Supplementary material

Species that migrate in flocks show greater long-term range shift rates

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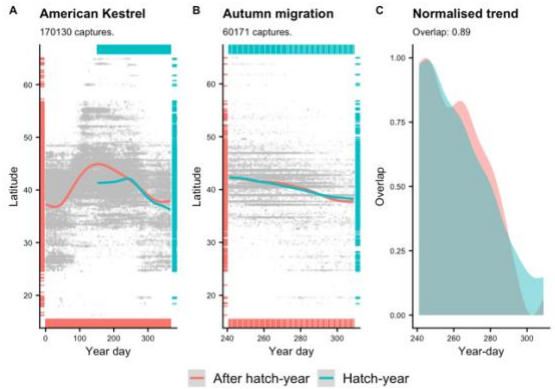
SM1. Migratory timing banding analysis



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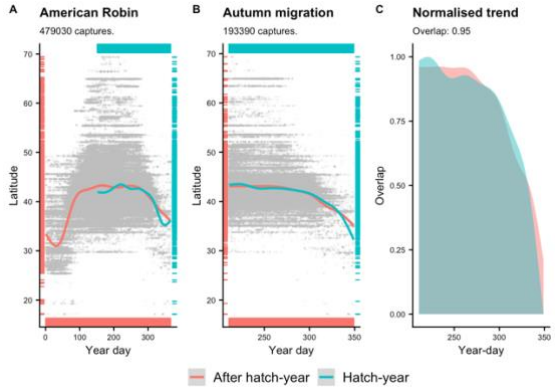

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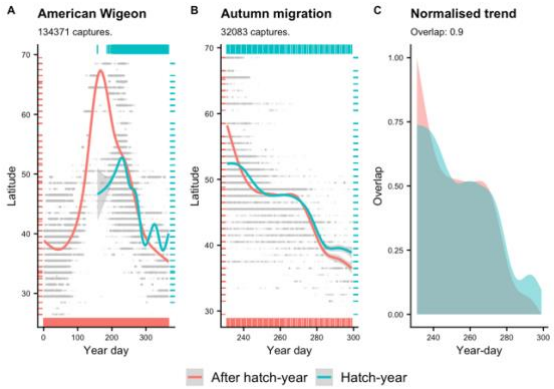

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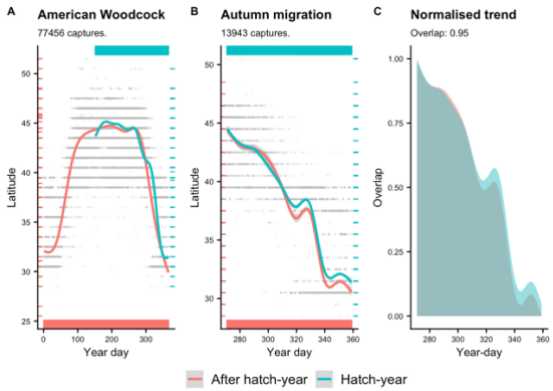

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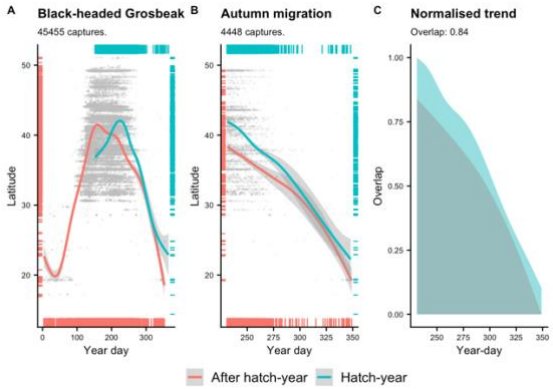

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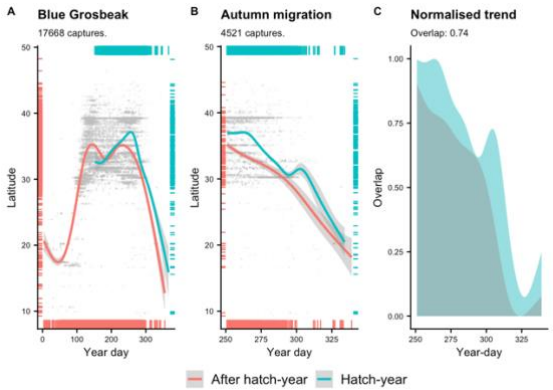

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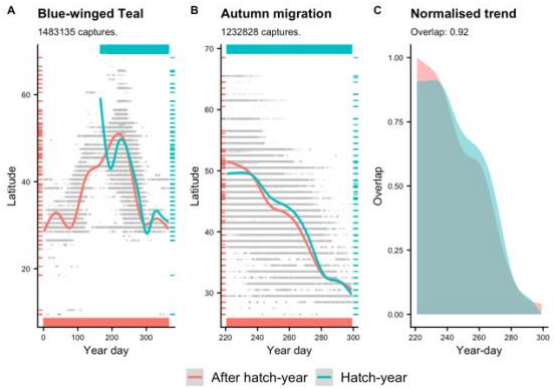

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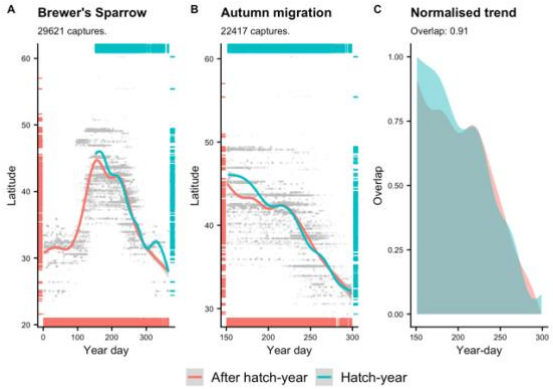

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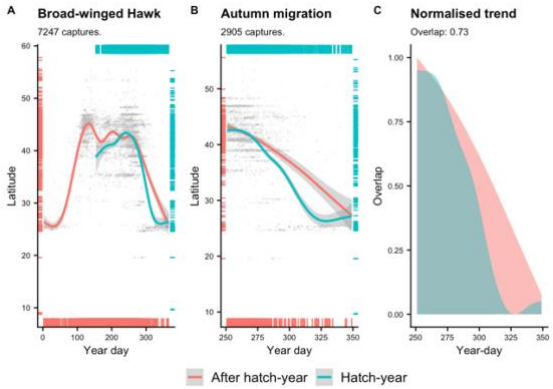

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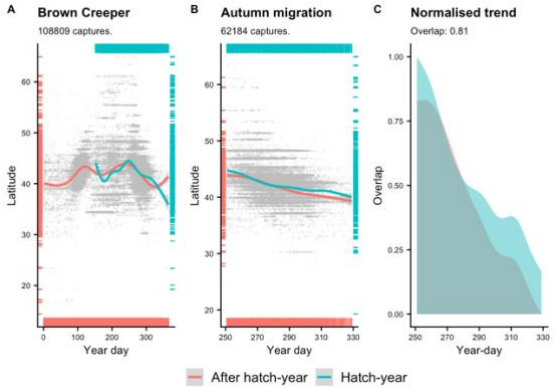

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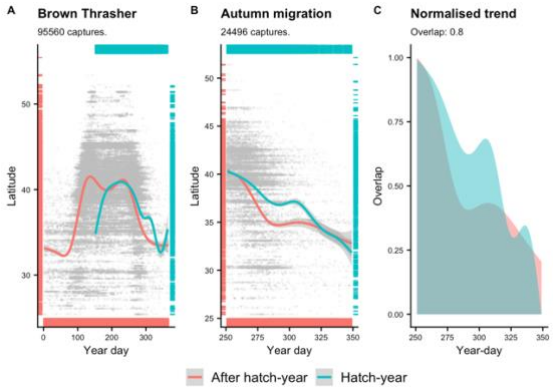

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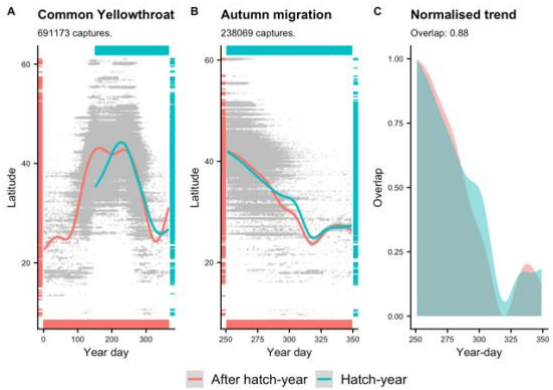

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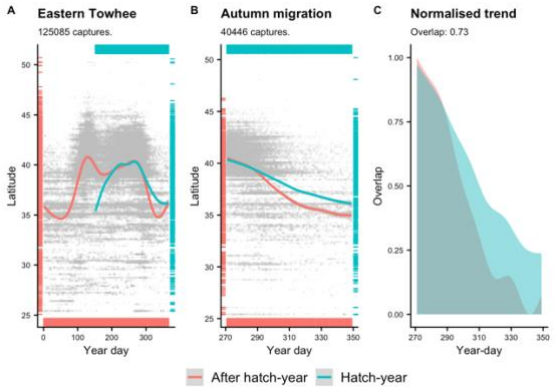

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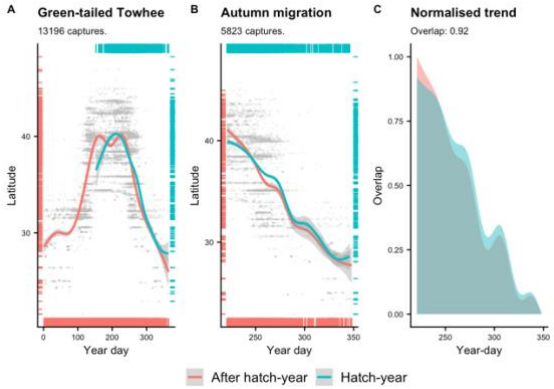

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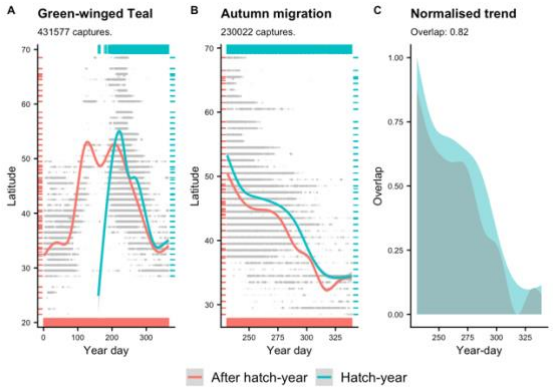

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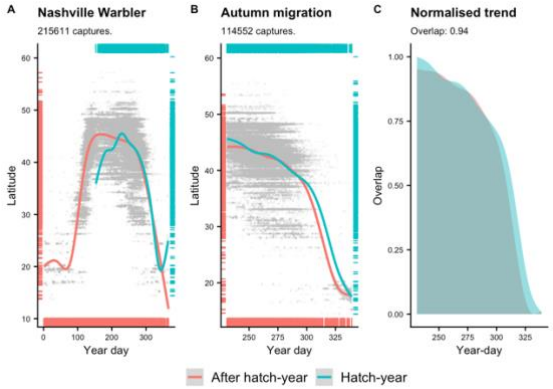

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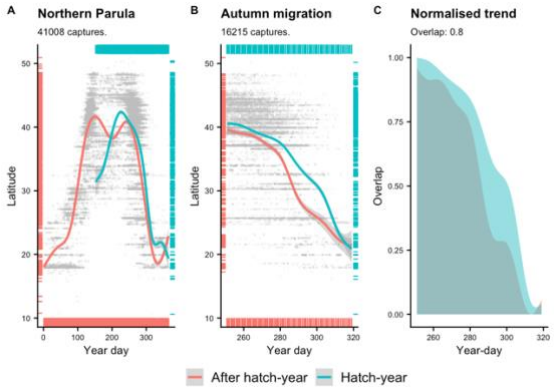

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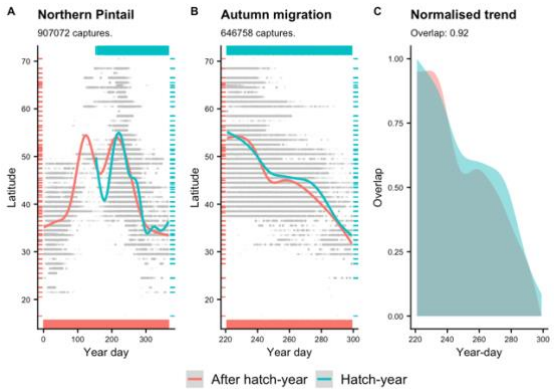

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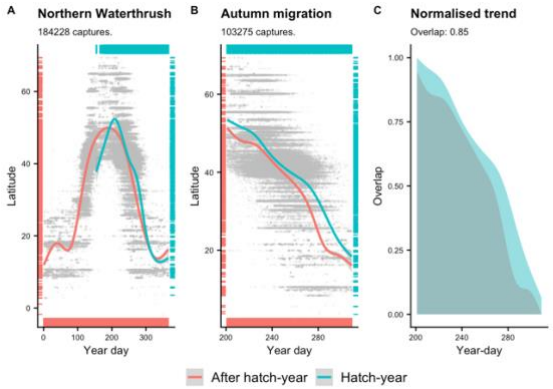

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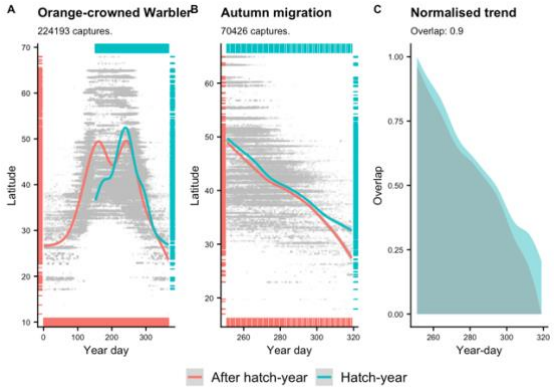

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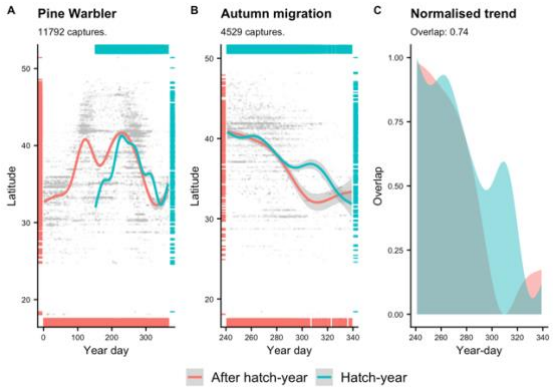

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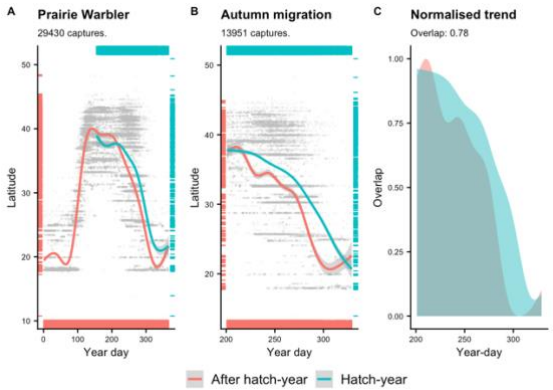

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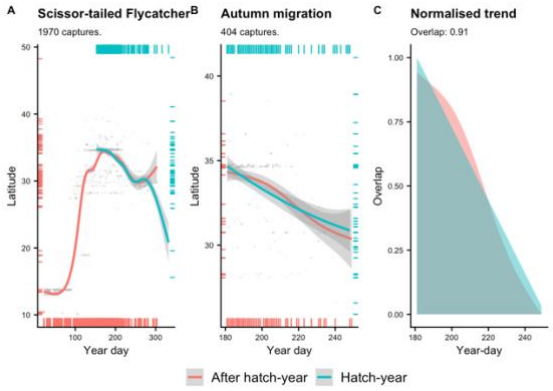

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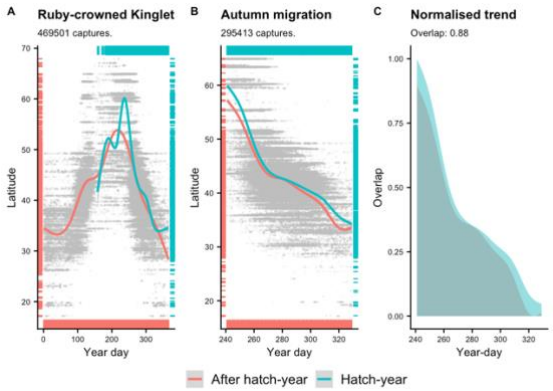

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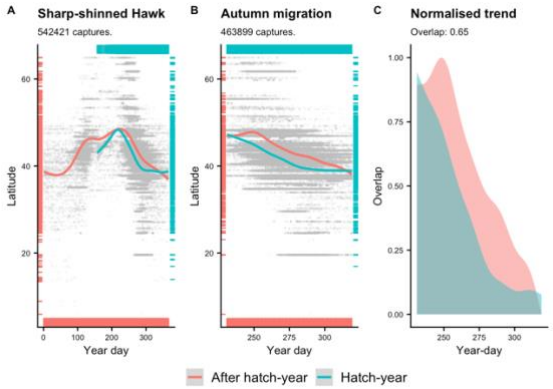
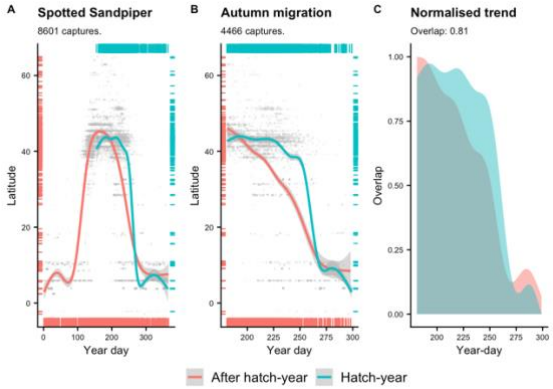
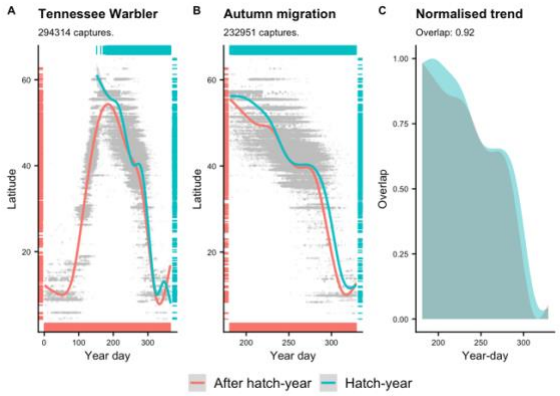


BOTW classification: Juveniles first



BOTW classification: Adults first



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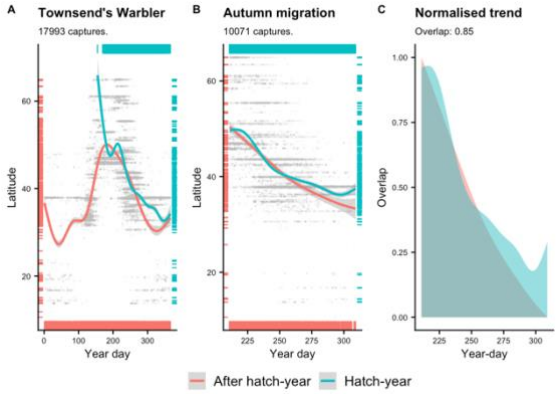

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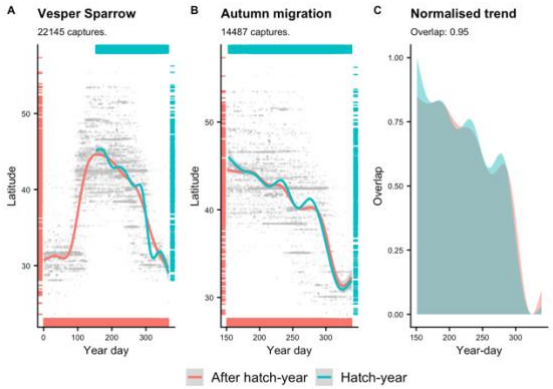

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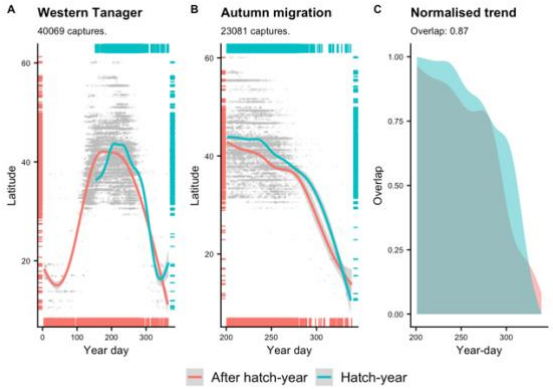

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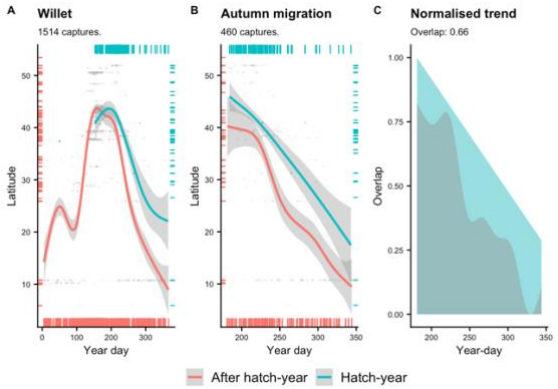

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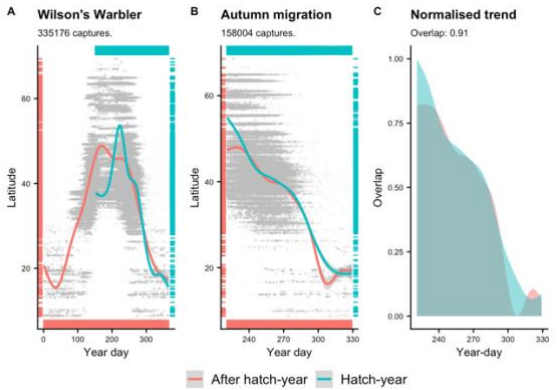

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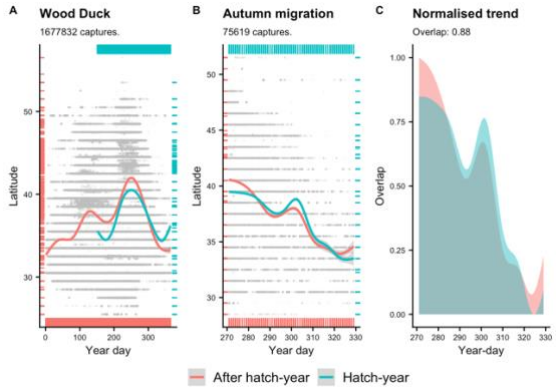

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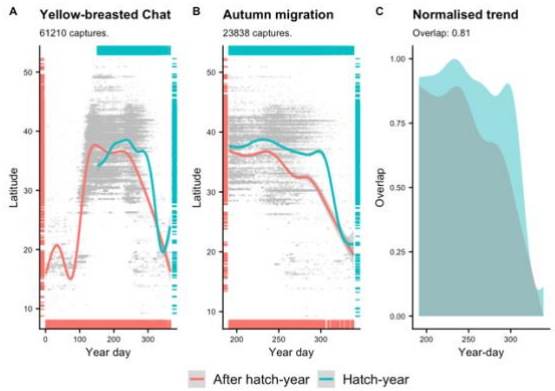

BOTW classification: Not classified

Figure SM1. Species timing plots for the 34 species included in PGLS model analysis whereby cohort-timing assessment was undertaken via analysis of USGS banding data. Start and end dates used for autumn migration period can be found in the full trait database dataset. Generalised Additive Model (GAM) model predicted average latitude of banding events across year-day for hatch-year and after hatch-year age cohorts across all USGS banding events 1960–2019 (plots labelled A). Time period was cropped to the autumn migration period where latitude is showing a clear negative trend (southward migration) (plots labelled B). Latitudes are normalised to a 0–1 scale and area under the curve overlap is calculated (plots labelled C).


50°N
45°N
40°N
35°N
30°N
25°N
110°W
100°W
90°W
80°W

Figure SM2. Breeding Bird Survey and Christmas Bird Count analysis strata used to calculate annual centres of abundance 1970–2019. Strata refer to intersections between Bird Conservation Regions (BCRs) and states or provinces across North America.

SM2. PGLS analysis

SM2.1. *Breeding Bird Survey analysis*

SM2.1.1 Flocking vs. Solo

Table SM1. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Breeding_rangesize	Combined_Migration_Timing	Diet_specialism_score	Flocks	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
4038.35	314.96	NA	+	NA	NA	NA	510.75	NA	NA	1867.12	6	-1222.09	2456.92	0	0.03
4501.13	NA	NA	+	NA	NA	NA	539.21	NA	NA	1588.84	5	-1223.51	2457.54	0.63	0.02
3447.77	363.18	NA	NA	NA	NA	NA	421.55	NA	NA	2075.84	5	-1223.64	2457.79	0.87	0.02
4266.28	NA	223.23	+	NA	NA	NA	551.57	NA	NA	1689.19	6	-1222.65	2458.04	1.12	0.02
4021.36	320.7	NA	+	NA	NA	-327.23	533.89	NA	NA	1905.69	7	-1221.77	2458.53	1.61	0.01
4356.63	336.71	NA	+	NA	+	NA	540.2	NA	NA	1790.01	7	-1221.8	2458.59	1.67	0.01
3509.34	316.55	NA	NA	235.42	NA	NA	365.33	NA	NA	2150.14	6	-1222.99	2458.71	1.8	0.01
4007.28	292.76	NA	+	140	NA	NA	467.09	NA	NA	1935.23	7	-1221.88	2458.74	1.83	0.01
3694.97	NA	278.35	NA	NA	NA	NA	470.83	NA	NA	1878.04	5	-1224.16	2458.85	1.93	0.01
4410.11	NA	NA	+	200.1	NA	NA	473.95	NA	NA	1714.22	6	-1223.07	2458.88	1.96	0.01

Table SM2. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	4037.92	2644.56	5431.28	Significant	10

Overlap range size	201.23	-229.55	632	Non-significant	10
Migration timing (ref: day)	-758.21	-2111.77	595.34	Non-significant	10
Habitat specialism score	492.91	73.24	912.58	Significant	10
Absolute population trend	1849.15	911.5	2786.81	Significant	10
Total range size	43.3	-190.6	277.21	Non-significant	10
Generation length	-27.11	-324.17	269.95	Non-significant	10
Flocking (ref: solo)	-37.67	-471.66	396.33	Non-significant	10
Diet specialism score	42.11	-214.44	298.66	Non-significant	10

SM2.1.2 Age-structured flocking

Table SM3. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Breeding_rangesize	Combined_Migration_Timing	Diet_specialism_score	FlocksWithAdults	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
3591.11	NA	NA	NA	385.46	NA	NA	NA	NA	NA	2832.43	4	-793.93	1596.38	0	0.03
3757.15	NA	-244.04	NA	446.76	NA	NA	NA	NA	NA	2615.04	5	-792.82	1596.43	0.05	0.03
3899.79	-272.48	NA	NA	467.15	NA	NA	NA	NA	NA	2619.91	5	-793	1596.79	0.42	0.02
3473.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	2741.08	3	-795.26	1596.82	0.45	0.02
3547.45	NA	NA	NA	NA	NA	NA	NA	448.29	NA	2811.41	4	-794.25	1597.02	0.65	0.02
3895.72	NA	NA	NA	363.21	NA	NA	NA	NA	+	2814.28	5	-793.34	1597.48	1.1	0.02
3823.69	NA	NA	NA	NA	NA	NA	NA	NA	+	2726.59	4	-794.53	1597.59	1.21	0.02
3624.89	NA	NA	NA	316.59	NA	NA	NA	330.99	NA	2868.04	5	-793.41	1597.61	1.23	0.02
3626.04	NA	NA	NA	NA	NA	NA	306.59	521.51	NA	2609.49	5	-793.41	1597.63	1.25	0.02
3587.92	NA	-190.19	NA	NA	NA	NA	NA	NA	NA	2560.35	4	-794.59	1597.7	1.32	0.02
3625.67	NA	NA	NA	361.76	NA	NA	192.93	NA	NA	2692.52	5	-793.59	1597.98	1.6	0.01
3524.53	NA	NA	NA	NA	NA	NA	237.09	NA	NA	2576.05	4	-794.75	1598.03	1.66	0.01
3656.22	-175.84	NA	NA	NA	NA	NA	NA	NA	NA	2591.44	4	-794.86	1598.24	1.87	0.01
3760.17	NA	-215.19	NA	393.34	NA	NA	NA	221.93	NA	2664.62	6	-792.59	1598.32	1.94	0.01

3521.58	NA	NA	NA	376.86	NA	-266.73	NA	NA	NA	2818.67	5	-793.78	1598.36	1.99	0.01

Table SM4. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	3665.63	2538.11	4793.14	Significant	15
Diet specialism score	224.41	-310.96	759.78	Non-significant	15
Absolute population trend	2708.72	1761.93	3655.52	Significant	15
Total range size	-46.11	-280.56	188.34	Non-significant	15
Overlap range size	-32.09	-252.38	188.19	Non-significant	15
Migratory distance	95.69	-377.41	568.8	Non-significant	15
Partial migrant (ref: complete)	-65.76	-543.22	411.7	Non-significant	15
Habitat specialism score	39.15	-223.83	302.13	Non-significant	15
Generation length	-10.91	-241.15	219.32	Non-significant	15

SM2.2. *Christmas Bird Count analysis*

SM2.2.1 Flocking vs. Solo

Table SM5. Model set used for model averaging.

X.Intercept.	Combined_Migration_Timing	Diet_specialism_score	Flocks	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Nonbreeding_overlap_size	Nonbreeding_rangesize	Trend	df	logLik	AICc	delta	weight
3058.7	NA	NA	+	NA	449.46	NA	NA	NA	550.96	NA	5	-1303.81	2618.15	0	0.03
3204.28	NA	NA	+	NA	398.41	422.79	NA	NA	539.26	NA	6	-1302.81	2618.36	0.21	0.02
2569.61	+	NA	+	419.11	373.74	NA	NA	NA	658.33	NA	7	-1301.76	2618.5	0.36	0.02
2687.04	+	NA	+	NA	434.18	NA	NA	NA	624.77	NA	6	-1303.1	2618.92	0.78	0.02
3350.35	NA	NA	+	285.4	375.77	448.89	NA	NA	530.17	NA	7	-1302.01	2619.01	0.86	0.02
3184.44	NA	NA	+	261.77	431.6	NA	NA	NA	543.29	NA	6	-1303.15	2619.03	0.88	0.02

3356.65	NA	-288.94	+	NA	325	458.3	NA	NA	471.37	NA	7	-1302.05	2619.07	0.93	0.02
3184.67	NA	-266.57	+	NA	370.92	NA	NA	NA	482.51	NA	6	-1303.2	2619.14	0.99	0.02
3170.12	NA	-379.15	+	NA	NA	530.02	NA	NA	397.25	NA	6	-1303.33	2619.38	1.24	0.01
2814.55	+	NA	+	404.88	344.41	329.12	NA	NA	625.64	NA	8	-1301.2	2619.66	1.52	0.01
3008.29	NA	NA	+	NA	525.37	578.78	NA	273.84	440.54	NA	7	-1302.44	2619.86	1.71	0.01
2369.27	+	NA	+	490.63	NA	NA	NA	NA	578.89	NA	6	-1303.63	2619.98	1.84	0.01
2938.16	+	NA	+	NA	406.9	333.09	NA	NA	593.59	NA	7	-1302.54	2620.06	1.91	0.01
2679.35	NA	NA	+	NA	397.12	585.42	+	NA	509.98	NA	7	-1302.56	2620.11	1.96	0.01

Table SM6. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	2995.97	1833.44	4158.51	Significant	14
Flocking (ref: solo)	1791.84	910.81	2672.88	Significant	14
Habitat specialism score	358.13	-79.61	795.87	Non-significant	14
Total range size	543.54	197.19	889.89	Significant	14
Migratory distance	233.5	-414.44	881.44	Non-significant	14
Migration timing (ref: day)	214.94	-596.75	1026.63	Non-significant	14
Generation length	127.66	-325.76	581.09	Non-significant	14
Diet specialism score	-64.24	-375.42	246.95	Non-significant	14
Overlap range size	13.62	-170.95	198.2	Non-significant	14
Partial migrant (ref: complete)	27.4	-423.4	478.2	Non-significant	14

SM2.2.2 Age-structured flocking

Table SM7. Model set used for model averaging.

X.Intercept.	Combined_Migration_Timing	Diet_specialism_score	FlocksWithAdults	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Nonbreeding_overlap_size	df	logLik	AICc	delta	weight
4447.86	+	NA	+	NA	NA	741.63	NA	NA	6	-858.66	1730.45	0	0.11
4424.67	+	NA	+	257.47	NA	719.67	NA	NA	7	-858.18	1731.89	1.44	0.05
4585.76	+	NA	+	NA	167.31	683.9	NA	NA	7	-858.34	1732.22	1.76	0.05

Table SM8. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	4471.93	3450.77	5493.09	Significant	3
Migration timing (ref: day)	-1276.23	-2049.66	-502.81	Significant	3
Age-separated flocks (ref: solo)	797.5	-116.6	1711.59	Non-significant	3
Mixed-age flocks (ref: solo)	2660.87	1786.08	3535.67	Significant	3
Migratory distance	723.43	49.97	1396.89	Significant	3
Generation length	66	-285.91	417.92	Non-significant	3
Habitat specialism score	36.42	-207.15	279.98	Non-significant	3

SM3. Sensitivity analysis

SM3.1. *Breeding Bird Survey analysis*

SM3.1.1. Flocking as Solo – Small – Large

Table SM9. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Breeding_rangesize	Combined_Migration_Timing	Diet_specialism_score	Flock_size	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
2893.69	865.85	NA	NA	NA	NA	NA	NA	NA	NA	1951.2	4	-1051.22	2110.84	0	0.06
2994.51	809.16	NA	NA	NA	NA	NA	236.65	NA	NA	1931.08	5	-1050.63	2111.86	1.03	0.03
2971.64	855.19	NA	NA	NA	NA	353.5	NA	NA	NA	1878.36	5	-1050.85	2112.3	1.46	0.03

2733.89	850.07	NA	NA	NA	+	NA	NA	NA	NA	1902.4	6	-1049.9	2112.66	1.83	0.02
2935.63	737.68	152.08	NA	NA	NA	NA	NA	NA	NA	1874.47	5	-1051.09	2112.79	1.96	0.02

Table SM10. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	2911.01	1720.05	4101.97	Significant	5
Overlap range size	833.09	332.4	1333.78	Significant	5
Absolute population trend	1917.77	990.59	2844.95	Significant	5
Habitat specialism score	49.6	-226.24	325.44	Non-significant	5
Generation length	59.49	-368.06	487.04	Non-significant	5
Small flocks (ref: Solo)	59.62	NA	NA	NA	5
Large flocks (ref: Solo)	-66.72	NA	NA	NA	5
Total range size	20.01	-224.81	264.84	Non-significant	5

SM3.1.2. Binary Flocking variable – threshold of 5 (Beauchamp 2011 data)

Table SM11. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Combined_Migration_Timing	Diet_specialism_score	Flock_size	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
3524.66	NA	+	470.97	NA	-876.44	NA	NA	+	2481.06	7	-713.95	1443.62	0	0.04
4238.78	NA	+	560.87	NA	-740.81	NA	-699.47	NA	2324.48	7	-714.09	1443.91	0.29	0.03
4172.36	NA	+	574.21	NA	NA	NA	-658.82	NA	2263.96	6	-715.45	1444.17	0.55	0.03
3651.45	NA	+	393.23	NA	-962.8	330.87	NA	+	2211.6	8	-713.01	1444.27	0.65	0.03
3567.05	NA	+	478.54	NA	NA	NA	NA	+	2393.7	6	-715.77	1444.81	1.19	0.02
3941.43	NA	+	NA	NA	-1006.77	443.78	NA	+	1997.14	7	-714.62	1444.96	1.34	0.02
3987.99	392.76	+	NA	NA	-879.02	441.51	NA	NA	2232.12	7	-714.76	1445.24	1.62	0.02
4040.27	NA	+	384.92	NA	NA	NA	NA	NA	2354.87	5	-717.2	1445.3	1.68	0.02
4358.52	NA	+	490.48	NA	-796.33	254.94	-680.11	NA	2116.34	8	-713.54	1445.32	1.7	0.02

4093.41	NA	+	362.11	NA	-675.58	NA	NA	NA	2415.17	6	-716.13	1445.53	1.91	0.02
3811.96	NA	+	534.59	NA	-836	NA	-366.16	+	2409.11	8	-713.68	1445.61	1.99	0.01

Table SM12. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	3918.55	2397.88	5439.23	Significant	11
Migration timing (ref: day)	-1703.31	-3290.02	-116.6	Significant	11
Diet specialism score	410.14	-146.96	967.25	Non-significant	11
Generation length	-622.8	-1731.1	485.49	Non-significant	11
Partial migrant (ref: complete)	436.6	-707.99	1581.19	Non-significant	11
Absolute population trend	2301.09	1372.26	3229.93	Significant	11
Migratory distance	-236.76	-1013.7	540.19	Non-significant	11
Habitat specialism score	119.29	-329.46	568.04	Non-significant	11
Overlap range size	26.96	-201.07	254.99	Non-significant	11

SM3.1.3. Binary Flocking variable – threshold of 10 (Beauchamp 2011 data)

Table SM13. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Combined_Migration_Timing	Diet_specialism_score	Flock_size	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
3524.66	NA	+	470.97	NA	-876.44	NA	NA	+	2481.06	7	-713.95	1443.62	0	0.04
4238.78	NA	+	560.87	NA	-740.81	NA	-699.47	NA	2324.48	7	-714.09	1443.91	0.29	0.03
4172.36	NA	+	574.21	NA	NA	NA	-658.82	NA	2263.96	6	-715.45	1444.17	0.55	0.03
3651.45	NA	+	393.23	NA	-962.8	330.87	NA	+	2211.6	8	-713.01	1444.27	0.65	0.03
3567.05	NA	+	478.54	NA	NA	NA	NA	+	2393.7	6	-715.77	1444.81	1.19	0.02
3941.43	NA	+	NA	NA	-1006.77	443.78	NA	+	1997.14	7	-714.62	1444.96	1.34	0.02
3987.99	392.76	+	NA	NA	-879.02	441.51	NA	NA	2232.12	7	-714.76	1445.24	1.62	0.02
4040.27	NA	+	384.92	NA	NA	NA	NA	NA	2354.87	5	-717.2	1445.3	1.68	0.02
4358.52	NA	+	490.48	NA	-796.33	254.94	-680.11	NA	2116.34	8	-713.54	1445.32	1.7	0.02

4093.41	NA	+	362.11	NA	-675.58	NA	NA	NA	2415.17	6	-716.13	1445.53	1.91	0.02
3811.96	NA	+	534.59	NA	-836	NA	-366.16	+	2409.11	8	-713.68	1445.61	1.99	0.01

Table SM14. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	3918.55	2397.88	5439.23	Significant	11
Migration timing (ref: day)	-1703.31	-3290.02	-116.6	Significant	11
Diet specialism score	410.14	-146.96	967.25	Non-significant	11
Generation length	-622.8	-1731.1	485.49	Non-significant	11
Partial migrant (ref: complete)	436.6	-707.99	1581.19	Non-significant	11
Absolute population trend	2301.09	1372.26	3229.93	Significant	11
Migratory distance	-236.76	-1013.7	540.19	Non-significant	11
Habitat specialism score	119.29	-329.46	568.04	Non-significant	11
Overlap range size	26.96	-201.07	254.99	Non-significant	11

SM3.2. *Christmas Bird Count analysis*

SM3.2.1. Flocking as Solo – Small – Large

Table SM15. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Breeding_rangesize	Combined_Migration_Timing	Diet_specialism_score	Flock_size	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
3627.51	NA	807.93	+	NA	+	600.34	NA	NA	+	NA	8	-1115.69	2248.88	0	0.03
2182.66	NA	754.95	+	NA	+	590.77	NA	NA	NA	NA	7	-1116.98	2249.12	0.23	0.02
4216.98	NA	599.14	NA	-421.93	+	NA	NA	NA	+	NA	7	-1117.13	2249.42	0.53	0.02
4702.19	NA	696.38	NA	-599.74	+	749.78	338.69	NA	+	-879.92	10	-1113.65	2249.63	0.75	0.02
4570.08	NA	649.82	NA	-577.16	+	633.51	NA	NA	+	-623.5	9	-1114.91	2249.71	0.83	0.02

2794.4	NA	537.14	NA	-424.83	+	NA	NA	NA	NA	NA	6	-1118.43	2249.72	0.84	0.02
3342.49	NA	640.41	NA	-602.85	+	734.17	375.18	NA	NA	-889.99	9	-1114.93	2249.76	0.88	0.02
2365.49	NA	770.51	+	NA	+	559.43	232.46	NA	NA	NA	8	-1116.27	2250.04	1.15	0.01
4422.78	NA	611.51	NA	-351.74	+	316.24	NA	NA	+	NA	8	-1116.27	2250.05	1.16	0.01
3684.63	NA	817.69	+	NA	+	572.57	201.03	NA	+	NA	9	-1115.15	2250.2	1.32	0.01
3788.43	NA	749.52	+	-204.71	+	489.28	NA	NA	+	NA	9	-1115.23	2250.36	1.48	0.01
3033.53	NA	581.61	NA	-577.92	+	602.04	NA	NA	NA	-603.86	8	-1116.46	2250.41	1.53	0.01
3605.86	229.64	663.06	+	NA	+	578.01	NA	NA	+	NA	9	-1115.26	2250.42	1.53	0.01
2932.05	NA	546.32	NA	-359.39	+	295.34	NA	NA	NA	NA	7	-1117.7	2250.56	1.68	0.01
2970.09	NA	544.3	NA	-421.66	+	NA	NA	364.8	NA	NA	7	-1117.71	2250.57	1.69	0.01
2335.24	NA	697.05	+	-202.12	+	481.07	NA	NA	NA	NA	8	-1116.54	2250.59	1.71	0.01
4147.15	267.55	442.6	NA	-402.51	+	NA	NA	NA	+	NA	8	-1116.56	2250.61	1.73	0.01
4495.65	295.75	478.92	NA	-573.27	+	643.83	NA	NA	+	-665.36	10	-1114.18	2250.7	1.82	0.01

Table SM16. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	3511.31	1199.18	5823.44	Significant	18
Total range size	658.82	264.01	1053.63	Significant	18
Migration timing (ref: day)	394.85	-726.45	1516.16	Non-significant	18
Small flocks (ref: Solo)	1513.31	539.07	2487.55	Significant	18
Large flocks (ref: Solo)	2721.56	-262.87	5705.99	Non-significant	18
Generation length	448.75	-259.06	1156.55	Non-significant	18
Partial migrant (ref: complete)	-878.81	-2952.13	1194.52	Non-significant	18

Diet specialism score	-303.05	-887.14	281.05	Non-significant	18
Habitat specialism score	67.81	-255.51	391.12	Non-significant	18
Absolute population trend	-204.51	-993.45	584.42	Non-significant	18
Overlap range size	32.32	-214.53	279.17	Non-significant	18
Migratory distance	15.01	-174.18	204.2	Non-significant	18

SM3.2.2. Binary Flocking variable – threshold of 5 (Beauchamp 2011 data)

Table SM17. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Breeding_rangesize	Combined_Migration_Timing	Diet_specialism_score	Flock_size	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
4235.45	NA	NA	NA	NA	+	1638.41	NA	658.61	NA	-1022.47	6	-776.24	1565.75	0	0.07
3849.03	NA	NA	NA	NA	+	1542.56	NA	NA	NA	-974.38	5	-777.87	1566.64	0.89	0.05
4434.26	NA	NA	NA	-374.82	+	1550.03	NA	723.54	NA	-1178.43	7	-775.56	1566.85	1.1	0.04
3920.51	NA	NA	NA	NA	+	1577.91	-265.59	737.43	NA	-854.04	7	-775.83	1567.39	1.65	0.03

Table SM18. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	4133.43	3266.07	5000.78	Significant	4
Flocking (ref: Solo/Small)	1373.27	425.82	2320.73	Significant	4
Generation length	1586.11	845.7	2326.53	Significant	4
Migratory distance	526.96	-353.41	1407.33	Non-significant	4
Absolute population trend	-1016.92	-1721.83	-312.01	Significant	4
Diet specialism score	-81.4	-494.47	331.67	Non-significant	4
Habitat specialism score	-43.88	-360.14	272.37	Non-significant	4

SM3.2.3. Binary Flocking variable – threshold of 10 (Beauchamp 2011 data)

Table SM19. Model set used for model averaging.

X.Intercept.	Breeding_overlap_size	Breeding_rangesize	Combined_Migration_Timing	Diet_specialism_score	Flock_size	GenFLS	Habitat_specialism_score	Mig_dist_numeric	Migration	Trend	df	logLik	AICc	delta	weight
3930.7	NA	NA	NA	NA	+	1428.52	NA	NA	NA	-730.31	5	-776.02	1562.94	0	0.06
4293.08	NA	NA	NA	NA	+	1328.42	NA	617.97	NA	-645.22	6	-774.91	1563.1	0.16	0.05
4417.82	NA	NA	NA	-308.39	+	1386.87	NA	605.52	NA	-876.39	7	-774.34	1564.4	1.46	0.03
3412.58	NA	NA	NA	NA	+	1321.54	NA	927.01	+	-640.89	7	-774.38	1564.48	1.54	0.03
4031.48	298.83	NA	NA	NA	+	1381.94	NA	626.33	NA	-723.59	7	-774.41	1564.55	1.61	0.02
4077.65	NA	NA	NA	-323.85	+	1358.39	NA	NA	NA	-889.22	6	-775.72	1564.71	1.77	0.02
5322.37	NA	NA	+	-720.33	+	1200.44	NA	828.66	NA	-1131.13	8	-773.25	1564.76	1.82	0.02

Table SM20. Model averaged coefficients. Full average used.

Variable	Estimate	2.50%	97.50%	Significance	n_mod
Intercept	4172.07	2801.39	5542.76	Significant	7
Flocking (ref: Solo/Small)	1625.77	634.5	2617.04	Significant	7
Generation length	1355	611.87	2098.12	Significant	7
Absolute population trend	-772.54	-1494.14	-50.93	Significant	7
Migratory distance	461.33	-482.87	1405.54	Non-significant	7
Diet specialism score	-138.57	-733.88	456.75	Non-significant	7
Partial migrant (ref: complete)	121.37	-870.44	1113.17	Non-significant	7
Overlap range size	32.37	-241.29	306.03	Non-significant	7
Migration timing (ref: day)	-134.24	-1083	814.52	Non-significant	7

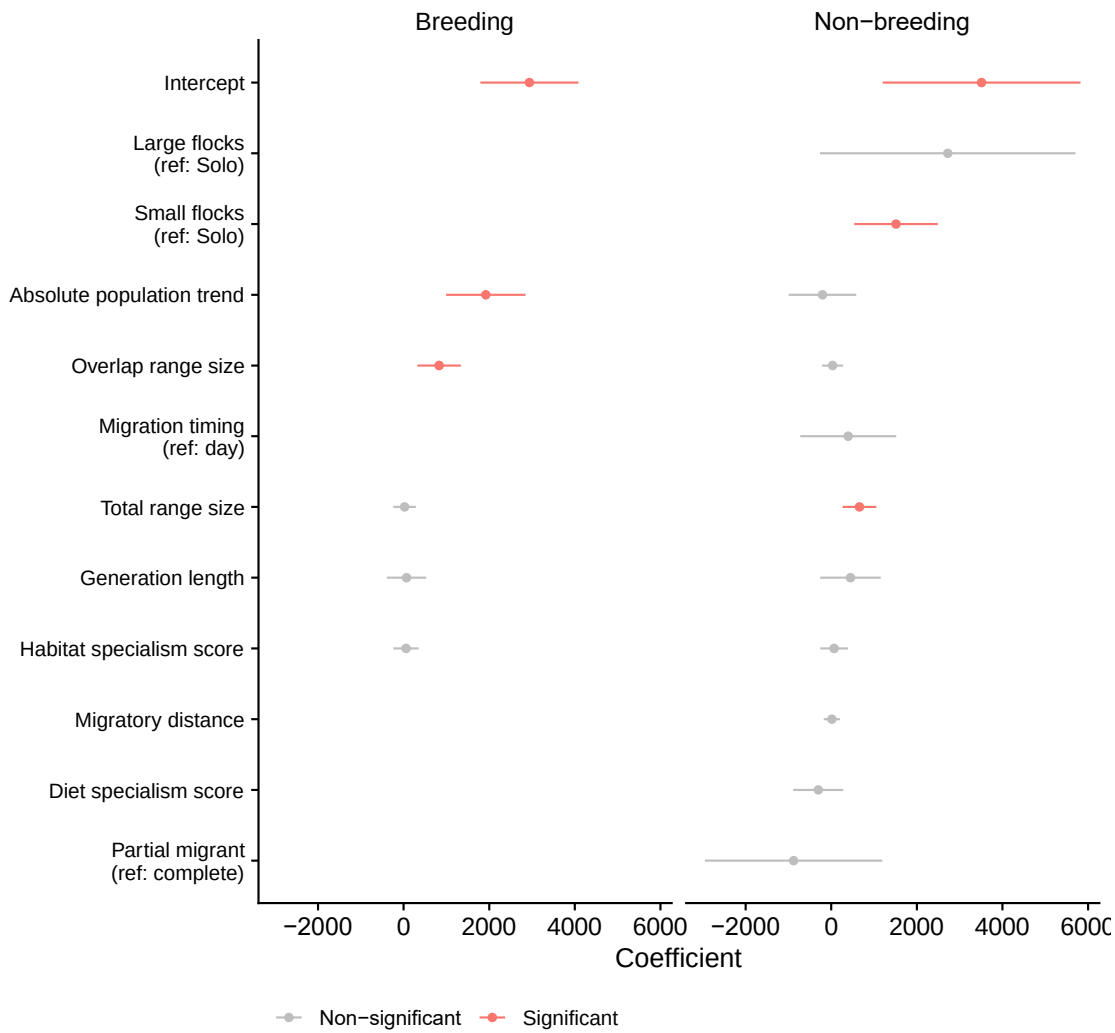

Figure SM3. Phylogenetic Generalised Least Squares (PGLS) model coefficients for predictors of annual shift rates of Breeding Bird Survey (left) and Christmas Bird Count (right) centre of abundance (in metres) 1970–2019. Models assessed migratory flocking as solo, small (<10 individuals), and large (>10 individuals) for 105 species. Red points indicate significant results inferred from credible 95th percentiles (error bars) that exclude zero.

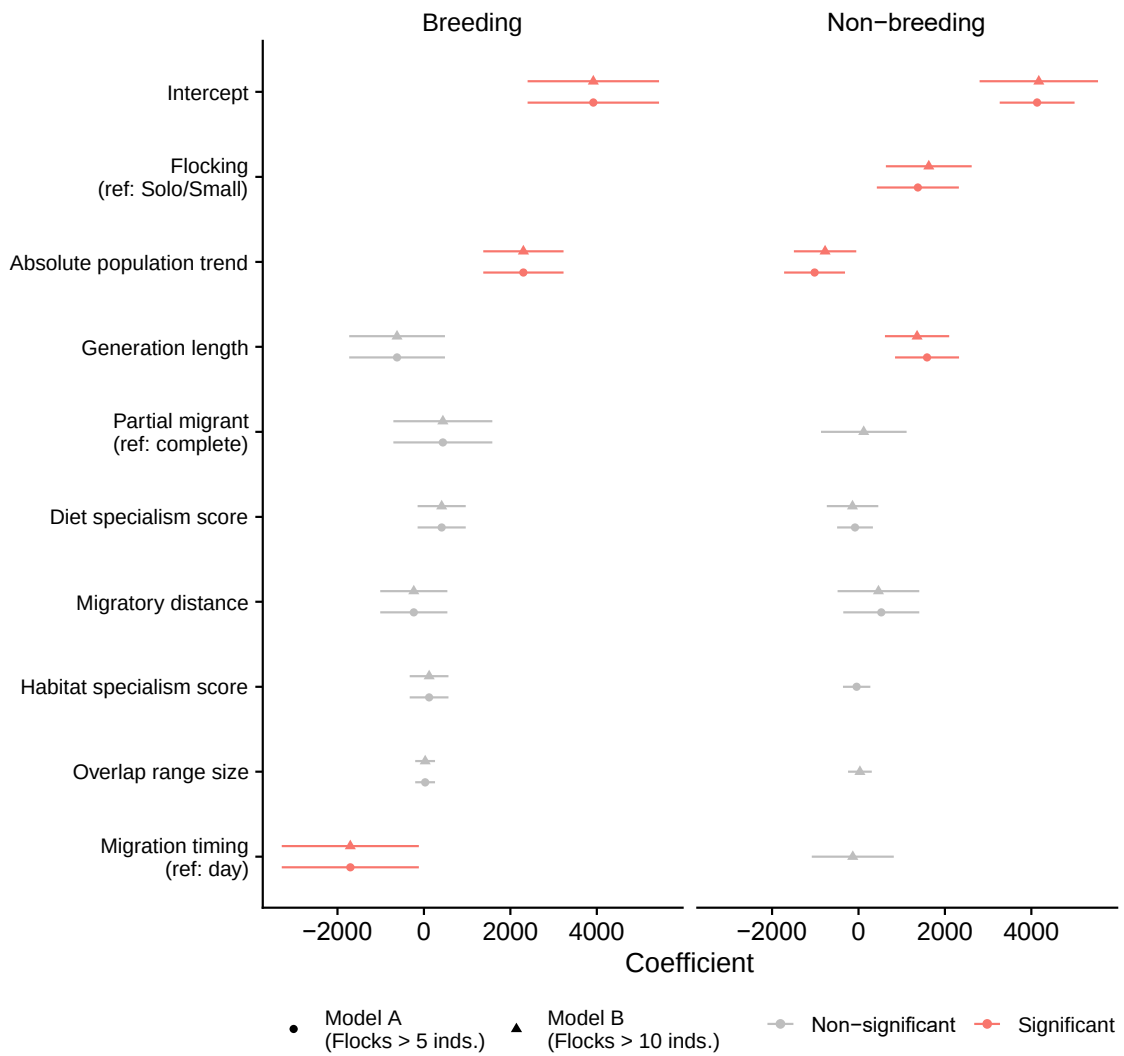

Figure SM4. Phylogenetic Generalised Least Squares (PGLS) model coefficients for predictors of annual shift rates of Breeding Bird Survey (left) and Christmas Bird Count (right) centre of abundance (in metres) 1970–2019 for 73 species. Model A assessed migratory flocking as a binary flocking vs. solo migrants with flocking species defined as those with maximum flock

size while travelling of >5 from Beachamp (2011) and Model B with a threshold of >10 individuals. Red points indicate significant results inferred from credible 95th percentiles (error bars) that exclude zero.

SM4. Birds of the World – Reference list

Table SM21. Birds of the World references for each species used in PGLS analysis.

AOU	Genus	Species	BOTW_Ref
20	Podiceps	grisegena	Stout, B. E. & G. L. Nuechterlein (2020). Red-necked Grebe (Podiceps grisegena), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
40	Podiceps	nigricollis	Cullen, S. A., J. R. Jehl Jr., & G. L. Nuechterlein (2020). Eared Grebe (Podiceps nigricollis), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
470	Larus	marinus	Good, T. P. (2020). Great Black-backed Gull (*Larus marinus*), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
580	Leucophaeus	atricilla	Burger, J. (2020). Laughing Gull (*Leucophaeus atricilla*), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
590	Leucophaeus	pipixcan	Burger, J. & M. Gochfeld (2020). Franklin's Gull (Leucophaeus pipixcan), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
640	Hydroprogne	caspia	Cuthbert, F. J. & L. R. Wires (2020). Caspian Tern (Hydroprogne caspia), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
650	Thalasseus	maximus	Buckley, P. A., F. G. Buckley, & S. G. Mlodinow (2021). Royal Tern (Thalasseus maximus), version 1.1. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
690	Sterna	forsteri	McNicholl, M. K., P. E. Lowther, & J. A. Hall (2020). Forster's Tern (Sterna forsteri), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
800	Rynchops	niger	Gochfeld, M., J. Burger, & K. L. Lefevre (2020). Black Skimmer (Rynchops niger), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1230	Urile	pelagicus	Hobson, K. A. (2021). Pelagic Cormorant (*Urile pelagicus*), version 1.1. In Birds of the World (Editor not available). Cornell Lab of Ornithology, Ithaca, NY, USA.
1250	Pelecanus	erythrorhynchos	Knopf, F. L. & R. M. Evans (2020). American White Pelican (Pelecanus erythrorhynchos), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1260	Pelecanus	occidentalis	Shields, M. (2020). Brown Pelican (*Pelecanus occidentalis*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.

1290	Mergus	merganser	Pearce, J., M. L. Mallory, & K. Metz (2020). Common Merganser (Mergus merganser), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1310	Lophodytes	cucullatus	Dugger, B. D., K. M. Dugger, & L. H. Fredrickson (2020). Hooded Merganser (Lophodytes cucullatus), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1350	Mareca	strepera	Leschack, C. R., S. K. McKnight, & G. R. Hepp (2020). Gadwall (Mareca strepera), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1370	Mareca	americana	Mini, A. E., E. R. Harrington, E. Rucker, B. D. Dugger, & T. B. Mowbray (2020). American Wigeon (Mareca americana), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1390	Anas	crecca	Johnson, K., C. Carboneras, D. A. Christie, & G. M. Kirwan (2020). Green-winged Teal (Anas crecca), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1400	Spatula	discors	Rohwer, F. C., W. P. Johnson, & E. R. Loos (2020). Blue-winged Teal (Spatula discors), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
1410	Spatula	cyanoptera	Gammonley, J. H. (2020). Cinnamon Teal (*Spatula cyanoptera*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1430	Anas	acuta	Clark, R. G., J. P. Fleskes, K. L. Guyn, D. A. Haukos, J. E. Austin, & M. R. Miller (2020). Northern Pintail (Anas acuta), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1440	Aix	sponsa	Hepp, G. R. & F. C. Bellrose (2020). Wood Duck (Aix sponsa), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1490	Aythya	affinis	Anteau, M. J., J. DeVink, D. N. Koons, J. E. Austin, C. M. Custer, & A. D. Afton (2020). Lesser Scaup (Aythya affinis), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1500	Aythya	collaris	Roy, C. L., C. M. Herwig, W. L. Hohman, & R. T. Eberhardt (2020). Ring-necked Duck (Aythya collaris), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1510	Bucephala	clangula	Eadie, J. M., M. L. Mallory, & H. G. Lumsden (2020). Common Goldeneye (Bucephala clangula), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1530	Bucephala	albeola	Gauthier, G. (2020). Bufflehead (*Bucephala albeola*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1770	Dendrocygna	autumnalis	James, J. D. & J. E. Thompson (2020). Black-bellied Whistling-Duck (Dendrocygna autumnalis), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
1780	Dendrocygna	bicolor	Hohman, W. L. & S. A. Lee (2020). Fulvous Whistling-Duck (Dendrocygna bicolor), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1860	Plegadis	falcinellus	Davis Jr., W. E. & J. C. Kricher (2020). Glossy Ibis (Plegadis falcinellus), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
1900	Botaurus	lentiginosus	Lowther, P. E., A. F. Poole, J. P. Gibbs, S. M. Melvin, & F. A. Reid (2020). American Bittern (Botaurus lentiginosus), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.

1960	Ardea	alba	McCrimmon Jr., D. A., J. C. Ogden, G. T. Bancroft, A. Martínez-Vilalta, A. Motis, G. M. Kirwan, & P. F. D. Boesman (2020). Great Egret (Ardea alba), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2000	Egretta	caerulea	Rodgers Jr., J. A. & H. T. Smith (2020). Little Blue Heron (Egretta caerulea), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2001	Bubulcus	ibis	Telfair II, R. C. (2020). Cattle Egret (*Bubulcus ibis*), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2010	Butorides	virescens	Davis Jr., W. E. & J. A. Kushlan (2020). Green Heron (Butorides virescens), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2060	Antigone	canadensis	Gerber, B. D., J. F. Dwyer, S. A. Nesbitt, R. C. Drewien, C. D. Littlefield, T. C. Tacha, & P. A. Vohs (2020). S&hill Crane (Antigone canadensis), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2080	Rallus	elegans	Pickens, B. A. & B. Meanley (2020). King Rail (Rallus elegans), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2120	Rallus	limicola	Conway, C. J. (2020). Virginia Rail (Rallus limicola), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2140	Porzana	carolina	Melvin, S. M. & J. P. Gibbs (2020). Sora (Porzana carolina), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2210	Fulica	americana	Brisbin Jr., I. L. & T. B. Mowbray (2020). American Coot (Fulica americana), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2250	Recurvirostra	americana	Ackerman, J. T., C. A. Hartman, M. P. Herzog, J. Y. Takekawa, J. A. Robinson, L. W. Oring, J. P. Skorupa, & R. Boettcher (2020). American Avocet (Recurvirostra americana), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2260	Himantopus	mexicanus	Robinson, J. A., J. M. Reed, J. P. Skorupa, & L. W. Oring (2020). Black-necked Stilt (Himantopus mexicanus), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2280	Scolopax	minor	McAuley, D. G., D. M. Keppie, & R. M. Whiting Jr. (2020). American Woodcock (Scolopax minor), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2490	Limosa	fedoa	Gratto-Trevor, C. L. (2020). Marbled Godwit (Limosa fedoa), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2540	Tringa	melanoleuca	Elphick, C. S. & T. L. Tibbitts (2020). Greater Yellowlegs (Tringa melanoleuca), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2550	Tringa	flavipes	Tibbitts, T. L. & W. Moskoff (2020). Lesser Yellowlegs (Tringa flavipes), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2560	Tringa	solitaria	Moskoff, W. (2020). Solitary S&piper (Tringa solitaria), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.

2580	Tringa	semipalmata	Lowther, P. E., H. D. Douglas III, & C. L. Gratto-Trevor (2020). Willet (Tringa semipalmata), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2630	Actitis	macularius	Reed, J. M., L. W. Oring, & E. M. Gray (2020). Spotted S&piper (Actitis macularius), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
2640	Numenius	americanus	Dugger, B. D. & K. M. Dugger (2020). Long-billed Curlew (Numenius americanus), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
2730	Charadrius	vociferus	Jackson, B. J. & J. A. Jackson (2020). Killdeer (Charadrius vociferus), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3120	Patagioenas	fasciata	Keppie, D. M. & C. E. Braun (2020). B&-tailed Pigeon (Patagioenas fasciata), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3160	Zenaida	macroura	Otis, D. L., J. H. Schulz, D. Miller, R. E. Mirarchi, & T. S. Baskett (2020). Mourning Dove (Zenaida macroura), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
3190	Zenaida	asiatica	Schwertner, T. W., H. A. Mathewson, J. A. Roberson, & G. L. Waggerman (2020). White-winged Dove (Zenaida asiatica), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3250	Cathartes	aura	Kirk, D. A. & M. J. Mossman (2020). Turkey Vulture (Cathartes aura), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3260	Coragyps	atratus	Buckley, N. J., B. M. Kluever, R. Driver, & S. A. Rush (2022). Black Vulture (Coragyps atratus), version 2.0. In Birds of the World (P. G. Rodewald & B. K. Keeney, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3320	Accipiter	striatus	Bildstein, K. L., K. D. Meyer, C. M. White, J. S. Marks, & G. M. Kirwan (2020). Sharp-shinned Hawk (Accipiter striatus), version 1.0. In Birds of the World (S. M. Billerman, B. K. Keeney, P. G. Rodewald, & T. S. Schulenberg, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3420	Buteo	swainsoni	Bechard, M. J., C. S. Houston, J. H. Sarasola, & A. S. Engl& (2020). Swainson's Hawk (Buteo swainsoni), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
3430	Buteo	platypterus	Goodrich, L. J., S. T. Crocoll, & S. E. Senner (2020). Broad-winged Hawk (Buteo platypterus), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
3480	Buteo	regalis	Ng, J., M. D. Giovanni, M. J. Bechard, J. K. Schmutz, & P. Pyle (2020). Ferruginous Hawk (Buteo regalis), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
3490	Aquila	chrysaetos	Katzner, T. E., M. N. Kochert, K. Steenhof, C. L. McIntyre, E. H. Craig, & T. A. Miller (2020). Golden Eagle (Aquila chrysaetos), version 2.0. In Birds of the World (P. G. Rodewald & B. K. Keeney, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3520	Haliaeetus	leucocephalus	Buehler, D. A. (2022). Bald Eagle (Haliaeetus leucocephalus), version 2.0. In Birds of the World (P. G. Rodewald & S. G. Mlodinow, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3550	Falco	mexicanus	Steenhof, K. (2020). Prairie Falcon (*Falco mexicanus*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.

3560	Falco	peregrinus	White, C. M., N. J. Clum, T. J. Cade, & W. G. Hunt (2020). Peregrine Falcon (Falco peregrinus), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
3600	Falco	sparverius	Smallwood, J. A. & D. M. Bird (2020). American Kestrel (Falco sparverius), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
3640	Pandion	haliaetus	Bierregaard, R. O., A. F. Poole, M. S. Martell, P. Pyle, & M. A. Patten (2020). Osprey (P&ion haliaetus), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
3670	Asio	flammeus	Wiggins, D. A., D. W. Holt, & S. M. Leasure (2020). Short-eared Owl (Asio flammeus), version 1.0. In Birds of the World (S. M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
3900	Megaceryle	alcyon	Kelly, J. F., E. S. Bridge, & M. J. Hamas (2020). Belted Kingfisher (Megaceryle alcyon), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4160	Antrostomus	carolinensis	Straight, C. A. & R. J. Cooper (2020). Chuck-will's-widow (Antrostomus carolinensis), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4171	Antrostomus	vociferus	Cink, C. L., P. Pyle, & M. A. Patten (2020). Eastern Whip-poor-will (Antrostomus vociferus), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4210	Chordeiles	acutipennis	Latta, S. C. & M. E. Baltz (2020). Lesser Nighthawk (Chordeiles acutipennis), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4250	Aeronautes	saxatalis	Ryan, T. P. & C. T. Collins (2020). White-throated Swift (Aeronautes saxatalis), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
4280	Archilochus	colubris	Weidensaul, S., T. R. Robinson, R. R. Sargent, M. B. Sargent, & T. J. Zenzal (2020). Ruby-throated Hummingbird (Archilochus colubris), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4290	Archilochus	alexandri	Baltosser, W. H. & S. M. Russell (2020). Black-chinned Hummingbird (Archilochus alex&ri), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
4330	Selasphorus	rufus	Healy, S. & W. A. Calder (2020). Rufous Hummingbird (Selasphorus rufus), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4340	Selasphorus	sasin	Clark, C. J. & D. E. Mitchell (2020). Allen's Hummingbird (Selasphorus sasin), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4430	Tyrannus	forficatus	Regosin, J. V. (2020). Scissor-tailed Flycatcher (*Tyrannus forficatus*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4470	Tyrannus	verticalis	Gamble, L. R. & T. M. Bergin (2020). Western Kingbird (Tyrannus verticalis), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
4480	Tyrannus	vociferans	Tweit, R. C. & J. C. Tweit (2020). Cassin's Kingbird (Tyrannus vociferans), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
4540	Myiarchus	cinerascens	Cardiff, S. W. & D. L. Dittmann (2020). Ash-throated Flycatcher (Myiarchus cinerascens), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.

5011	Sturnella	neglecta	Davis, S. K. & W. E. Lanyon (2020). Western Meadowlark (Sturnella neglecta), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
5390	Rhynchophanes	mccownii	With, K. A. (2021). Thick-billed Longspur (*Rhynchophanes mccownii*), version 1.1. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
5400	Pooecetes	gramineus	Jones, S. L. & J. E. Cornely (2020). Vesper Sparrow (Pooecetes gramineus), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5450	Centronyx	bairdii	Green, M. T., P. E. Lowther, S. L. Jones, S. K. Davis, & B. C. Dale (2020). Baird's Sparrow (Centronyx bairdii), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5480	Ammospiza	leconteii	Lowther, P. E. (2020). LeConte's Sparrow (*Ammospiza leconteii*), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
5520	Chondestes	grammacus	Martin, J. W. & J. R. Parrish (2020). Lark Sparrow (Chondestes grammacus), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5540	Zonotrichia	leucophrys	Chilton, G., M. C. Baker, C. D. Barrentine, & M. A. Cunningham (2020). White-crowned Sparrow (Zonotrichia leucophrys), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5620	Spizella	breweri	Rotenberry, J. T., M. A. Patten, & K. L. Preston (2020). Brewer's Sparrow (Spizella breweri), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5650	Spizella	atrogularis	Tenney, C. R. (2020). Black-chinned Sparrow (Spizella atrogularis), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5730	Amphispiza	bilineata	Johnson, M. J., C. van Riper, & K. M. Pearson (2020). Black-throated Sparrow (Amphispiza bilineata), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5870	Pipilo	erythrophthalmus	Greenlaw, J. S. (2020). Eastern Towhee (*Pipilo erythrophthalmus*), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
5900	Pipilo	chlorurus	Dobbs, R. C., P. R. Martin, & T. E. Martin (2020). Green-tailed Towhee (Pipilo chlorurus), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
5950	Pheucticus	ludovicianus	Wyatt, V. E. & C. M. Francis (2020). Rose-breasted Grosbeak (Pheucticus ludovicianus), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5960	Pheucticus	melanocephalus	Hill, G. E. (2022). Black-headed Grosbeak (Pheucticus melanocephalus), version 2.0. In Birds of the World (S. M. Billerman & B. K. Keeney, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
5970	Passerina	caerulea	Lowther, P. E. & J. L. Ingold (2020). Blue Grosbeak (Passerina caerulea), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6040	Spiza	americana	Sousa, B. F., S. A. Temple, & G. D. Basili (2022). Dickcissel (Spiza americana), version 2.0. In Birds of the World (T. S. Schulenberg & B. K. Keeney, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
6050	Calamospiza	melanocorys	Shane, T. G. (2020). Lark Bunting (Calamospiza melanocorys), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.

6070	Piranga	ludoviciana	Hudon, J. (2020). Western Tanager (Piranga ludoviciana), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
6170	Stelgidopteryx	serripennis	De Jong, M. J. (2020). Northern Rough-winged Swallow (Stelgidopteryx serripennis), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
6200	Phainopepla	nitens	Chu, M. & G. Walsberg (2020). Phainopepla (Phainopepla nitens), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
6220	Lanius	ludovicianus	Yosef, R. (2020). Loggerhead Shrike (Lanius ludovicianus), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
6280	Vireo	flavifrons	Rodewald, P. G. & R. D. James (2020). Yellow-throated Vireo (Vireo flavifrons), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6450	Leiothlypis	ruficapilla	Lowther, P. E. & J. M. Williams (2020). Nashville Warbler (Leiothlypis ruficapilla), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6460	Leiothlypis	celata	Gilbert, W. M., M. K. Sogge, & C. van Riper (2020). Orange-crowned Warbler (Leiothlypis celata), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6470	Leiothlypis	peregrina	Rimmer, C. C. & K. P. McFarl& (2020). Tennessee Warbler (Leiothlypis peregrina), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6480	Setophaga	americana	Moldenhauer, R. R. & D. J. Regelski (2020). Northern Parula (Setophaga americana), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6680	Setophaga	townsendi	Wright, A. L., G. D. Hayward, S. M. Matsuoka, & P. H. Hayward (2020). Townsend's Warbler (Setophaga townsendi), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6690	Setophaga	occidentalis	Pearson, S. F. (2020). Hermit Warbler (*Setophaga occidentalis*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6710	Setophaga	pinus	Rodewald, P. G., J. H. Withgott, & K. G. Smith (2020). Pine Warbler (Setophaga pinus), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6720	Setophaga	palmarum	Wilson Jr., W. H. (2020). Palm Warbler (*Setophaga palmarum*), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6730	Setophaga	discolor	Nolan Jr, V., E. D. Ketterson, & C. A. Buerkle (2020). Prairie Warbler (Setophaga discolor), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6750	Parkesia	noveboracensis	Whitaker, D. M. & S. W. Eaton (2020). Northern Waterthrush (Parkesia noveboracensis), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6810	Geothlypis	trichas	Guzy, M. J. & G. Ritchison (2020). Common Yellowthroat (Geothlypis trichas), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
6830	Icteria	virens	Thompson, C. F. & K. P. Eckerle (2022). Yellow-breasted Chat (Icteria virens), version 2.0. In Birds of the World (P. G. Rodewald & B. K. Keeney, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.

6850	Cardellina	pusilla	Ammon, E. M. & W. M. Gilbert (2020). Wilson's Warbler (Cardellina pusilla), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
7000	Anthus	spragueii	Davis, S. K., M. B. Robbins, & B. C. Dale (2020). Sprague's Pipit (Anthus spragueii), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
7050	Toxostoma	rufum	Cavitt, J. F. & C. A. Haas (2020). Brown Thrasher (Toxostoma rufum), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
7080	Toxostoma	bendirei	Engl&, A. S. & W. F. Laudenslayer Jr. (2020). Bendire's Thrasher (Toxostoma bendirei), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
7190	Thryomanes	bewickii	Kennedy, E. D. & D. W. White (2020). Bewick's Wren (Thryomanes bewickii), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
7260	Certhia	americana	Poulin, J., É. D'Astous, M. Villard, S. J. Hejl, K. R. Newlon, M. E. McFadzen, J. S. Young, & C. K. Ghalambor (2020). Brown Creeper (Certhia americana), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
7490	Corthylio	calendula	Swanson, D. L., J. L. Ingold, & G. E. Wallace (2021). Ruby-crowned Kinglet (Corthylio calendula), version 1.1. In Birds of the World (Editor not available). Cornell Lab of Ornithology, Ithaca, NY, USA.
7540	Myadestes	townsendi	Bowen, R. V. (2020). Townsend's Solitaire (Myadestes townsendi), version 1.0. In Birds of the World (A. F. Poole & F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA.
7550	Hylocichla	mustelina	Evans, M., E. Gow, R. R. Roth, M. S. Johnson, & T. J. Underwood (2020). Wood Thrush (Hylocichla mustelina), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
7610	Turdus	migratorius	V&erhoff, N., P. Pyle, M. A. Patten, R. Sallabanks, & F. C. James (2020). American Robin (Turdus migratorius), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.