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Correlates of Annual Stopover Counts in Two Species of Arctic-Breeding Shorebirds: Roles of Local, Breeding, and Climatic Drivers

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APPENDICES

Appendix 1. Annual seasonal patterns in age classes for Western Sandpipers (*Calidris mauri*) and Least Sandpipers (*C. minutilla*).

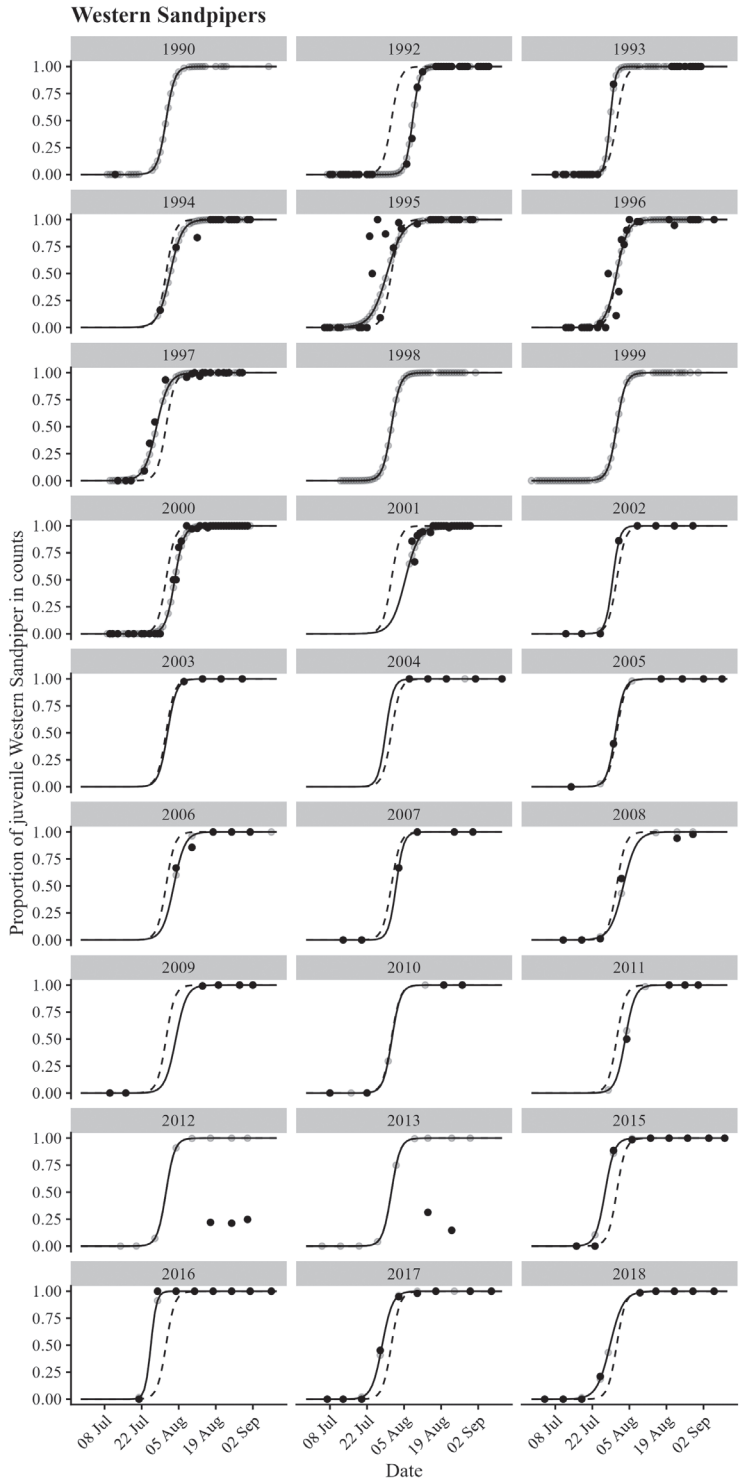

Fig. A1.1 Predicted pattern in seasonal changes in age-class composition in flocks of Western Sandpipers (*Calidris mauri*). The annual estimates (solid lines) are from a binomial model with random day of year and intercept for each year. The mean seasonal pattern is shown for comparison (dashed line), though is obscured in years with little data or where we excluded years from the model. Predicted proportions of juvenile Western Sandpipers are shown in grey dots, with observed proportions in black dots.

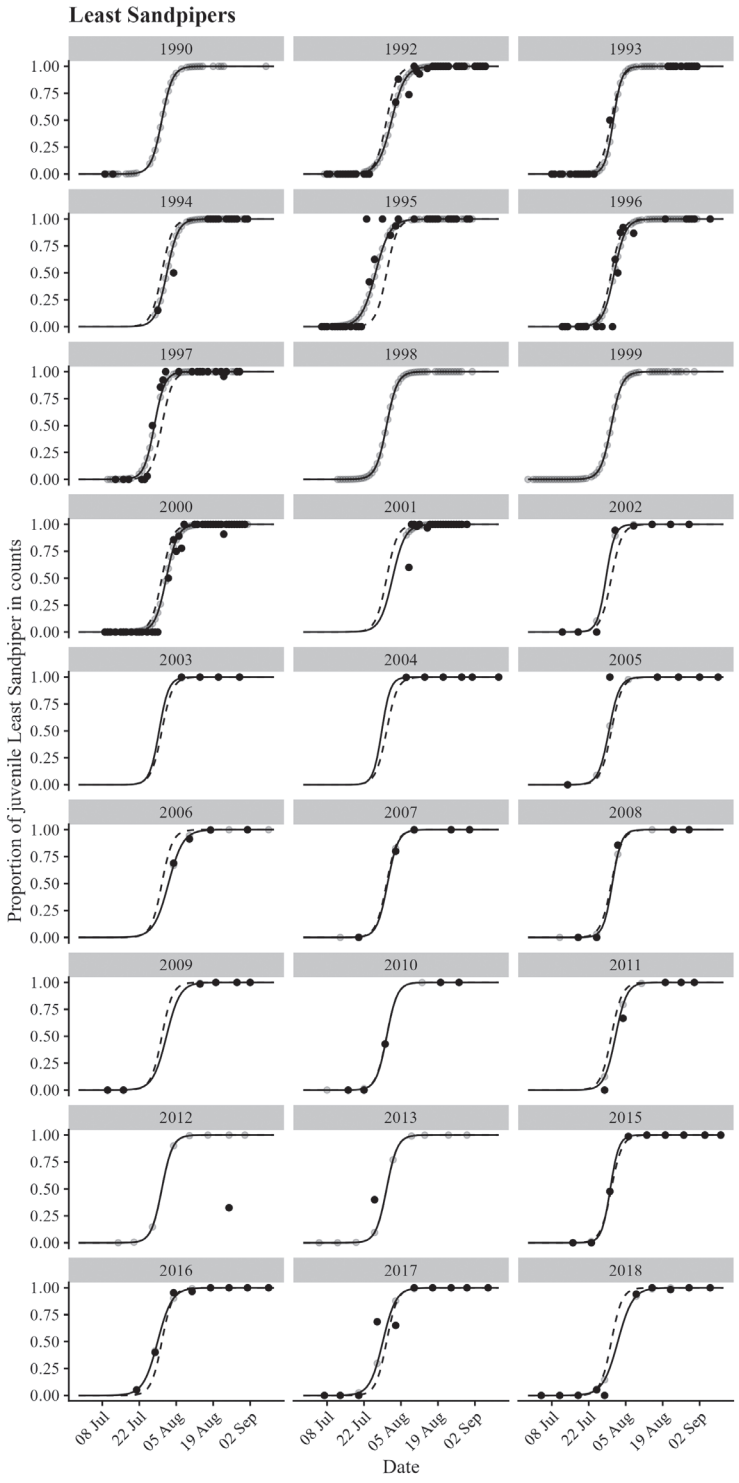

Fig. A1.2 Predicted pattern in seasonal changes in age-class composition in flocks of Least Sandpipers (*Calidris minutilla*). The annual estimates (solid lines) are from a binomial model with random day of year and intercept for each year. The mean seasonal pattern is shown for comparison (dashed line), though is obscured in years with little data or where we excluded years from the model. Predicted proportions of juvenile Least Sandpipers are shown in grey dots, with observed proportions in black dots.

Appendix 2. Overview of variables affecting annual abundances of Western Sandpipers (*Calidris mauri*) and Least Sandpipers (*C. minutilla*) at Sidney Island, British Columbia, Canada.

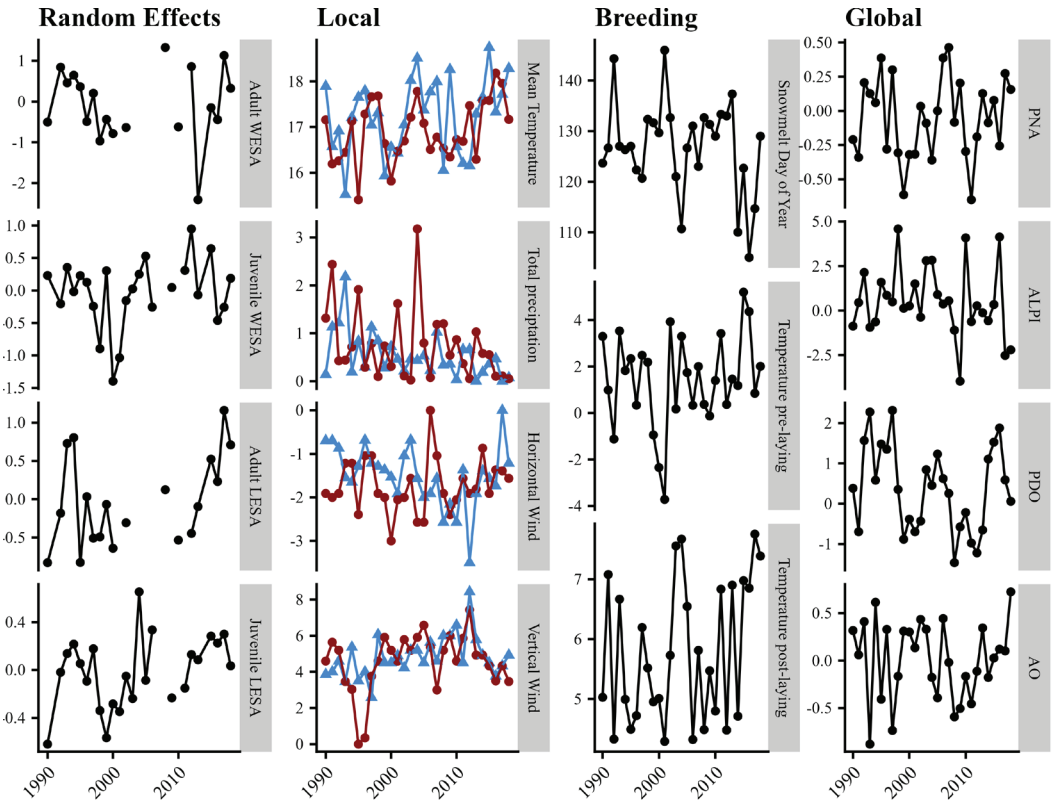

Figure A2.1. Overview of variables affecting annual abundances of Western (*Calidris mauri*) and Least (*C. minutilla*) sandpipers at Sidney Island, British Columbia, Canada. Random effects show the annual deviation of abundance in the baseline models for each age and species group. The local variables show the monthly mean from July (blue) and August (red) of the temperature (ºC), precipitation (mm), and the horizontal and vertical components of the wind vector (km/hr). The breeding variables include the annual day of year of snowmelt in western Alaska, the mean minimum daily temperature in the second half of May (pre-laying period; ºC), and the mean minimum daily temperature in June (post-laying period; ºC). The global variables include the following broad scale climate indices: the Pacific/North American teleconnection (PNA), the Alueutian Low Pressure Index (ALPI), the Pacific Decadal Oscillation (PDO), and the Arctic Oscillation (AO).

Appendix 3. Annual seasonal patterns in abundances for Western (*Calidris mauri*) and Least sandpipers (*C. minutilla*) sandpipers.

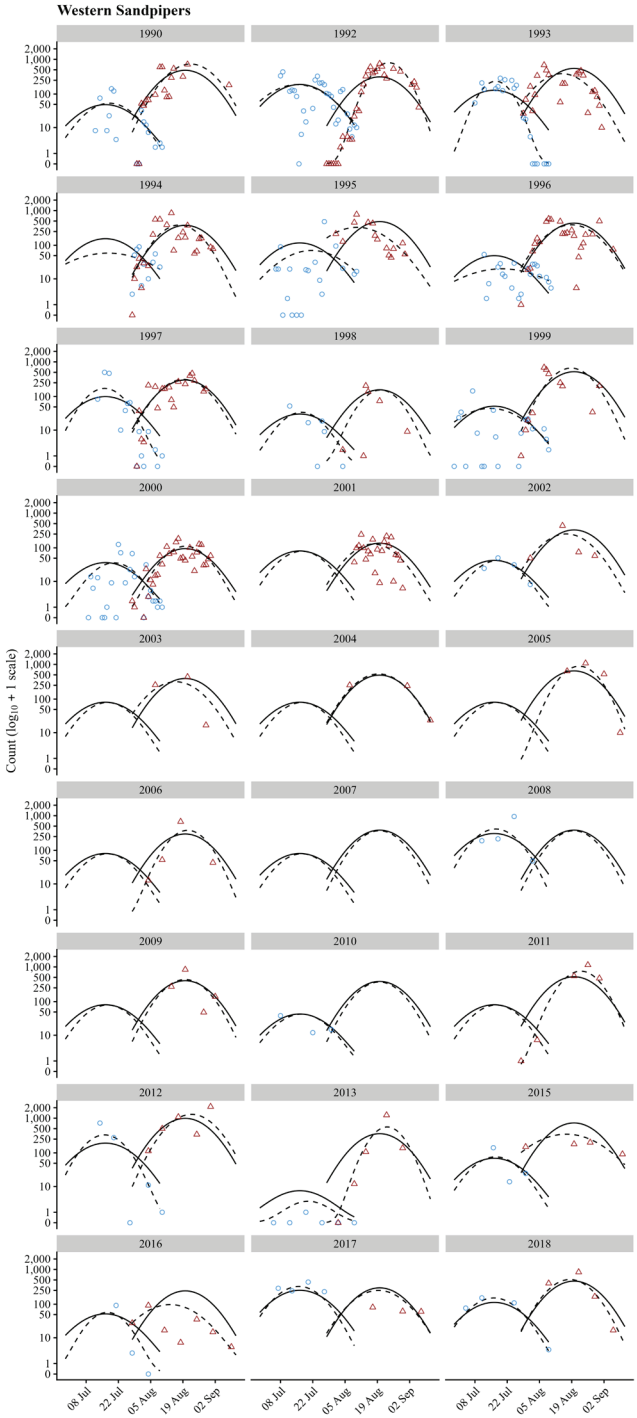

Fig. A3.1 Annual predicted pattern in abundances of Western Sandpipers (*Calidris mauri*). The annual estimates (solid black lines) are from the baseline model (Equation 2) with random intercept for each year. A model with random day of year and intercept for each year is shown for comparison (dotted lines). Abundances of Western Sandpipers are shown for adults (blue dots) and juveniles (red triangles).

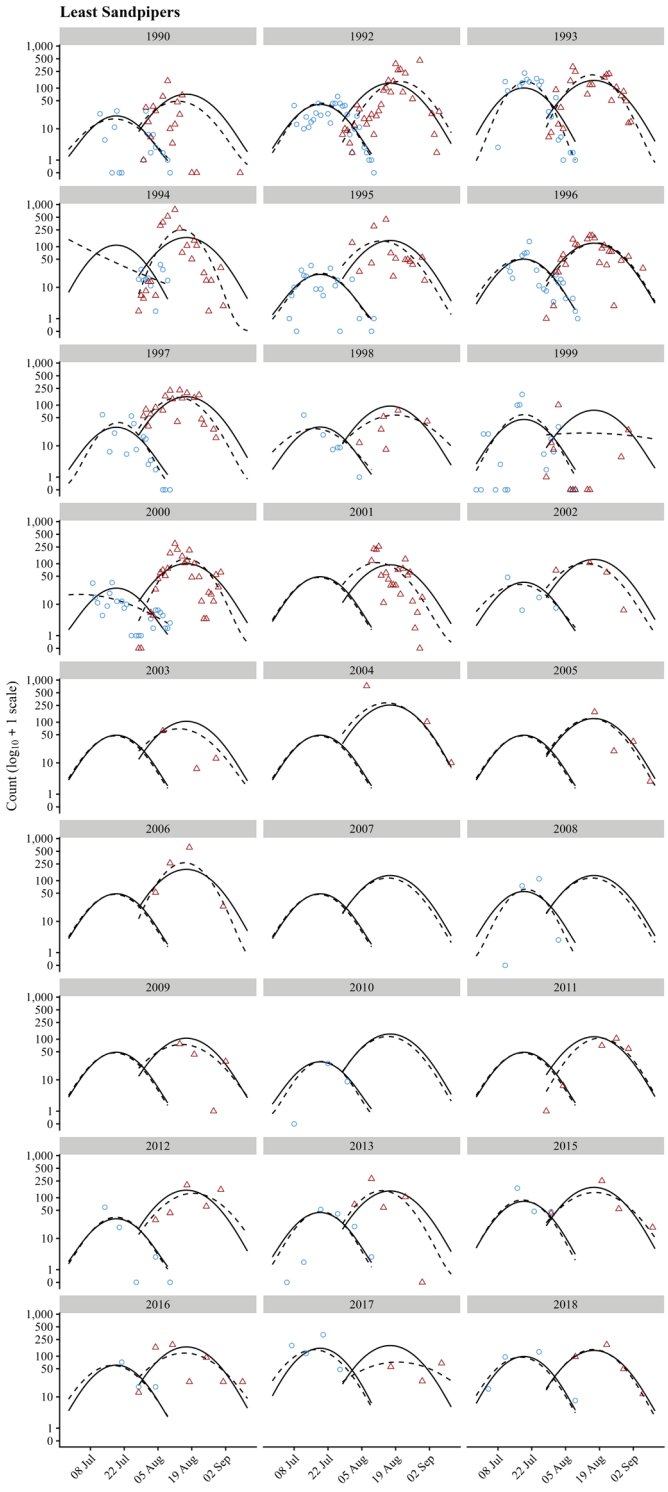

Fig. A3.2 Annual predicted pattern in abundances of Least Sandpipers (*Calidris minutilla*). The annual estimates (solid black lines) are from the baseline model (Equation 2) with random intercept for each year. A model with random day of year and intercept for each year is shown for comparison (dotted lines). Abundances of Least Sandpipers are shown for adults (blue dots) and juveniles (red triangles).

Appendix 4. Full AIC tables for models of annual abundances for all species and age classes.

Table A4.1 Support for models of abundances of migrating adult Western Sandpipers (*Calidris mauri*) at Sidney Island, British Columbia, Canada (*n* = 214 count days). Models are grouped by general hypotheses associated with global climate indices (Global), interannual trends in abundances (Interannual), local weather variables (Local), or weather variables associated with conditions on the breeding grounds (Breeding). Models are arranged from that with the most support to least support and are described more fully in the text. The log-likelihood value (log(L)), number of parameters (K), difference in AICc value from that of the top model (Δ_i), and Akaike weight (w_i) are also shown.

Model Names	log(L)	K	Δ_i	w_i	Hypothesis
PNA[a]	-960.96	7	0.00	0.24	Global
Full climate indices model	-957.99	10	0.60	0.18	Global
ALPI	-961.62	7	1.34	0.12	Global
Baseline model	-963.16	6	2.28	0.08	Interannual
AO	-962.43	7	2.96	0.06	Global
Total local precipitation	-962.62	7	3.33	0.05	Local
Temperature	-962.93	7	3.95	0.03	Local
Mean daily minimum temperature (June)	-963.00	7	4.10	0.03	Breeding
PDO	-963.02	7	4.13	0.03	Global
Day of Alaskan Snowmelt	-963.06	7	4.21	0.03	Breeding
Mean daily minimum temperature (2nd half May)	-963.08	7	4.24	0.03	Breeding
Local horizontal wind vector (u)	-963.14	7	4.37	0.03	Local
Local vertical wind vector (v)	-963.15	7	4.39	0.03	Local
Linear interannual trend	-963.16	7	4.41	0.03	Interannual
Quadratic interannual trend	-962.58	8	5.41	0.02	Interannual
Local wind vectors (u & v)	-961.72	9	5.86	0.01	Local
Full breeding conditions model	-962.45	9	7.32	0.01	Breeding
Full local weather model	-961.08	11	9.02	0.00	Local

[a]Top model AICc = 1936.46; n = 214

Table A4.2 Support for models of abundances of migrating juvenile Western Sandpipers (*Calidris mauri*) at Sidney Island, British Columbia, Canada (*n* = 274 count days). See caption of Table A2.1 for full table description.

Model Names	log(L)	K	Δ_i	w_i	Hypothesis
Mean daily minimum temperature (2nd half of May)[a]	-1635.23	6	0.00	0.46	Breeding
Full breeding conditions model	-1634.94	8	3.66	0.07	Breeding
ALPI	-1637.14	6	3.83	0.07	Global
Baseline model	-1638.26	5	3.97	0.06	Interannual
Mean daily minimum temperature (June)	-1637.64	6	4.81	0.04	Breeding
AO	-1637.72	6	4.97	0.04	Global
Linear interannual trend	-1637.87	6	5.28	0.03	Interannual
Day of Alaskan Snowmelt	-1637.91	6	5.35	0.03	Breeding
Local Temperature	-1637.91	6	5.37	0.03	Local
Local vertical wind vector (v)	-1638.14	6	5.82	0.03	Local
Total local precipitation	-1638.17	6	5.87	0.02	Local
PNA	-1638.17	6	5.89	0.02	Global
Local horizontal wind vector (u)	-1638.19	6	5.92	0.02	Local
PDO	-1638.23	6	5.99	0.02	Global
Quadratic interannual trend	-1637.38	7	6.41	0.02	Interannual
Full climate indices model	-1636.44	9	8.79	0.01	Global
Local wind vectors (u & v)	-1637.99	8	9.75	0.00	Local
Full local weather model	-1637.46	10	12.97	0.00	Local

[a]Top model AICc = 3282.78; n = 274

Table A4.3 Support for models of abundances of migrating adult Least Sandpipers (*Calidris minutilla*) at Sidney Island, British Columbia, Canada (*n* = 214 count days). See caption of Table A2.1 for full table description.

Model Names	log(L)	K	Δ_i	w_i	Hypothesis
Mean daily minimum temperature (June)[a]	-826.94	6	0.00	0.61	Breeding
Full breeding conditions model	-826.56	8	3.54	0.10	Breeding
ALPI	-828.98	6	4.07	0.08	Global
Quadratic interannual trend	-828.01	7	4.27	0.07	Interannual
Linear interannual trend	-829.88	6	5.88	0.03	Interannual
Full climate indices model	-827.41	9	7.41	0.01	Global
Baseline model	-831.74	5	7.48	0.01	Interannual
Day of Alaskan Snowmelt	-830.70	6	7.51	0.01	Breeding
PNA	-831.05	6	8.22	0.01	Global
Local horizontal wind vector (u)	-831.29	6	8.70	0.01	Local
Mean daily minimum temperature (2nd half May)	-831.40	6	8.91	0.01	Breeding
PDO	-831.46	6	9.03	0.01	Global
Local Temperature	-831.53	6	9.18	0.01	Local
AO	-831.54	6	9.20	0.01	Global
Total local precipitation	-831.68	6	9.48	0.01	Local
Local vertical wind vector (v)	-831.69	6	9.50	0.01	Local
Local wind vectors (u & v)	-830.77	8	11.96	0.00	Local
Full local weather model	-830.76	10	16.32	0.00	Local

[a]Top model AICc = 1666.29; n = 214

Table A4.3 Support for models of abundances of migrating juvenile Least Sandpipers (*Calidris minutilla*).at Sidney Island, British Columbia, Canada (*n* = 274 count days). See caption of Table A2.1 for full table description.

Model Names	log(L)	K	Δ_i	w_i	Hypothesis
PNA	-1424.31	6	0.0	0.18	Global
Day of Alaskan Snowmelt	-1424.38	6	0.1	0.17	Breeding
Mean daily minimum temperature (June)	-1424.65	6	0.7	0.13	Breeding
Mean daily minimum temperature (2nd half May)	-1424.94	6	1.3	0.09	Breeding
Linear interannual trend	-1425.09	6	1.5	0.08	Interannual
PDO	-1425.14	6	1.7	0.08	Global
Local Temperature	-1425.63	6	2.6	0.05	Local
Full breeding conditions model	-1423.65	8	2.9	0.04	Breeding
Local horizontal wind vector (u)	-1425.86	6	3.1	0.04	Local
Baseline model	-1426.96	5	3.2	0.04	Interannual
Quadratic interannual trend	-1424.90	7	3.3	0.03	Interannual
Total local precipitation	-1426.55	6	4.5	0.02	Local
AO	-1426.80	6	5.0	0.01	Global
Local vertical wind vector (v)	-1426.84	6	5.1	0.01	Local
Full climate indices model	-1423.66	9	5.1	0.01	Global
ALPI	-1426.91	6	5.2	0.01	Global
Full local weather model	-1423.64	10	7.2	0.00	Local
Local wind vectors (u & v)	-1425.80	8	7.2	0.00	Local

[a]Top model AICc = 2860.9; n = 274

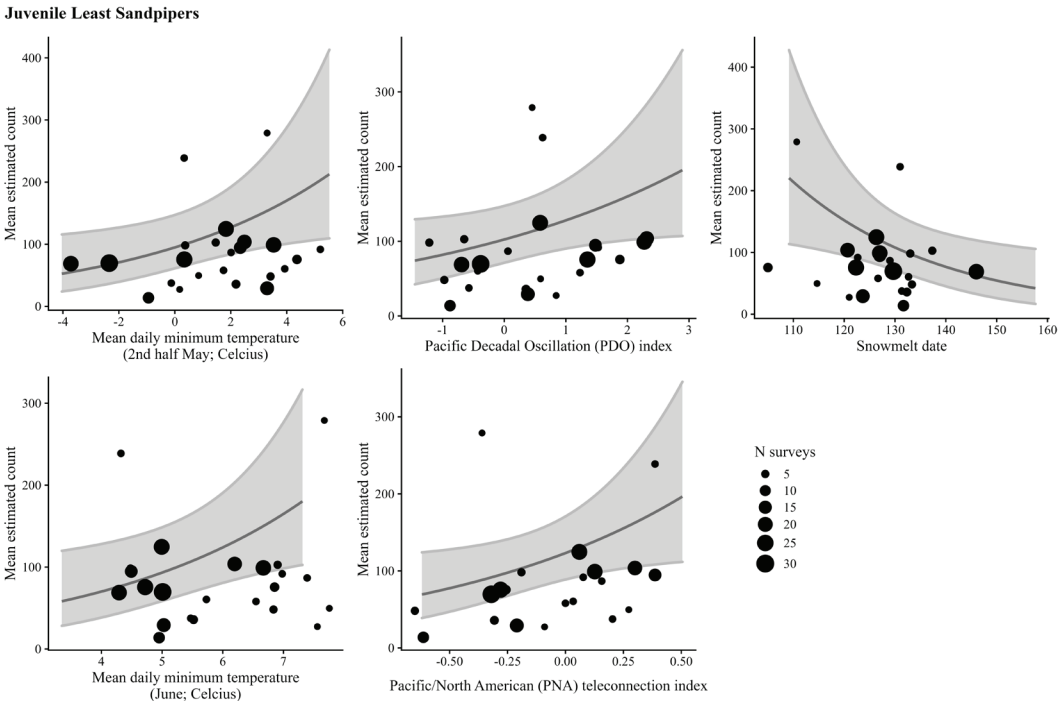

Figure A5.1 Predicted model trends in counts of juvenile Least Sandpipers (*Calidris minutilla*) from models that include the mean daily minimum temperature in Alaska during the 2nd half of May and month of June, the day of year of estimated snowmelt in Alaska, the Pacific Decadal Oscillation index, or the Pacific/North American teleconnection index. Only models with estimates where the confidence intervals do not overlap zero are shown (See Fig. 3 in paper). Mean estimated counts for each year are shown in dots, with the year indicated and the size of the dot indicating the number of surveys conducted.