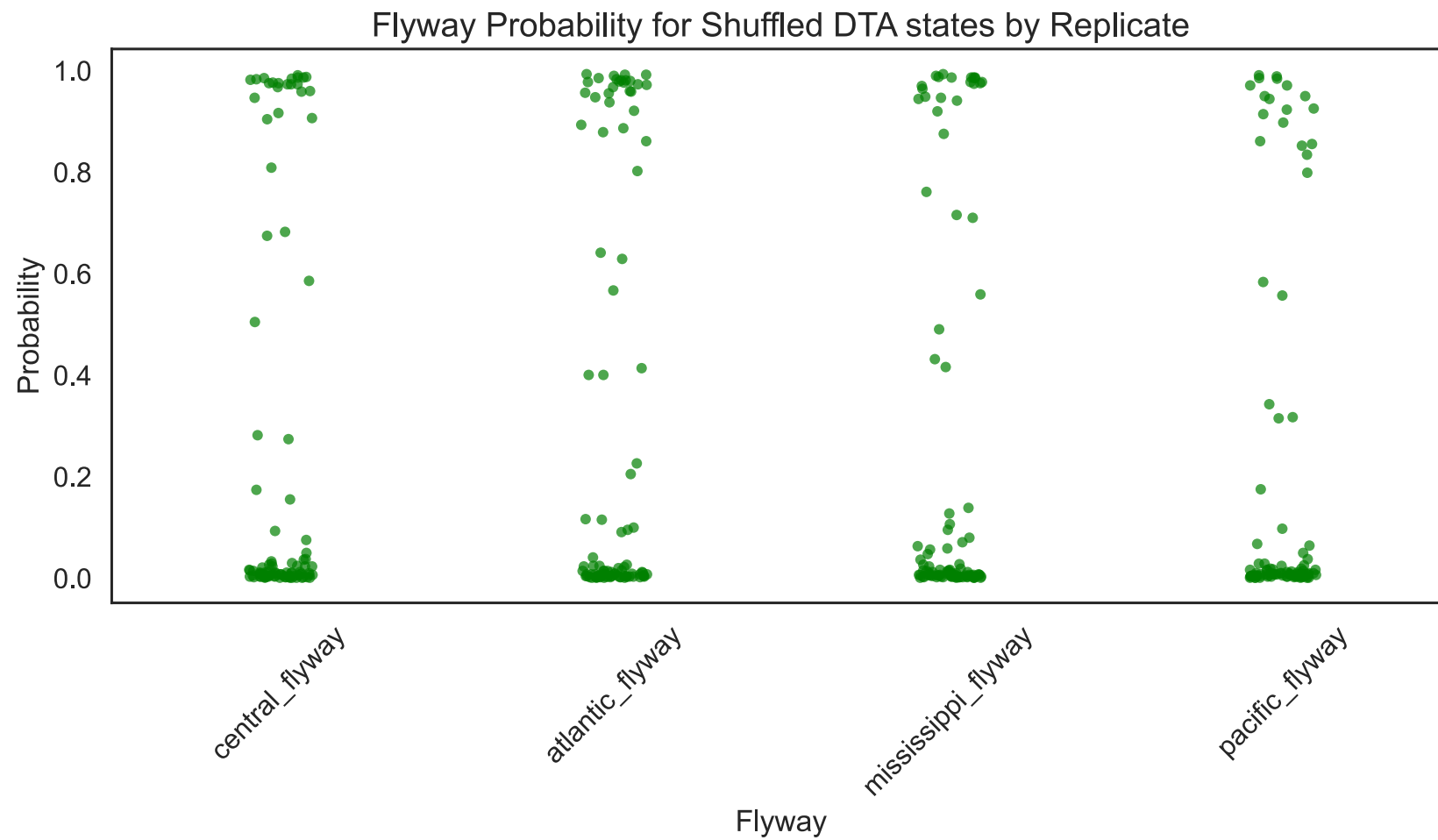


Figure S21 Root state probabilities for 100 replicates of tip shuffle test for flyway dataset.

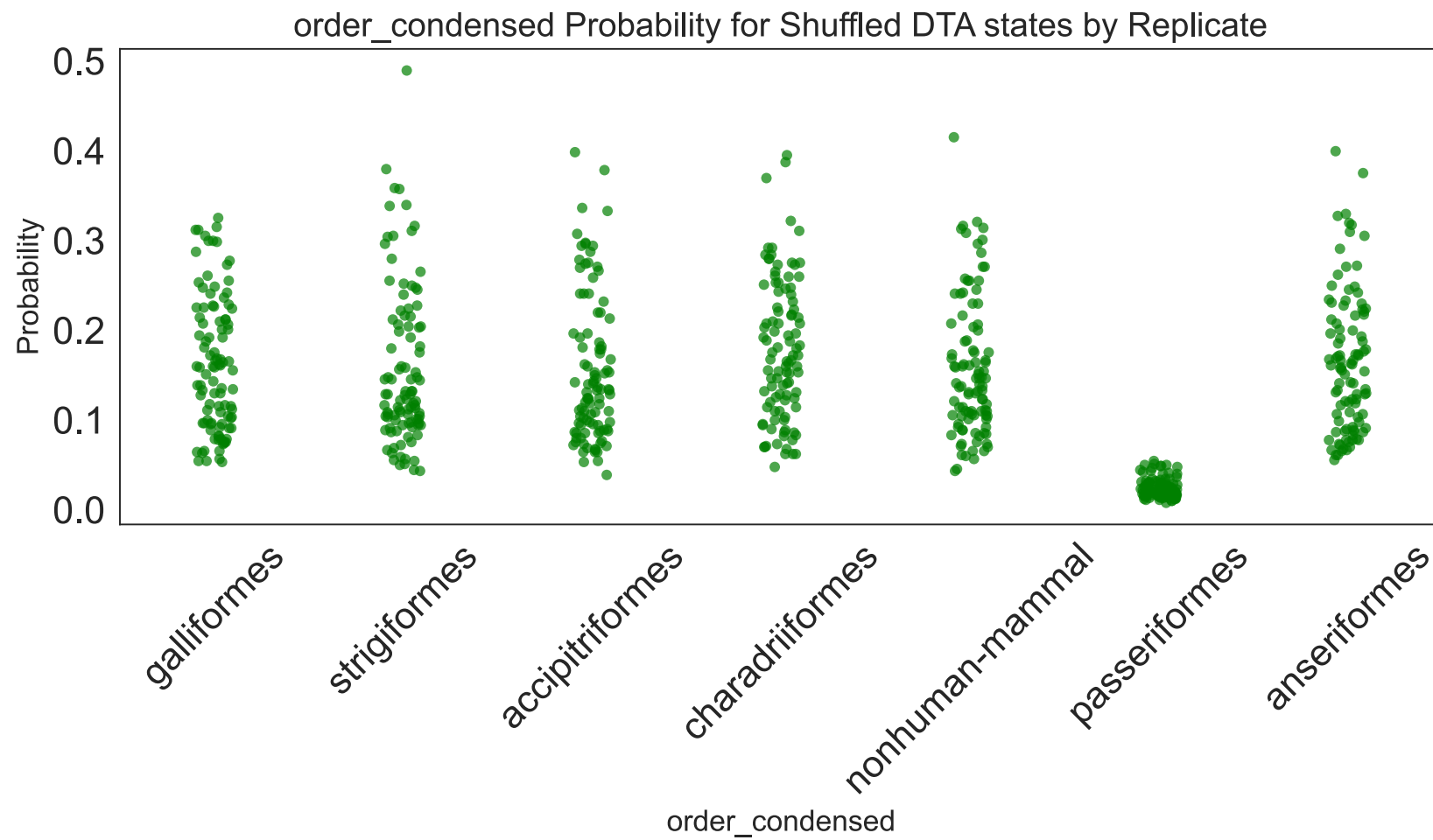


Figure S22 Root state probabilities for 100 replicates of tip shuffle test for order combined

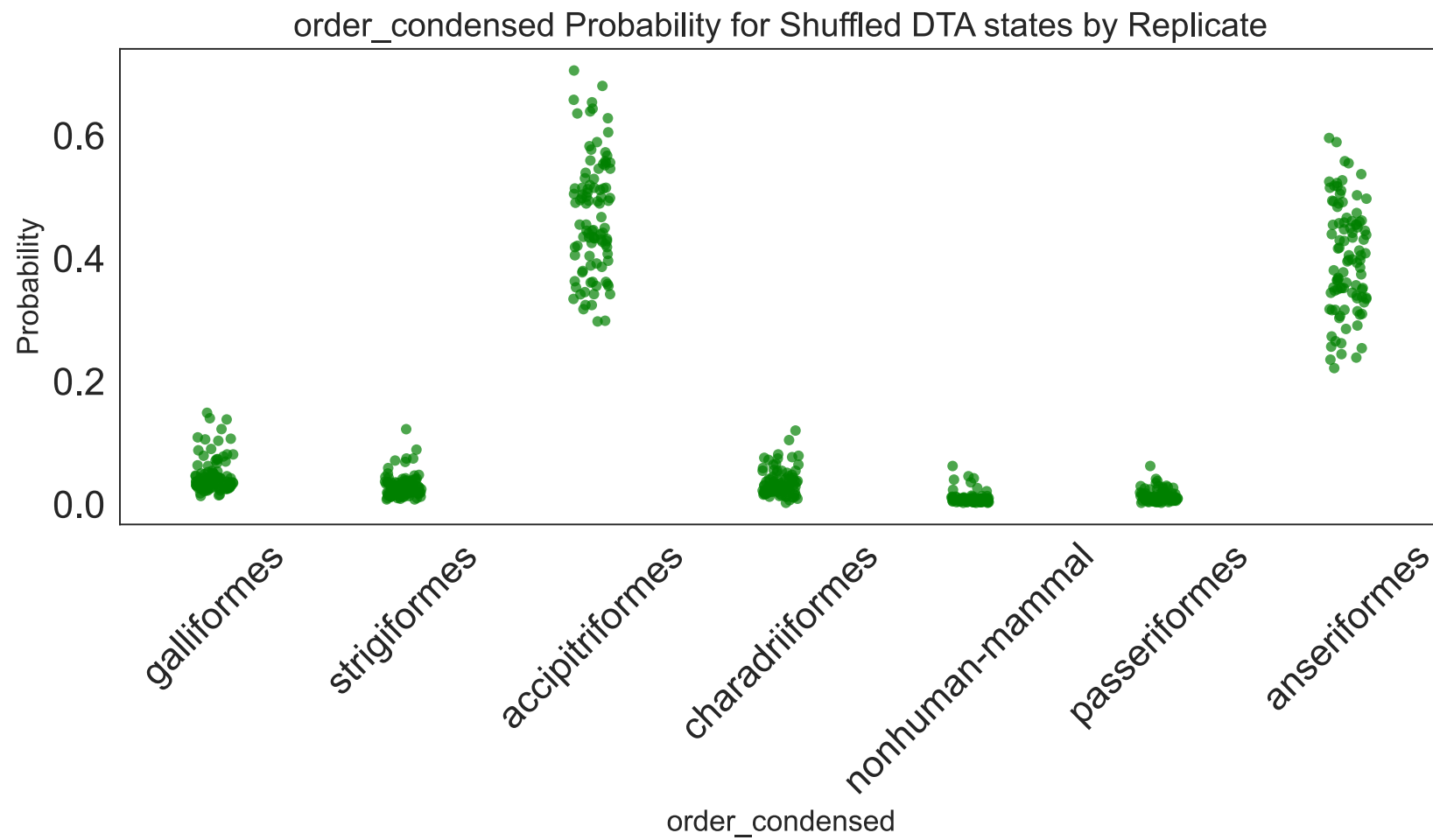


Figure S23 Root state probabilities for 100 replicates of tip shuffle test for order prop combined dataset.

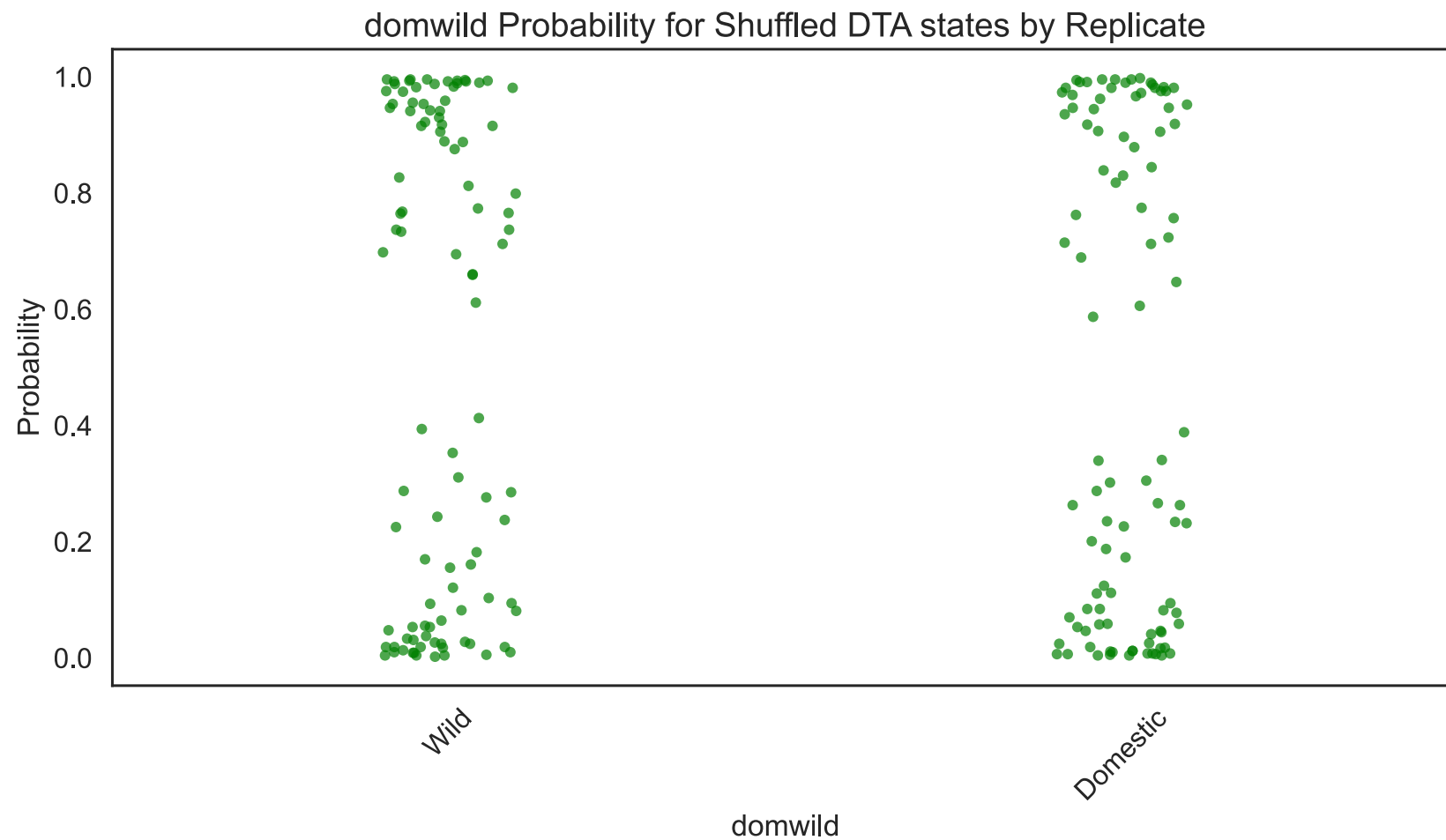


Figure S24 Root state probabilities for 100 replicates of tip shuffle test for domestic wild (1:1) dataset.

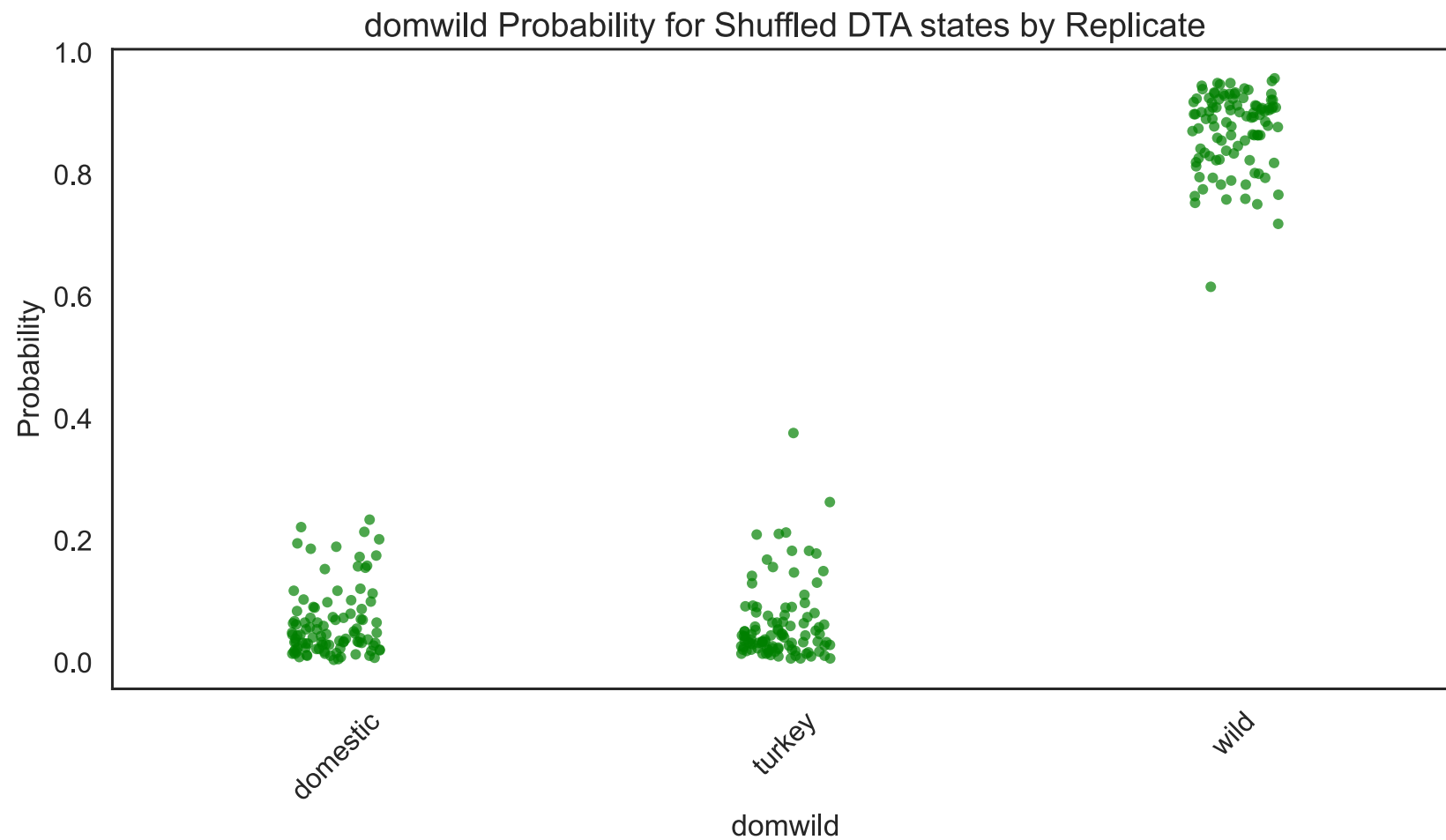


Figure S25 Root state probabilities for 100 replicates of tip shuffle test for domestic wild turkey (1:1:1) dataset.

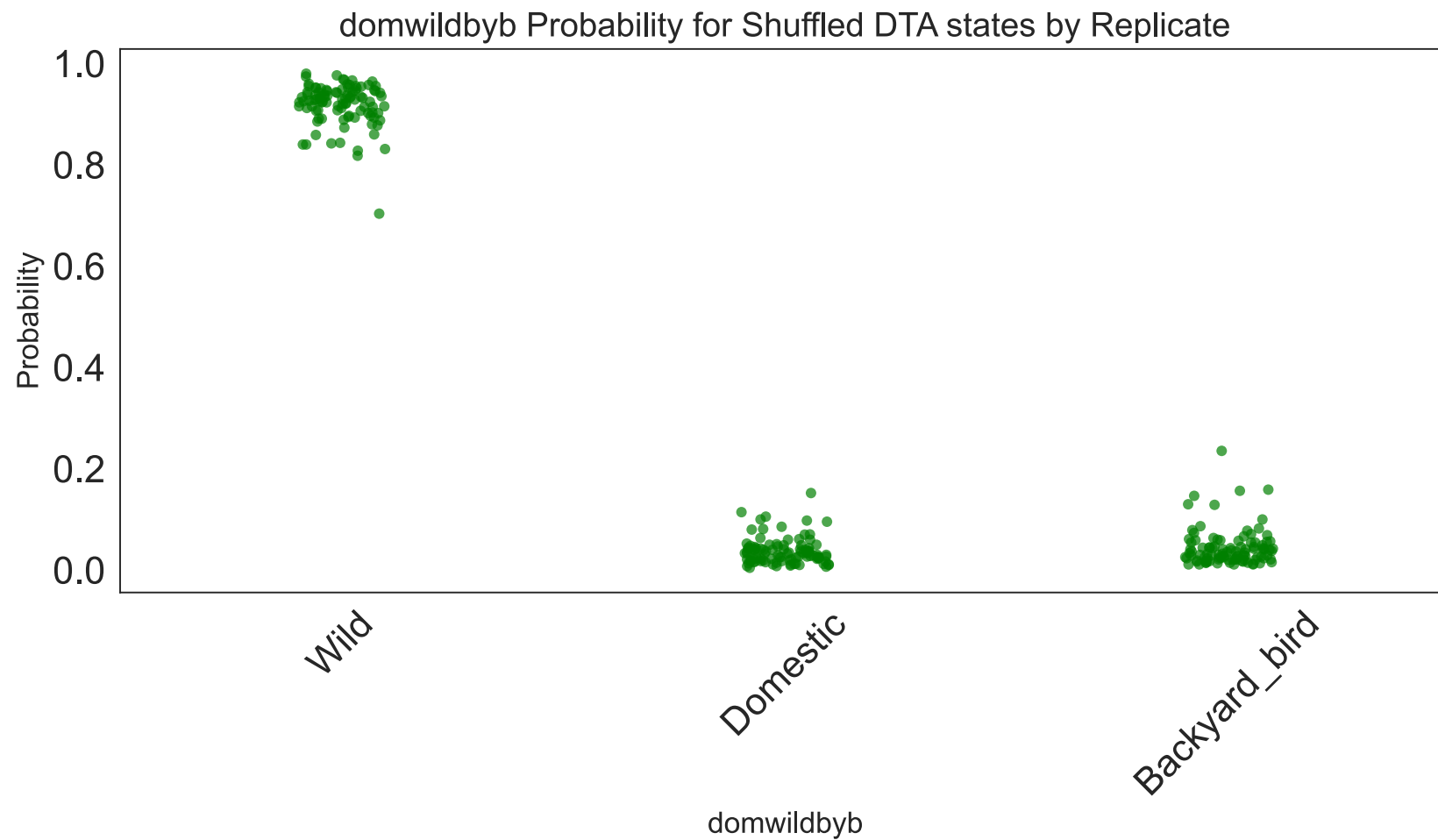


Figure S26 Root state probabilities for 100 replicates of tip shuffle test for domestic wild backyard bird dataset (1:1 domestic:backyard bird + 25% all wild).

Supplementary Tables

From	To	mean	median	l95hpd	h95hpd	BF	Post. prob	mean Markov Jumps	Markov Jumps 95% lhpdp	Markov Jumps 95% hhpd	mean Markov Jump / tree height	Markov jumps / tree height lower 95%hpd	Markov jumps / tree height upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Atlantic	Mississippi	2.305	2.186	0.742	4.08	27000	1	70.232	58	81	37.34	30.837	43.065	0.345	0.285	0.398
Atlantic	Pacific	0.505	0.223	0.004	2.349	9.672	0.763	3.163	1	5	1.681	0.532	2.658	0.016	0.005	0.025
Central	Pacific	1.935	1.823	0.641	3.48	27000	1	24.69	15	34	13.127	7.975	18.077	0.121	0.074	0.167
Central	Mississippi	0.899	0.818	0.21	1.746	27000	1	16.657	10	23	8.856	5.317	12.228	0.082	0.049	0.113
Mississippi	Central	4.687	4.491	1.67	7.873	27000	1	105.895	90	121	56.301	47.85	64.332	0.52	0.442	0.595
Mississippi	Atlantic	0.724	0.643	0.111	1.529	95.912	0.97	2.689	1	7	1.43	0.532	3.722	0.013	0.005	0.034
Pacific	Central	0.698	0.627	0.139	1.418	27000	1	21.134	15	25	11.236	7.975	13.292	0.104	0.074	0.123

Table S1: Results of BSSVS discrete trait analysis for USFWS flyways. Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES_F ACTOR	POSTER IOR PROBAB ILITY
group1_combined_above49N	group2_northernus_southern canada_42N_49N	0.7229 8544	0.6604 1858	0.1485 6531	1.3934 4548	29700	1
group1_combined_above49N	group4_southernus_below36 N	0.8676 7129	0.8023 4959	0.2092 5934	1.6251 426	29700	1
group3_centralus_36N_42N	group2_northernus_southern canada_42N_49N	1.8241 0787	1.6998 0647	0.4851 6246	3.4628 4291	29700	1
group4_southernus_below36 N	group2_northernus_southern canada_42N_49N	0.8289 8677	0.7635 2712	0.1957 8435	1.6407 2213	29700	1
group4_southernus_below36 N	group3_centralus_36N_42N	1.9283 7598	1.8215 5582	0.6390 7759	3.4548 0903	29700	1
group2_northernus_southern canada_42N_49N	group3_centralus_36N_42N	1.3135 3336	1.2012 4055	0.2623 0058	2.5986 7265	9898	0.99969 7
group2_northernus_southern canada_42N_49N	group1_combined_above49N	1.0555 7566	0.9745 5431	0.2306 4274	2.0387 8799	799.78378 4	0.99626 3
group2_northernus_southernca nada_42N_49N	group4_southernus_below36N	0.6058 1523	0.5326 2685	0.0447 1526	1.3228 8619	86.737160 1	0.96656 903
group3_centralus_36N_42N	group1_combined_above49N	0.5288 7832	0.3500 056	0.0002 0955	1.6981 6282	7.6999279 5	0.71962 428
group3_centralus_36N_42N	group4_southernus_below36N	0.7600 6982	0.4825 803	2.47E- 05	2.5101 7546	2.4480924 4	0.44934 855
group1_combined_above49N	group3_centralus_36N_42N	0.6589 8606	0.3403 8264	2.89E- 05	2.3973 9077	2.2889957 3	0.43278 457
group4_southernus_below36N	group1_combined_above49N	0.8512 5837	0.5154 6685	4.59E- 05	2.7941 7744	0.5951343 5	0.16553 883

Table S2: Results of BSSVS discrete trait analysis for geographic group based on latitude. Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	BAYES_FACTOR	POSTERIOR PROBABILITY	mean	median	l95hpd	h95hpd
Migration	PartMigration	36000	1	2.00874182	1.90919107	0.73749557	3.48482027
Migration	Sedentary	181.587629	0.97844684	1.04729841	0.95439458	0.11917316	2.10127971
Migration	Domestic	36000	1	1.33497394	1.25320356	0.40376184	2.38054574
Migration	Nonhumanmammal	400.539326	0.99011221	1.19631674	1.12017969	0.24933207	2.33312444
PartMigration	Sedentary	97.9943343	0.96078214	0.87098186	0.77876747	0.07788287	1.84752126
PartMigration	Domestic	0.52141153	0.11532052	0.91600762	0.58774557	0.00061945	2.89768449
PartMigration	Nonhumanmammal	1.13316225	0.22075325	0.8826551	0.55567327	0.00047205	2.81096245
Sedentary	Domestic	0.53450882	0.11787579	0.95396382	0.62897596	0.00061559	2.96816781
Sedentary	Nonhumanmammal	3.036154	0.43150761	0.779748	0.52251605	3.72E-06	2.41343409
Domestic	Nonhumanmammal	20.3929539	0.83601822	0.93032214	0.80834525	0.01262889	2.11755253
PartMigration	Migration	2.21508717	0.35640484	0.75888425	0.4470211	0.0005076	2.5426762
Sedentary	Migration	36000	1	1.44051268	1.35975899	0.48396807	2.58706142
Domestic	Migration	1.43128677	0.26352628	0.83338968	0.52381554	5.85E-05	2.68385089
Nonhumanmammal	Migration	0.50275138	0.11165426	0.89103885	0.58370738	8.10E-05	2.77166192
Sedentary	PartMigration	5.62416466	0.58437951	0.7707354	0.57152876	5.10E-05	2.17327905
Domestic	PartMigration	10.9891757	0.73314076	0.75017909	0.58957738	0.00020665	1.96900017
Nonhumanmammal	PartMigration	140.594378	0.97233641	0.89119182	0.80402919	0.03583859	1.84688931
Domestic	Sedentary	4.18272727	0.51116543	0.88474002	0.68014107	0.00151883	2.41678285
Nonhumanmammal	Sedentary	510.342857	0.99222309	1.19024247	1.11177603	0.24962462	2.29915023
Nonhumanmammal	Domestic	4.69661836	0.54005111	0.64654853	0.41283259	0.00046807	2.10029534

Table S3: Results of BSSVS discrete trait analysis for Migratory Behavior. Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROB	mean Markov Jumps	Markov jumps lower 95%hpd	Markov jumps upper 95%hpd	Markov Jumps / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hiegh t upper 95% hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Galliformes	4.494	4.374	1.842	7.208	1691.250	0.996	49.950	26.000	73.000	17.808	9.269	26.025	0.493	0.257	0.721
Shorebirds	Nonhuman-Mammal	2.089	1.970	0.640	3.620	537.120	0.989	17.035	9.000	25.000	6.073	3.209	8.913	0.168	0.089	0.247
Shorebirds	Raptors	1.787	1.668	0.358	3.298	245.444	0.976	14.651	5.000	24.000	5.223	1.783	8.556	0.145	0.049	0.237
Anseriformes	Strigiformes	3.406	3.238	1.239	6.141	232.211	0.975	37.889	15.000	64.000	13.508	5.348	22.816	0.374	0.148	0.632
Galliformes	Strigiformes	3.015	2.871	0.853	5.365	193.676	0.970	28.517	4.000	47.000	10.166	1.426	16.756	0.282	0.039	0.464
Galliformes	Nonhuman-Mammal	2.648	2.524	0.779	4.771	170.338	0.966	24.653	5.000	38.000	8.789	1.783	13.547	0.243	0.049	0.375
Shorebirds	Passeriformes	1.219	1.103	0.268	2.428	150.069	0.962	9.351	3.000	14.000	3.334	1.070	4.991	0.092	0.030	0.138
Galliformes	Anseriformes	2.472	2.296	0.453	4.882	146.562	0.961	22.044	2.000	42.000	7.859	0.713	14.973	0.218	0.020	0.415
Anseriformes	Shorebirds	1.775	1.662	0.330	3.411	143.209	0.960	18.978	5.000	34.000	6.766	1.783	12.121	0.187	0.049	0.336
Anseriformes	Raptors	2.527	2.344	0.383	4.865	127.118	0.955	27.702	6.000	51.000	9.876	2.139	18.182	0.273	0.059	0.504
Galliformes	Passeriformes	2.043	1.967	0.469	3.785	117.436	0.951	18.563	5.000	30.000	6.618	1.783	10.695	0.183	0.049	0.296
Strigiformes	Passeriformes	1.574	1.455	0.183	3.095	81.600	0.932	11.313	2.000	20.000	4.033	0.713	7.130	0.112	0.020	0.197
Raptors	Nonhuman-Mammal	1.797	1.633	0.240	3.673	71.148	0.922	14.656	3.000	27.000	5.225	1.070	9.626	0.145	0.030	0.267
Strigiformes	Raptors	1.919	1.753	0.235	3.942	61.218	0.911	13.627	3.000	25.000	4.858	1.070	8.913	0.135	0.030	0.247
Nonhuman-Mammal	Anseriformes	2.236	2.039	0.207	4.517	53.815	0.900	15.836	2.000	29.000	5.646	0.713	10.339	0.156	0.020	0.286
Raptors	Strigiformes	1.710	1.539	0.178	3.444	51.534	0.896	13.861	2.000	25.000	4.941	0.713	8.913	0.137	0.020	0.247
Raptors	Shorebirds	1.681	1.555	0.169	3.486	47.881	0.889	13.376	1.000	24.000	4.769	0.357	8.556	0.132	0.010	0.237
Galliformes	Raptors	2.009	1.857	0.195	4.059	41.642	0.874	19.161	1.000	35.000	6.831	0.357	12.478	0.189	0.010	0.346
Raptors	Anseriformes	1.873	1.719	0.182	3.942	38.518	0.865	14.530	1.000	26.000	5.180	0.357	9.269	0.143	0.010	0.257
Galliformes	Shorebirds	1.479	1.311	0.129	3.152	33.818	0.849	12.235	2.000	23.000	4.362	0.713	8.200	0.121	0.020	0.227
Shorebirds	Anseriformes	1.209	0.952	0.013	3.149	17.014	0.739	7.472	1.000	15.000	2.664	0.357	5.348	0.074	0.010	0.148
Strigiformes	Shorebirds	1.487	1.187	0.016	3.692	11.588	0.659	9.110	1.000	18.000	3.248	0.357	6.417	0.090	0.010	0.178
Strigiformes	Nonhuman-Mammal	1.321	1.040	0.005	3.421	10.660	0.640	7.089	1.000	14.000	2.527	0.357	4.991	0.070	0.010	0.138
Raptors	Galliformes	1.314	1.030	0.002	3.302	9.807	0.620	8.312	1.000	17.000	2.963	0.357	6.061	0.082	0.010	0.168
Nonhuman-Mammal	Galliformes	1.553	1.262	0.009	3.804	8.727	0.593	7.869	1.000	16.000	2.805	0.357	5.704	0.078	0.010	0.158
Anseriformes	Nonhuman-Mammal	1.574	1.334	0.010	3.769	8.399	0.583	16.845	1.000	45.000	6.005	0.357	16.043	0.166	0.010	0.444

Passeriformes	Raptors	1.494	1.206	0.006	3.750	8.353	0.582	5.655	1.000	12.000	2.016	0.357	4.278	0.056	0.010	0.118
Nonhuman-Mammal	Shorebirds	1.369	1.048	0.009	3.769	6.080	0.503	6.318	1.000	14.000	2.252	0.357	4.991	0.062	0.010	0.138
Nonhuman-Mammal	Raptors	1.383	1.076	0.004	3.619	6.069	0.503	6.761	1.000	15.000	2.410	0.357	5.348	0.067	0.010	0.148
Nonhuman-Mammal	Strigiformes	1.370	1.037	0.002	3.771	6.059	0.502	6.575	1.000	14.000	2.344	0.357	4.991	0.065	0.010	0.138
Passeriformes	Anseriformes	1.512	1.156	0.037	4.284	5.963	0.498	5.226	1.000	11.000	1.863	0.357	3.922	0.052	0.010	0.109
Strigiformes	Galliformes	1.434	1.136	0.005	3.733	5.487	0.478	8.253	1.000	18.000	2.942	0.357	6.417	0.081	0.010	0.178
Anseriformes	Passeriformes	1.441	1.124	0.014	3.748	5.066	0.458	13.073	1.000	28.000	4.660	0.357	9.982	0.129	0.010	0.276

Table S4: Results of BSSVS discrete trait analysis for combined results of equal host schema. Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% lhpdpd	Markov Jumps 95% hhpd	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Galliformes	4.427	4.291	2.201	6.781	18006.000	1.000	47.738	30.000	61.000	21.275	13.370	27.186	0.345	0.217	0.441
Anseriformes	Nonhuman-Mammal	0.911	0.856	0.183	1.659	321.491	0.982	12.112	1.000	27.000	5.398	0.446	12.033	0.088	0.007	0.195
Anseriformes	Passeriformes	0.680	0.626	0.158	1.296	714.480	0.992	14.041	5.000	23.000	6.258	2.228	10.250	0.102	0.036	0.166
Anseriformes	Raptors	5.885	5.711	2.805	9.178	18006.000	1.000	85.675	69.000	99.000	38.183	30.751	44.122	0.620	0.499	0.716
Anseriformes	Shorebirds	1.647	1.565	0.359	3.094	1379.538	0.996	25.412	11.000	43.000	11.325	4.902	19.164	0.184	0.080	0.311
Anseriformes	Strigiformes	1.508	1.436	0.594	2.531	18006.000	1.000	27.070	12.000	40.000	12.064	5.348	17.827	0.196	0.087	0.289
Galliformes	Anseriformes	1.391	1.101	0.002	3.668	6.371	0.515	7.856	1.000	19.000	3.501	0.446	8.468	0.057	0.007	0.138
Galliformes	Nonhuman-Mammal	1.131	0.842	0.001	3.323	3.880	0.393	4.239	1.000	14.000	1.889	0.446	6.239	0.031	0.007	0.101
Galliformes	Raptors	1.241	0.924	0.000	3.456	3.555	0.372	8.394	1.000	18.000	3.741	0.446	8.022	0.061	0.007	0.130
Passeriformes	Raptors	1.106	0.775	0.002	3.219	3.627	0.377	4.334	1.000	10.000	1.931	0.446	4.457	0.031	0.007	0.072
Raptors	Anseriformes	2.951	2.753	0.880	5.633	299.288	0.980	26.316	3.000	54.000	11.728	1.337	24.066	0.190	0.022	0.391
Raptors	Passeriformes	1.151	0.744	0.001	3.658	3.897	0.394	11.379	2.000	22.000	5.071	0.891	9.805	0.082	0.014	0.159
Raptors	Shorebirds	1.455	1.265	0.012	3.293	11.253	0.652	18.281	7.000	36.000	8.147	3.120	16.044	0.132	0.051	0.261
Raptors	Strigiformes	1.210	0.998	0.005	2.960	13.121	0.686	19.129	6.000	29.000	8.525	2.674	12.925	0.138	0.043	0.210
Shorebirds	Anseriformes	1.200	0.941	0.005	3.160	9.474	0.612	11.610	1.000	25.000	5.174	0.446	11.142	0.084	0.007	0.181
Shorebirds	Raptors	1.226	0.904	0.000	3.462	3.199	0.348	8.708	1.000	22.000	3.881	0.446	9.805	0.063	0.007	0.159

Table S5: Results of BSSVS discrete trait analysis for combined results of proportional schema. Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% lhpdp	Markov Jumps 95% hhpd	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Galliformes	4.267	4.138	1.981	6.494	702.000	0.992	69.609	53.000	81.000	24.315	18.513	28.294	0.674	0.513	0.784
Anseriformes	Strigiformes	3.977	3.748	1.408	6.777	702.000	0.992	64.918	48.000	78.000	22.676	16.767	27.246	0.629	0.465	0.755
Galliformes	Strigiformes	2.863	2.712	0.467	4.893	151.333	0.962	8.935	1.000	19.000	3.121	0.349	6.637	0.087	0.010	0.184
Galliformes	Anseriformes	2.761	2.501	0.598	5.132	1410.000	0.996	10.775	1.000	21.000	3.764	0.349	7.335	0.104	0.010	0.203
Shorebirds	Nonhuman-mammal	2.643	2.531	0.991	4.629	277.200	0.979	21.281	14.000	30.000	7.434	4.890	10.479	0.206	0.136	0.291
Anseriformes	Raptors	2.628	2.475	0.984	4.545	196.286	0.970	45.234	26.000	60.000	15.801	9.082	20.958	0.438	0.252	0.581
Galliformes	Passeriformes	2.365	2.181	0.873	4.169	95.143	0.941	7.368	1.000	16.000	2.574	0.349	5.589	0.071	0.010	0.155
Galliformes	Nonhuman-mammal	2.267	2.122	0.492	4.185	151.333	0.962	6.759	1.000	14.000	2.361	0.349	4.890	0.065	0.010	0.136
Raptors	Anseriformes	2.175	2.063	0.355	4.230	64.800	0.915	11.995	3.000	22.000	4.190	1.048	7.685	0.116	0.029	0.213
Anseriformes	Nonhuman-mammal	2.148	2.008	0.198	4.164	41.200	0.873	43.700	29.000	56.000	15.265	10.130	19.561	0.423	0.281	0.542
Anseriformes	Shorebirds	2.024	1.879	0.387	3.799	102.923	0.945	33.690	19.000	47.000	11.768	6.637	16.417	0.326	0.184	0.455
Nonhuman -mammal	Galliformes	1.943	1.788	0.374	4.135	135.600	0.958	7.364	1.000	13.000	2.572	0.349	4.541	0.071	0.010	0.126
Strigiformes	Raptors	1.925	1.768	0.237	4.202	26.930	0.818	9.093	1.000	19.000	3.176	0.349	6.637	0.088	0.010	0.184
Passeriformes	Raptors	1.922	1.748	0.276	3.671	196.286	0.970	6.607	1.000	13.000	2.308	0.349	4.541	0.064	0.010	0.126
Raptors	Shorebirds	1.843	1.761	0.021	3.381	48.462	0.890	10.215	1.000	20.000	3.568	0.349	6.986	0.099	0.010	0.194
Galliformes	Raptors	1.767	1.585	0.195	3.549	35.647	0.856	6.841	1.000	14.000	2.390	0.349	4.890	0.066	0.010	0.136
Strigiformes	Shorebirds	1.719	1.350	0.082	4.279	10.465	0.636	7.913	1.000	16.000	2.764	0.349	5.589	0.077	0.010	0.155
Shorebirds	Raptors	1.676	1.553	0.358	3.249	68.526	0.919	12.752	4.000	23.000	4.454	1.397	8.034	0.123	0.039	0.223
Strigiformes	Passeriformes	1.645	1.491	0.246	3.428	72.667	0.924	6.307	1.000	13.000	2.203	0.349	4.541	0.061	0.010	0.126
Raptors	Strigiformes	1.630	1.400	0.227	3.355	34.457	0.852	12.966	2.000	21.000	4.529	0.699	7.335	0.126	0.019	0.203
Shorebirds	Anseriformes	1.609	1.390	0.188	3.173	88.400	0.936	12.370	4.000	23.000	4.321	1.397	8.034	0.120	0.039	0.223
Nonhuman -mammal	Anseriformes	1.578	1.257	0.070	4.015	9.733	0.619	6.065	1.000	13.000	2.118	0.349	4.541	0.059	0.010	0.126
Strigiformes	Galliformes	1.569	1.155	0.032	4.223	3.077	0.339	4.346	1.000	10.000	1.518	0.349	3.493	0.042	0.010	0.097
Raptors	Nonhuman-mammal	1.563	1.217	0.043	3.509	18.414	0.754	5.693	1.000	12.000	1.989	0.349	4.192	0.055	0.010	0.116

Nonhuman - mammal	Shorebirds	1.550	1.199	0.099	3.939	6.991	0.538	4.844	1.000	11.000	1.692	0.349	3.842	0.047	0.010	0.107
Shorebirds	Passeriformes	1.467	1.377	0.432	2.889	196.286	0.970	10.579	5.000	17.000	3.695	1.747	5.938	0.102	0.048	0.165
Nonhuman - mammal	Raptors	1.450	1.293	0.011	3.363	20.222	0.771	7.361	1.000	14.000	2.571	0.349	4.890	0.071	0.010	0.136
Galliformes	Shorebirds	1.448	1.241	0.009	3.263	25.467	0.809	4.992	1.000	11.000	1.744	0.349	3.842	0.048	0.010	0.107
Strigiformes	Nonhuman-mammal	1.398	0.998	0.005	3.770	7.234	0.547	3.981	1.000	9.000	1.391	0.349	3.144	0.039	0.010	0.087
Raptors	Galliformes	1.393	0.950	0.014	3.926	3.316	0.356	3.613	1.000	9.000	1.262	0.349	3.144	0.035	0.010	0.087
Shorebirds	Strigiformes	1.370	1.019	0.003	4.025	9.226	0.606	5.959	1.000	12.000	2.082	0.349	4.192	0.058	0.010	0.116
Nonhuman - mammal	Strigiformes	1.350	1.024	0.023	3.472	9.391	0.610	5.693	1.000	13.000	1.989	0.349	4.541	0.055	0.010	0.126
Anseriformes	Passeriformes	1.304	0.970	0.100	3.500	7.358	0.551	24.674	11.000	35.000	8.619	3.842	12.226	0.239	0.107	0.339

Table S6: Results of BSSVS discrete trait analysis for Taxonomic host order (equal order sample 1). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% lhpdp	Markov Jumps 95% hhpdp	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Galliformes	4.451	4.350	2.028	7.004	5400.000	0.999	49.279	30.000	67.000	15.519	9.448	21.100	0.523	0.319	0.712
Anseriformes	Strigiformes	2.987	2.886	1.293	5.258	194.222	0.970	33.088	15.000	49.000	10.420	4.724	15.431	0.351	0.159	0.520
Galliformes	Strigiformes	2.791	2.672	0.936	4.954	194.222	0.970	28.210	10.000	44.000	8.884	3.149	13.856	0.300	0.106	0.467
Galliformes	Nonhuman-mammal	2.712	2.620	1.173	4.723	409.846	0.986	26.481	13.000	37.000	8.339	4.094	11.652	0.281	0.138	0.393
Galliformes	Raptors	2.455	2.288	0.932	4.453	194.222	0.970	24.571	9.000	39.000	7.738	2.834	12.282	0.261	0.096	0.414
Nonhuman -mammal	Anseriformes	2.138	1.968	0.463	4.173	129.150	0.956	15.442	3.000	27.000	4.863	0.945	8.503	0.164	0.032	0.287
Galliformes	Passeriformes	2.137	2.046	0.716	3.505	239.727	0.976	20.990	10.000	30.000	6.610	3.149	9.448	0.223	0.106	0.319
Raptors	Nonhuman-mammal	2.106	2.009	0.333	3.880	174.200	0.967	17.918	5.000	29.000	5.643	1.575	9.133	0.190	0.053	0.308
Shorebirds	Nonhuman-mammal	2.001	1.900	0.740	3.467	534.600	0.989	17.302	9.000	24.000	5.449	2.834	7.558	0.184	0.096	0.255
Galliformes	Anseriformes	1.892	1.758	0.495	3.653	96.000	0.941	17.963	4.000	30.000	5.657	1.260	9.448	0.191	0.042	0.319
Shorebirds	Raptors	1.863	1.783	0.522	3.374	444.500	0.987	15.574	7.000	25.000	4.905	2.204	7.873	0.165	0.074	0.266
Anseriformes	Raptors	1.855	1.739	0.383	3.679	72.348	0.923	19.340	5.000	34.000	6.091	1.575	10.707	0.205	0.053	0.361
Raptors	Strigiformes	1.851	1.742	0.337	3.512	153.000	0.962	15.209	4.000	26.000	4.790	1.260	8.188	0.162	0.042	0.276
Raptors	Anseriformes	1.846	1.704	0.220	3.615	69.083	0.920	15.037	2.000	26.000	4.735	0.630	8.188	0.160	0.021	0.276
Strigiformes	Raptors	1.790	1.643	0.235	3.447	132.615	0.957	12.926	3.000	23.000	4.070	0.945	7.243	0.137	0.032	0.244
Raptors	Shorebirds	1.688	1.566	0.260	3.486	64.208	0.915	14.188	3.000	27.000	4.468	0.945	8.503	0.151	0.032	0.287
Strigiformes	Passeriformes	1.595	1.470	0.330	3.120	109.021	0.948	12.416	2.000	21.000	3.910	0.630	6.613	0.132	0.021	0.223
Anseriformes	Shorebirds	1.566	1.455	0.342	3.037	111.522	0.949	16.447	5.000	27.000	5.179	1.575	8.503	0.175	0.053	0.287
Nonhuman -mammal	Galliformes	1.430	1.142	0.009	3.580	6.121	0.505	7.415	1.000	16.000	2.335	0.315	5.039	0.079	0.011	0.170
Passeriformes	Raptors	1.421	1.141	0.006	3.501	5.803	0.492	6.209	1.000	12.000	1.955	0.315	3.779	0.066	0.011	0.127
Strigiformes	Galliformes	1.372	1.038	0.014	3.833	3.636	0.377	7.221	1.000	17.000	2.274	0.315	5.354	0.077	0.011	0.181
Raptors	Passeriformes	1.347	1.040	0.010	3.471	7.250	0.547	8.488	1.000	17.000	2.673	0.315	5.354	0.090	0.011	0.181
Nonhuman -mammal	Raptors	1.322	1.044	0.004	3.295	5.310	0.469	6.728	1.000	15.000	2.119	0.315	4.724	0.071	0.011	0.159
Shorebirds	Strigiformes	1.320	0.793	0.003	4.003	3.086	0.340	4.692	1.000	10.000	1.478	0.315	3.149	0.050	0.011	0.106
Galliformes	Shorebirds	1.317	1.175	0.132	2.690	30.527	0.836	11.262	1.000	20.000	3.547	0.315	6.298	0.120	0.011	0.212

Strigiformes	Shorebirds	1.311	1.074	0.032	3.117	11.327	0.654	8.375	1.000	16.000	2.637	0.315	5.039	0.089	0.011	0.170
Nonhuman - mammal	Strigiformes	1.303	0.949	0.002	3.716	5.576	0.482	6.347	1.000	14.000	1.999	0.315	4.409	0.067	0.011	0.149
Nonhuman - mammal	Shorebirds	1.291	0.974	0.011	3.753	6.013	0.501	5.966	1.000	12.000	1.879	0.315	3.779	0.063	0.011	0.127
Passeriformes	Anseriformes	1.255	1.026	0.039	2.911	29.801	0.832	5.402	1.000	10.000	1.701	0.315	3.149	0.057	0.011	0.106
Raptors	Galliformes	1.240	0.988	0.002	3.038	11.495	0.657	8.312	1.000	16.000	2.618	0.315	5.039	0.088	0.011	0.170
Strigiformes	Nonhuman-mammal	1.239	0.899	0.006	3.383	6.810	0.532	6.466	1.000	14.000	2.036	0.315	4.409	0.069	0.011	0.149
Shorebirds	Passeriformes	1.152	1.023	0.222	2.282	140.108	0.959	9.277	3.000	14.000	2.922	0.945	4.409	0.099	0.032	0.149
Shorebirds	Anseriformes	1.118	0.873	0.002	3.217	11.439	0.656	6.597	1.000	13.000	2.077	0.315	4.094	0.070	0.011	0.138

Table S7: Results of BSSVS discrete trait analysis for Taxonomic host order (equal order sample 2). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% lhpdp	Markov Jumps 95% hhpdp	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Galliformes	4.593	4.473	1.842	7.736	1075.2	0.994	48.298	24	72	20.316	10.095	30.286	0.454	0.225	0.676
Anseriformes	Strigiformes	3.674	3.455	1.467	6.572	210.24	0.972	39.473	17	61	16.604	7.151	25.659	0.371	0.16	0.573
Galliformes	Strigiformes	3.278	3.148	0.974	5.738	219.25	0.973	30.129	8	49	12.674	3.365	20.611	0.283	0.075	0.46
Anseriformes	Raptors	3.171	3.014	1.071	5.517	312	0.981	33.503	14	53	14.093	5.889	22.294	0.315	0.132	0.498
Galliformes	Anseriformes	2.974	2.821	0.685	5.363	201.923	0.971	27.024	6	48	11.368	2.524	20.191	0.254	0.056	0.451
Galliformes	Nonhuman-mammal	2.682	2.533	0.617	4.865	116.864	0.951	24.272	7	39	10.21	2.944	16.405	0.228	0.066	0.366
Nonhuman -mammal	Anseriformes	2.505	2.361	0.304	4.87	64.208	0.915	17.048	3	32	7.171	1.262	13.461	0.16	0.028	0.301
Strigiformes	Raptors	2.045	1.884	0.246	4.204	48.06	0.889	14.44	3	26	6.074	1.262	10.937	0.136	0.028	0.244
Shorebirds	Nonhuman-mammal	2.03	1.915	0.733	3.622	766.286	0.992	16.093	8	23	6.769	3.365	9.675	0.151	0.075	0.216
Anseriformes	Shorebirds	1.917	1.799	0.551	3.74	264.3	0.978	19.757	6	32	8.311	2.524	13.461	0.186	0.056	0.301
Galliformes	Passeriformes	1.865	1.766	0.165	3.479	81.194	0.931	16.82	3	28	7.075	1.262	11.778	0.158	0.028	0.263
Raptors	Anseriformes	1.821	1.63	0.012	3.84	23.867	0.799	13.928	1	26	5.859	0.421	10.937	0.131	0.009	0.244
Shorebirds	Raptors	1.74	1.615	0.329	3.322	380.143	0.984	13.668	4	22	5.749	1.683	9.254	0.128	0.038	0.207
Anseriformes	Nonhuman-mammal	1.664	1.508	0.096	3.539	30.282	0.835	16.275	1	32	6.846	0.421	13.461	0.153	0.009	0.301
Galliformes	Shorebirds	1.65	1.488	0.215	3.383	41.009	0.872	13.486	2	24	5.673	0.841	10.095	0.127	0.019	0.225
Raptors	Shorebirds	1.63	1.499	0.172	3.494	36.905	0.86	12.477	2	22	5.248	0.841	9.254	0.117	0.019	0.207
Galliformes	Raptors	1.624	1.416	0.039	3.523	21.303	0.78	13.357	2	26	5.619	0.841	10.937	0.125	0.019	0.244
Strigiformes	Shorebirds	1.602	1.328	0.016	3.97	12.706	0.679	9.599	1	18	4.038	0.421	7.572	0.09	0.009	0.169
Raptors	Strigiformes	1.588	1.406	0.152	3.424	31.542	0.84	11.929	2	23	5.018	0.841	9.675	0.112	0.019	0.216
Nonhuman -mammal	Galliformes	1.574	1.237	0.031	4.031	9.101	0.603	8.156	1	17	3.431	0.421	7.151	0.077	0.009	0.16
Raptors	Nonhuman-mammal	1.548	1.387	0.296	3.337	77.169	0.928	11.618	2	20	4.887	0.841	8.413	0.109	0.019	0.188
Strigiformes	Passeriformes	1.535	1.425	0.183	3.086	66.08	0.917	10.874	2	19	4.574	0.841	7.992	0.102	0.019	0.178
Passeriformes	Strigiformes	1.473	1.095	0.004	4.282	3.758	0.385	4.923	1	11	2.071	0.421	4.627	0.046	0.009	0.103
Strigiformes	Galliformes	1.46	1.19	0.005	3.587	8.975	0.599	8.907	1	19	3.747	0.421	7.992	0.084	0.009	0.178
Passeriformes	Raptors	1.454	1.137	0.026	3.939	7.686	0.562	4.365	1	9	1.836	0.421	3.786	0.041	0.009	0.085
Nonhuman -mammal	Strigiformes	1.442	1.137	0.007	3.951	5.429	0.475	6.615	1	14	2.782	0.421	5.889	0.062	0.009	0.132
Nonhuman -mammal	Raptors	1.424	1.054	0.024	3.917	5.381	0.473	6.571	1	14	2.764	0.421	5.889	0.062	0.009	0.132

Anseriformes	Passeriformes	1.413	1.186	0.015	3.276	18.912	0.759	12.582	1	25	5.293	0.421	10.516	0.118	0.009	0.235
Nonhuman - mammal	Shorebirds	1.399	1.077	0.009	3.757	5.676	0.486	6.42	1	15	2.701	0.421	6.31	0.06	0.009	0.141
Strigiformes	Nonhuman-mammal	1.382	1.165	0.008	3.225	20.116	0.77	7.754	1	15	3.262	0.421	6.31	0.073	0.009	0.141
Raptors	Galliformes	1.367	1.114	0.005	3.302	10.634	0.639	8.329	1	17	3.504	0.421	7.151	0.078	0.009	0.16
Shorebirds	Strigiformes	1.227	0.806	0.004	3.752	5.881	0.495	4.89	1	10	2.057	0.421	4.206	0.046	0.009	0.094
Shorebirds	Passeriformes	1.22	1.147	0.221	2.328	162.938	0.964	9.431	4	14	3.967	1.683	5.889	0.089	0.038	0.132
Shorebirds	Anseriformes	1.196	0.933	0.013	2.953	20.762	0.776	7.195	1	14	3.026	0.421	5.889	0.068	0.009	0.132

Table S8: Results of BSSVS discrete trait analysis for Taxonomic host order (equal order sample 3). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% lhpdpd	Markov Jumps 95% hhpd	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Raptors	5.127	5.039	2.671	7.870	6000.000	1.000	85.678	72.000	99.000	44.299	37.227	51.187	0.647	0.543	0.747
Anseriformes	Galliformes	4.187	4.061	2.120	6.373	6000.000	1.000	47.280	36.000	59.000	24.445	18.613	30.505	0.357	0.272	0.445
Raptors	Anseriformes	2.938	2.736	0.880	5.486	347.294	0.983	27.786	11.000	43.000	14.366	5.687	22.233	0.210	0.083	0.324
Raptors	Shorebirds	1.710	1.581	0.029	3.281	42.435	0.876	15.135	7.000	23.000	7.825	3.619	11.892	0.114	0.053	0.174
Anseriformes	Strigiformes	1.456	1.405	0.606	2.306	6000.000	1.000	31.811	22.000	40.000	16.448	11.375	20.681	0.240	0.166	0.302
Galliformes	Anseriformes	1.302	1.035	0.002	3.313	7.903	0.568	8.462	1.000	19.000	4.375	0.517	9.824	0.064	0.008	0.143
Galliformes	Raptors	1.178	0.908	0.017	3.183	4.391	0.423	9.857	1.000	18.000	5.096	0.517	9.307	0.074	0.008	0.136
Anseriformes	Shorebirds	1.082	0.989	0.288	2.083	456.000	0.987	20.930	11.000	29.000	10.822	5.687	14.994	0.158	0.083	0.219
Shorebirds	Raptors	1.067	0.797	0.003	3.008	4.128	0.408	6.214	1.000	13.000	3.213	0.517	6.721	0.047	0.008	0.098
Shorebirds	Anseriformes	1.063	0.762	0.005	3.049	4.611	0.435	10.599	4.000	17.000	5.480	2.068	8.790	0.080	0.030	0.128
Raptors	Nonhuman-Mammal	1.016	0.677	0.007	3.116	3.766	0.386	7.885	2.000	13.000	4.077	1.034	6.721	0.059	0.015	0.098
Galliformes	Nonhuman-Mammal	0.983	0.765	0.003	2.571	10.410	0.634	3.114	1.000	6.000	1.610	0.517	3.102	0.024	0.008	0.045
Anseriformes	Nonhuman-Mammal	0.710	0.658	0.183	1.277	255.130	0.977	7.070	1.000	11.000	3.655	0.517	5.687	0.053	0.008	0.083
Raptors	Passeriformes	0.664	0.550	0.040	1.454	47.150	0.887	8.598	2.000	15.000	4.445	1.034	7.756	0.065	0.015	0.113
Anseriformes	Passeriformes	0.569	0.530	0.138	1.024	1195.200	0.995	13.836	7.000	22.000	7.154	3.619	11.375	0.104	0.053	0.166

Table S9: Results of BSSVS discrete trait analysis for Taxonomic host order (case proportional sample 1). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% lhp	Markov Jumps 95% hhp	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Raptors	6.506	6.299	3.435	9.973	6000.000	1.000	87.856	75.000	99.000	34.776	29.687	39.187	0.603	0.515	0.680
Anseriformes	Galliformes	4.443	4.280	2.520	7.024	6000.000	1.000	42.613	30.000	52.000	16.867	11.875	20.583	0.293	0.206	0.357
Raptors	Anseriformes	3.009	2.830	0.986	5.906	208.500	0.972	34.512	14.000	54.000	13.661	5.542	21.375	0.237	0.096	0.371
Anseriformes	Shorebirds	2.133	2.023	0.931	3.447	6000.000	1.000	29.608	14.000	43.000	11.720	5.542	17.020	0.203	0.096	0.295
Galliformes	Anseriformes	1.696	1.451	0.050	4.017	16.664	0.735	7.348	1.000	17.000	2.908	0.396	6.729	0.050	0.007	0.117
Anseriformes	Strigiformes	1.528	1.437	0.533	2.554	6000.000	0.999	27.804	17.000	38.000	11.006	6.729	15.041	0.191	0.117	0.261
Galliformes	Raptors	1.358	1.036	0.035	3.744	3.734	0.384	6.912	1.000	13.000	2.736	0.396	5.146	0.047	0.007	0.089
Shorebirds	Anseriformes	1.357	1.048	0.005	3.559	5.708	0.488	8.537	1.000	18.000	3.379	0.396	7.125	0.059	0.007	0.124
Raptors	Strigiformes	1.355	1.173	0.114	3.012	32.500	0.844	17.417	6.000	28.000	6.894	2.375	11.083	0.120	0.041	0.192
Raptors	Nonhuman-Mammal	1.329	0.942	0.003	3.853	3.032	0.336	4.321	1.000	10.000	1.710	0.396	3.958	0.030	0.007	0.069
Raptors	Shorebirds	1.278	0.990	0.006	3.764	3.326	0.357	21.252	7.000	36.000	8.412	2.771	14.250	0.146	0.048	0.247
Galliformes	Nonhuman-Mammal	1.237	0.922	0.007	3.621	3.059	0.338	2.925	1.000	6.000	1.158	0.396	2.375	0.020	0.007	0.041
Strigiformes	Raptors	1.203	0.862	0.001	3.389	4.145	0.409	12.006	1.000	22.000	4.752	0.396	8.708	0.082	0.007	0.151
Shorebirds	Nonhuman-Mammal	1.140	0.872	0.003	2.965	6.307	0.512	3.665	1.000	6.000	1.451	0.396	2.375	0.025	0.007	0.041
Passeriformes	Galliformes	1.118	0.793	0.003	3.318	5.440	0.476	3.573	1.000	7.000	1.414	0.396	2.771	0.025	0.007	0.048
Anseriformes	Nonhuman-Mammal	0.995	0.921	0.198	1.709	181.688	0.968	11.096	6.000	15.000	4.392	2.375	5.937	0.076	0.041	0.103
Anseriformes	Passeriformes	0.740	0.694	0.220	1.367	394.400	0.985	15.569	8.000	23.000	6.163	3.167	9.104	0.107	0.055	0.158

Table S10: Results of BSSVS discrete trait analysis for Taxonomic host order (case proportional sample 2). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% lhpdpd	Markov Jumps 95% hhpd	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Anseriformes	Raptors	6.016	5.933	3.202	9.178	6000.000	1.000	83.491	69.000	99.000	36.763	30.382	43.592	0.612	0.506	0.726
Anseriformes	Galliformes	4.648	4.525	2.393	7.064	6000.000	1.000	53.319	42.000	61.000	23.478	18.494	26.860	0.391	0.308	0.447
Raptors	Anseriformes	2.904	2.684	0.915	5.356	423.000	0.986	16.650	3.000	31.000	7.331	1.321	13.650	0.122	0.022	0.227
Anseriformes	Shorebirds	1.724	1.632	0.566	2.983	6000.000	1.000	25.697	13.000	37.000	11.315	5.724	16.292	0.188	0.095	0.271
Anseriformes	Strigiformes	1.540	1.472	0.659	2.660	6000.000	1.000	21.595	12.000	29.000	9.509	5.284	12.769	0.158	0.088	0.213
Raptors	Shorebirds	1.376	1.197	0.084	3.069	15.761	0.724	18.455	8.000	28.000	8.126	3.523	12.329	0.135	0.059	0.205
Shorebirds	Anseriformes	1.181	0.988	0.043	2.996	64.659	0.915	15.695	5.000	25.000	6.911	2.202	11.008	0.115	0.037	0.183
Raptors	Strigiformes	1.155	1.012	0.053	2.409	116.571	0.951	20.145	11.000	29.000	8.870	4.844	12.769	0.148	0.081	0.213
Anseriformes	Nonhuman-Mammal	1.029	0.986	0.413	1.852	6000.000	1.000	18.171	9.000	27.000	8.001	3.963	11.889	0.133	0.066	0.198
Passeriformes	Raptors	0.961	0.720	0.014	2.696	11.014	0.647	4.772	1.000	10.000	2.101	0.440	4.403	0.035	0.007	0.073
Anseriformes	Passeriformes	0.731	0.696	0.186	1.341	1195.200	0.995	12.717	5.000	20.000	5.599	2.202	8.806	0.093	0.037	0.147

Table S11: Results of BSSVS discrete trait analysis for Taxonomic host order (case proportional sample 3). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

Analysis	ratio	Transitions to Domestic	Transitions to Wild
2-state	1:1	46	40
2-state	1:1.5	66	29
2-state	1:2	79	16
2-state	1:2.5	99	4
2-state	1:3	106	4
2-state with turkey	1:1	61	51
2-state with turkey	1:1.5	109	26
2-state with turkey	1:2	113	4

Table S12: Transitions into Domestic and Wild for each ratio dataset for two state rarefaction and two state rarefaction with turkey sequences.

From	To	Transition count
Wild	Domestic	48
Wild	Turkey	42
Domestic	Wild	5
Domestic	Turkey	18
Turkey	Domestic	38
Turkey	Wild	1

Table S13: Number of transitions between states in three state rarefaction of wild, domestic, and turkey for the 1:2 domestic:wild with turkey sequence dataset.

From	To	mean	median	l95hpd	h95hpd	BAYES_FACTOR	POSTERIOR PROBABILITY
Wild	Backyard_bird	1.86774162	1.70511383	0.37454847	3.68662003	18000	1
Wild	Commercial	1.46084104	1.31711214	0.26387335	3.00326823	18000	1
Backyard_bird	Commercial	0.95115148	0.81135468	0.07030257	2.20310188	87.5621891	0.97766915
Backyard_bird	Wild	0.59728953	0.41999835	0.00047605	1.71248402	7.84792123	0.79691145
Commercial	Backyard_bird	0.58676046	0.29058374	3.52E-05	2.18585542	2.50726089	0.55627153
Commercial	Wild	0.51687069	0.26402531	0.00010671	1.99546369	3.66278704	0.64681702

Table S14. Discrete trait rates for backyard bird wild bird titration analysis (25% of all wild bird sequence). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES_FACTOR	POSTERIOR PROBABILITY
Wild	Backyard_bird	1.91959767	1.75610576	0.39212384	3.81857375	18000	1
Wild	Commercial	1.71435411	1.5565693	0.3141297	3.48816005	18000	1
Backyard_bird	Commercial	0.72271333	0.56016402	0.00049205	1.90186488	12.5529507	0.86257083
Commercial	Wild	0.57838557	0.25387721	1.88E-05	2.25248367	1.92799476	0.49083435
Backyard_bird	Wild	0.56892638	0.36543149	0.00035904	1.81943486	5.7561396	0.74213976
Commercial	Backyard_bird	0.49228375	0.24128113	1.86E-05	1.8770157	3.86575432	0.65903788

Table S15 Discrete trait rates for backyard bird wild bird titration analysis (50% of all wild bird sequence). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES_FACTOR	POSTERIOR PROBABILITY
Wild	Backyard_bird	1.84672556	1.68062813	0.2989798	3.81025501	18000	1
Wild	Commercial	1.58010327	1.43058414	0.24177847	3.28214739	18000	1
Backyard_bird	Wild	0.81861356	0.50058483	1.08E-05	2.66432008	0.72964367	0.26730363
Backyard_bird	Commercial	0.64099347	0.50335486	0.0056189	1.63180822	18.9569267	0.90456616
Commercial	Wild	0.60637747	0.24737791	1.03E-06	2.40045423	1.71865317	0.46217087
Commercial	Backyard_bird	0.48361884	0.20683227	9.64E-06	1.94383423	3.45680509	0.63348517

Table S16. Discrete trait rates for backyard bird wild bird titration analysis (75% of all wild bird sequence). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

From	To	mean	median	l95hpd	h95hpd	BAYES_FACTOR	POSTERIOR PROBABILITY	mean Markov Jumps	Markov Jumps 95% l hpd	Markov Jumps 95% h hpd	mean Markov Jump / tree height	Markov jumps / tree hieght lower 95%hpd	Markov jumps / tree hieght upper 95%hpd	Markov Jump / tree length	Markov Jump / tree length lower 95% hpd	Markov Jump / tree length upper 95% hpd
Wild	Backyard_bird	1.825	1.644	0.283	3.787	18000.000	1.000	42.669	35.000	49.000	48.963	40.163	56.228	0.755	0.619	0.867
Wild	Commercial	1.601	1.441	0.233	3.356	18000.000	1.000	40.506	35.000	46.000	46.481	40.163	52.785	0.716	0.619	0.814
Backyard_bird	Wild	0.859	0.545	3.260E-05	2.727	0.424	0.175	1.748	1.000	4.000	2.006	1.148	4.590	0.031	0.018	0.071
Backyard_bird	Commercial	0.639	0.405	3.090E-06	2.053	4.584	0.696	2.334	1.000	4.000	2.678	1.148	4.590	0.041	0.018	0.071
Commercial	Backyard_bird	0.563	0.229	1.880E-06	2.317	2.137	0.517	1.257	1.000	2.000	1.442	1.148	2.295	0.022	0.018	0.035
Commercial	Wild	0.519	0.209	1.090E-05	2.072	2.649	0.570	1.262	1.000	2.000	1.448	1.148	2.295	0.022	0.018	0.035

Table S17 Discrete trait rates for backyard bird wild bird titration analysis (100% of all wild bird sequence). Table is in order of highest mean transition rate to lowest with rates having BF > 100 bolded. Rates with at least a BF > 3 are shown.

Table S20. Acknowledgments table for GISAID isolates used in these analyses. Please visit GitHub repository for acknowledgements table.