

Environmental variation and the demography and diet of thick-billed murre

Paul A. Smith*, Anthony J. Gaston

Environment Canada – National Wildlife Research Centre, Ottawa, Ontario K1A 0H3, Canada

Email: paul_smith@smitheco.ca

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Supplement. Additional model selection results for analyses of environmental variables versus demographic and diet variables for thick-billed murre.

Table S1. *Uria lomvia*. Structural reference models for apparent survival (ϕ) and resighting probability (p) of thick-billed murre. The best supported model included a constant estimate of survival and a quadratic temporal trend in resighting probability; this model was used as the basis for building and evaluating subsequent models with environmental covariates. $qAIC_C$ is the quasi-likelihood Akaike's Information Criterion corrected for small sample sizes, $\Delta qAIC_C$ is the difference with reference to the top model, K is the number of parameters in the model, $qDeviance$ is the model deviance adjusted for overdispersion and w_i is the Akaike weight. Symbols in the model column are abbreviations of the previous 2 column parameters

Survival, ϕ	Resight, p	Model	$qAIC_C$	$\Delta qAIC_C$	K	$qDeviance$	w_i
Constant	Quadratic temporal trend	$\phi(.) , p(T^2)$	1021.4	0.0	4	480.1	0.69
Yearly estimates	Quadratic temporal trend	$\phi(t) , p(T^2)$	1024.2	2.8	19	446.7	0.17
Constant	Yearly estimates	$\phi(.) , p(t)$	1026.0	4.6	17	453.8	0.07
Yearly estimates	Yearly estimates	$\phi(t) , p(t)$	1026.8	5.4	31	419.6	0.05
Constant	Constant	$\phi(.) , p(.)$	1030.2	8.8	2	495.5	0.01
Linear temporal trend	Constant	$\phi(T) , p(.)$	1032.1	10.7	3	495.4	0.00
Constant	Linear temporal trend	$\phi(.) , p(T)$	1032.2	10.8	3	495.5	0.00
Quadratic temporal trend	Constant	$\phi(T^2) , p(.)$	1033.5	12.1	4	494.7	0.00
Yearly estimates	Constant	$\phi(t) , p(.)$	1033.7	12.3	17	463.1	0.00

Table S2. Models explaining apparent survival (ϕ). All models receiving greater support than the constant-survival model are displayed. A fixed-effect model with year-specific estimates of survival is displayed for reference. All models contain a quadratic temporal trend in resighting probability and are adjusted for over-dispersion ($\hat{c} = 1.20$). See Table S1 for a description of column headings. AO: Arctic Oscillation; SST: Sea surface temperature

Survival, ϕ	qAIC _C	Δ qAIC _C	<i>K</i>	qDeviance	w_i
AO + Ice April SW	1015.9	0.0	6	468.7	0.43
AO + SST Jan–Mar	1016.0	0.1	6	468.7	0.41
AO	1018.4	2.5	5	474.1	0.12
Constant	1021.4	5.5	4	480.1	0.03
Year-specific	1024.2	8.3	19	446.7	0.01

Table S3. Models relating the proportion of laid eggs that fledged to environmental covariates. The number of parameters (*K*), residual sums of squares (RSS), Akaike’s Information Criterion corrected for small samples (AIC_C), difference in AIC_C versus the top model (Δ AIC_C) and Akaike weights (w_i) are displayed for each model. NAO: North Atlantic Oscillation; SST: Sea surface temperature

Proportion of laid eggs fledging	<i>K</i>	RSS	AIC _C	Δ AIC _C	w_i
SST around colony 1 yr lag + NAO 2 yr lag + Summer SST around colony 2 yr lag	5	506	126.1	0.0	0.57
SST around colony 1 yr lag + NAO 2 yr lag	4	695	127.9	1.8	0.23
SST around colony 1 yr lag	3	990	130.9	4.8	0.05
Year (linear trend)	3	1095	132.7	6.6	0.02
Null	2	1312	133.1	6.9	0.02

Table S4. Models relating the mass of chicks at departure (g) to environmental covariates. See Table S3 for a description of column headings and abbreviations

Departure mass (g)	<i>K</i>	RSS	AIC _C	Δ AIC _C	w_i
SST around colony 1 yr lag	3	1669.8	127.8	0.0	0.68
Year (linear trend)	3	1946.1	130.2	2.5	0.20
Null	2	2502.5	131.2	3.4	0.12

Table S5. Models relating the environmental variables to first principal component of nestling diet (where low PC1 values are associated with a diet high in cod, see Table 7 in the main text). See Table S3 for a description of column headings and abbreviations. *Both raw and detrended variables were considered separately, and 2 top models are therefore presented

Diet PC1	K	RSS	AIC_C	ΔAIC_C^*	w_i
Detrended SST around colony 2 yr lag	4	4.6	40.8	0.0	0.86
SST around colony + NAO 1 yr lag	4	4.4	40.3	0.0	0.59
SST around colony	3	6.9	41.6	1.3	0.31
Year (linear trend)	3	7.4	44.6	4.3	0.07
Null	2	14.0	46.5	6.2	0.03

Table S6. Models relating the environmental variables to the second principal component of nestling diet (where low PC2 values are associated with a diet high in capelin and sandlance, see Table 3). See Table S3 for a description of column headings and abbreviations. *Both raw and detrended variables were considered separately, and 2 top models are therefore presented

Diet PC2	K	RSS	AIC_C	ΔAIC_C^*	w_i
Detrended summer ice Hudson Bay 2 yr lag + Detrended summer ice Hudson Bay 3 yr lag + Detrended Coats summer SST 1 yr lag + NAO 2 yr lag	7	1.4	37.0	0.0	0.64
Detrended summer ice Hudson Bay 2 yr lag + Detrended summer ice Hudson Bay 3 yr lag + Detrended Coats summer SST 1 yr lag	6	2.7	39.1	2.1	0.23
Detrended summer ice Hudson Bay 2 yr lag + Detrended summer ice Hudson Bay 3 yr lag	5	4.5	41.0	4.0	0.09
Detrended summer ice Hudson Bay 3 yr lag	4	7.0	43.1	6.1	0.03
Summer ice Hudson Bay 2 yr lag + Summer ice Hudson Bay 3 yr lag	4	4.5	36.4	0.0	0.91
Summer ice Hudson Bay 3 yr lag	3	8.1	41.5	5.1	0.07
Year (linear trend)	3	10.0	44.6	8.2	0.02
Null	2	14.0	46.5	10.1	0.01

Table S7. Models relating the quantity of energy (kJ) delivered to nestling thick-billed murrelets to environmental covariates. See Table S3 for a description of column headings and abbreviations. *Both raw and detrended variables were considered separately, and 2 top models are therefore presented

Energy delivered chick ⁻¹ h ⁻¹	<i>K</i>	RSS	AIC _C	ΔAIC _C [*]	<i>w_i</i>
Detrended SST around colony 2 yr lag + NAO 3 yr lag	5	24.0	66.3	0.0	0.69
Detrended SST around colony 2 yr lag	4	36.5	67.9	1.6	0.31
Detrended NAO 3 yr lag	4	64.1	76.3	10.1	0.00
NAO 3 yr lag	3	72.4	74.4	0.0	0.77
Year (linear trend)	3	85.8	76.9	2.5	0.21
Null	2	119.0	81.8	7.4	0.02

Table S8. Models relating environmental variables to counts of thick-billed murrelets on fixed plots at Coats Island. See Table S3 for a description of column headings and abbreviations. *Both raw and detrended variables were considered separately, and 2 top models are therefore presented. SW: south-west quadrant of wintering range

Colony attendance	<i>K</i>	RSS	AIC _C	ΔAIC _C [*]	<i>w_i</i>
Detrended ice April SW	4	132212	211.9	0.0	0.50
Year	3	175908	213.2	0.0	0.92
Summer SST around colony 1 yr lag + Summer SST around colony + Ice April SW	5	154638	218.7	5.4	0.06
Summer SST around colony 1 yr lag + Summer SST around colony	4	237892	221.9	8.6	0.01
Summer SST around colony 1 yr lag	3	344659	224.7	11.4	0.00
Null	2	783180	223.1	9.9	0.00