The following supplement accompanies the article

Winter extratropical cyclone influence on seabird survival: variation between and within common eider *Somateria mollissima* populations

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Supplement. Goodness-of-fit (GOF) test results, ANODEV results testing the sensitivity to ellipse size (width–length combination) and correlation relationships between variables

Tables

Table S1: Main components of goodness-of-fit (GOF) tests for the standard time-dependent Cormack-Jolly-Seber model (CJS-model) and the time-dependent model with individual heterogeneity of detection (IDH-model) for Common Eider at Grindøya (1985-2014), East Bay (1996-2014) and Prins Heinrich (1999-2014) islands.

		Test3.SR: transience		Test2.CT: trap dependence		
Population		χ^2	z^2	χ^2	z^2	Total χ^2
East Bay	CJS-model	169.95	47.48	228.60	198.23	701.75
	df	17	1	16	1	165
	p	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**
	c-hat	10.00		14.29		4.25
	IDH-model	122.47		30.37		456.04
	df	16		15		163
	p	**<0.001**		**0.011**		**<0.001**
	c-hat	7.65		2.02		2.80
Prins Heinrich	CJS-model	20.24		12.50		66.98
	df	12		10		49
	p	0.063		0.253		**0.045**
	c-hat	1.69		1.25		1.37
Grindøya	CJS-model	58.17	3.18	81.63	24.14	280.91
	df	28	1	27	1	176
	p	**<0.001**	**0.037**	**<0.0001**	**<0.0001**	**<0.0001**
	c-hat	2.08		3.02		1.63
	IDH-model	54.99		57.49		253.59
	df	27		26		174
	p	**0.001**		**<0.001**		**<0.001**
	c-hat	2.11		2.27		1.46

Here are presented the two main components of the CJS-model GOF test: Test3.SR and Test2.CT assessing respectively transience and trap-dependence effects.
For each GOF component of the CJS-model, z^2 is the squared directional statistics, which is asymptotically distributed as N(0,1). Total χ^2 is the overall CJS-model GOF χ^2-statistics.
For the IDH-model, χ^2 is the non-directional component where z^2 was removed from their respective components of the standard GOF (Péron *et al*. 2010). Total χ^2 is the overall IDH-model GOF χ^2-statistics.
df is the degree of freedom, p the p-value, c-hat the overdispersion coefficient computed as the ratio between the corresponding χ^2-statistic and its degree of freedom.

The directional tests for transience (3.SR) and trap-happiness (2.CT) were both statistically significant for the Canadian and Norwegian breeding populations, i.e. individual heterogeneity in detection occurred in those two populations but not in the Svalbard one. For the Canadian population, the overall corrected GOF test of the model with individual detection heterogeneity (IDH-model) still proved significant, and we thus used a $\hat{c}$ of 2.80. For the Svalbard population, the main GOF test components were not significant (Appendix S1 Table S1). Our umbrella model was thus the CJS model. For the northern Norwegian population, the corrected 3.SR and 2.CT tests as well as the overall corrected GOF test of the IDH-model proved significant (Appendix S1 Table S1). To take this remaining lack of fit into account, we performed our model selection using a $\hat{c}$ of 1.46.

Table S2: Effect of the maximum wind speed of the strongest winter extratropical cyclones with or without time lag of one (L1) or two (L2) years on female adult survival of common eider breeding in northern Norway (1985-2014). Results of analysis of deviance (ANODEV) are presented for the four length-width combinations.

Survival	Length-width (km)	Deviance	Criterion	ΔCriterion	$F_{j-1,n-j}$	p	R^2_{Dev}
Norwegian population			QAICc	ΔQAICc			
NAO_L2+MaxWind_L1 of nNo	**200-160**	**8471.13**	**5882.87**	**0.00**	**14.86**	**<0.0001**	**0.53**
NAO_L2+MaxWind_L1 of nNo	300-210	8473.94	5884.79	1.92	13.56	<0.0001	0.51
NAO_L2+MaxWind_L1 of nNo	300-160	8474.38	5885.09	2.22	13.41	<0.0001	0.51
NAO_L2+MaxWind_L1 of nNo	200-210	8474.43	5885.13	2.26	13.38	<0.0001	0.51
NAO_L2+MaxWind_L2 of nNo	200-210	8473.49	5884.48	1.61	13.79	<0.0001	0.51
NAO_L2+MaxWind_L2 of nNo	**200-160**	**8473.73**	**5884.65**	**1.78**	**13.68**	**<0.0001**	**0.51**
NAO_L2+MaxWind_L2 of nNo	300-210	8473.87	5884.74	1.87	13.62	<0.0001	0.51
NAO_L2+MaxWind_L2 of nNo	300-160	8474.85	5885.42	2.55	13.21	<0.0001	0.50
Time	-	8412.23	5896.07	13.20	-	-	-
NAO_L2	-	8498.12	5899.34	16.48	12.68	0.001	0.32
Constant	-	8538.47	5924.99	42.13	-	-	-

Selected length-width combination is in bold. n is the number of survival estimates obtained from model Ft (fixed effect model with a time effect, see formula above), j the number of parameters required to describe the relationship between survival and the focal climatic covariate, $F_{j-1,n-j}$ the ANODEV test statistic following a Fisher-Snedecor distribution with j-1 and n-j degrees of freedom, p the p-value of the ANODEV test and R^2_{Dev} the proportion of survival variation explained by the covariate (see Grosbois *et al.* 2008 for more details).

Figures

In this figure section, winter was defined from December to March. We considered six variables to describe winter ETC activity, considering both mean and extreme climatologic measures: the number of all ETC (Nb_ETC), their mean wind speed (MeanWind), the number of extreme ETC (Nb_ExtrETC), i.e. their wind speed is above the 95th percentile threshold of the local wind speed distribution, the number of days of extreme ETC (Day_ExtrETC), the number of days of the longest ETC (Day_LongETC) and the wind speed of the strongest (in terms of wind speed) extreme ETC (MaxWind). The correlations between these variables and the winter North Atlantic Oscillation (NAO) with or without time lags are shown for each studied population.

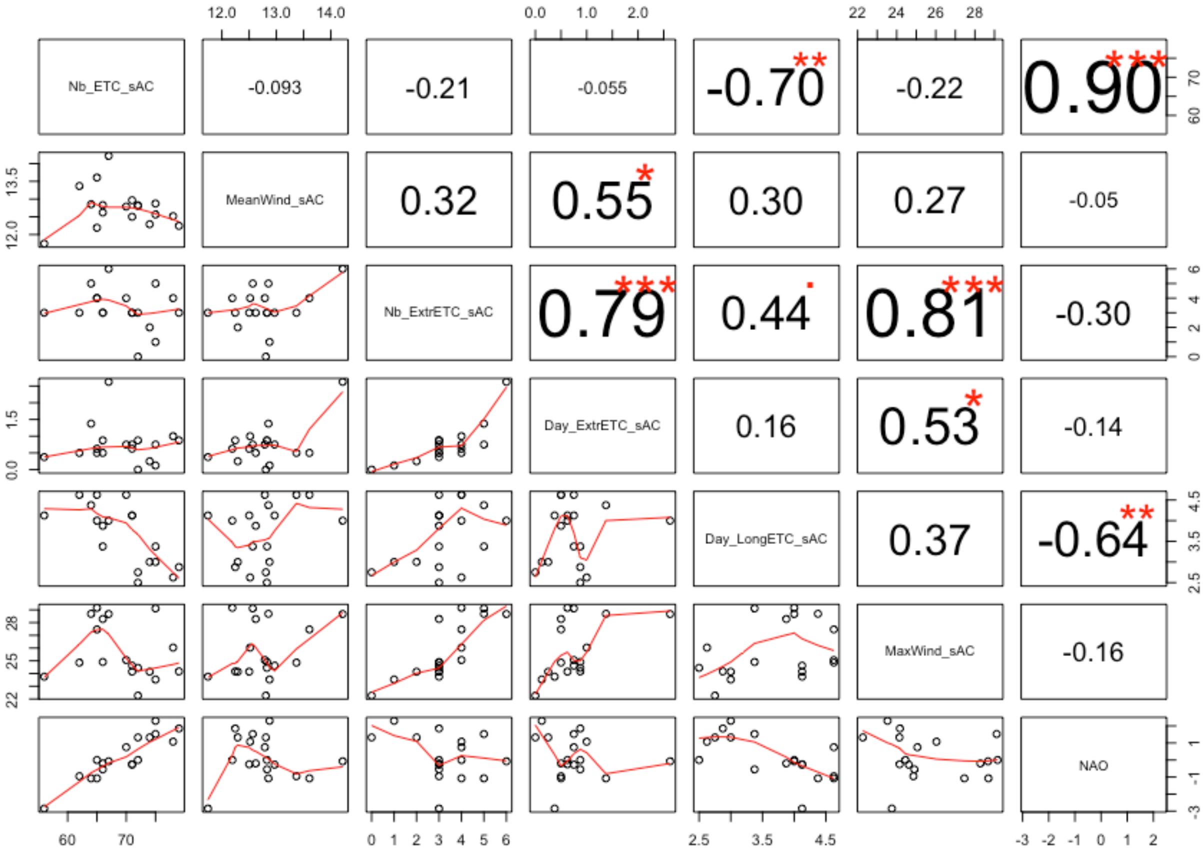

Figure S1: Correlations between winter North Atlantic Oscillation (NAO) and local winter ETC-related variables in southern Atlantic Canada (sAC), one of the wintering areas of eiders breeding in the Canadian Arctic (East Bay: EB; 1996-2014).

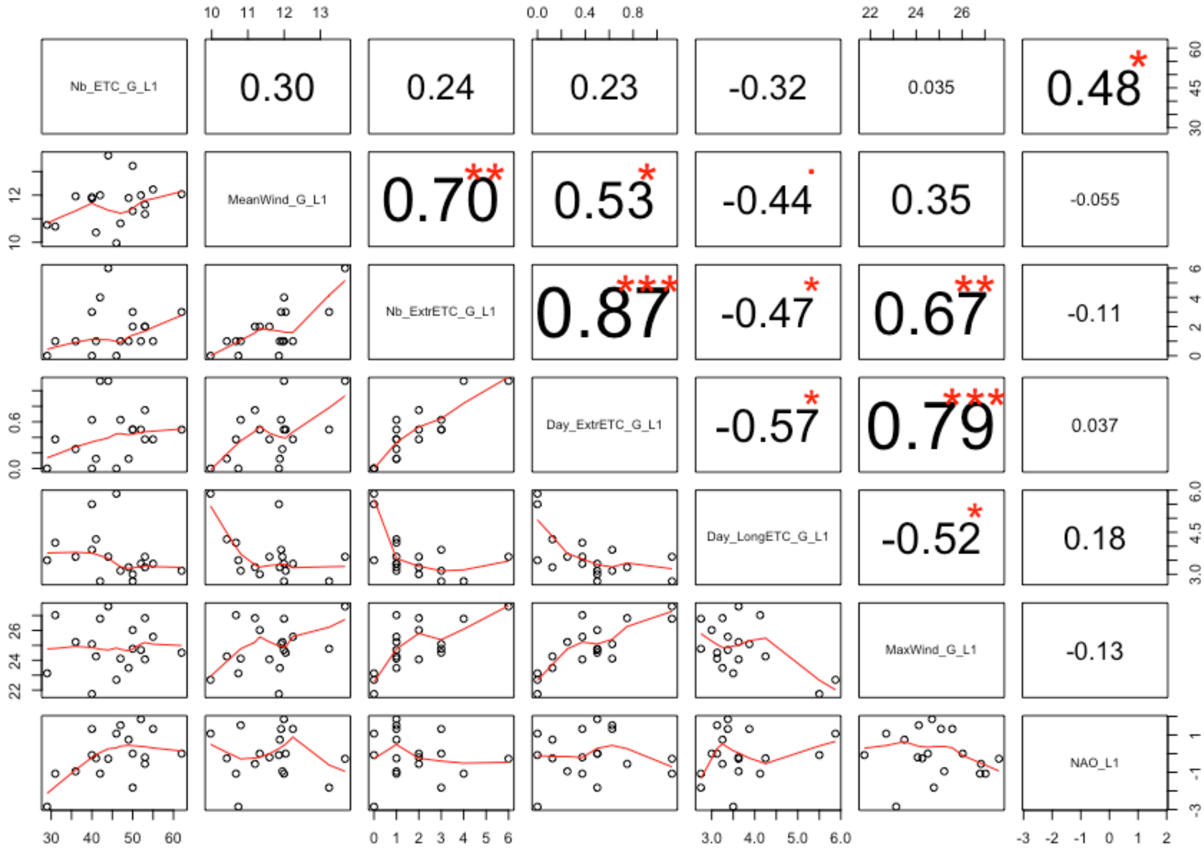

Figure S2: Correlations between one-year lagged (L1) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables in Greenland (G), one of the wintering areas of eiders breeding in the Canadian Arctic (East Bay: EB; 1996-2014).

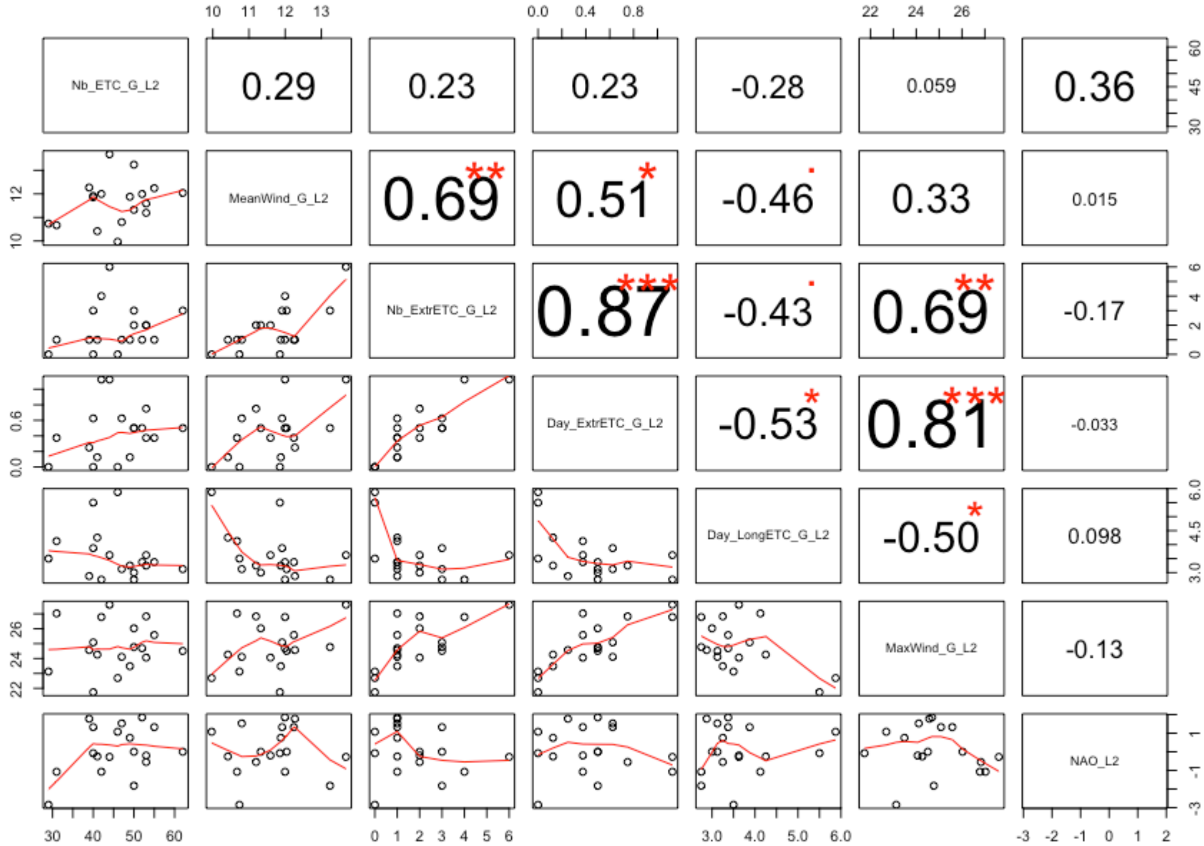

Figure S3: Correlations between two-years lagged (L2) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables in Greenland (G), one of the wintering areas of eiders breeding in the Canadian Arctic (East Bay: EB; 1996-2014).

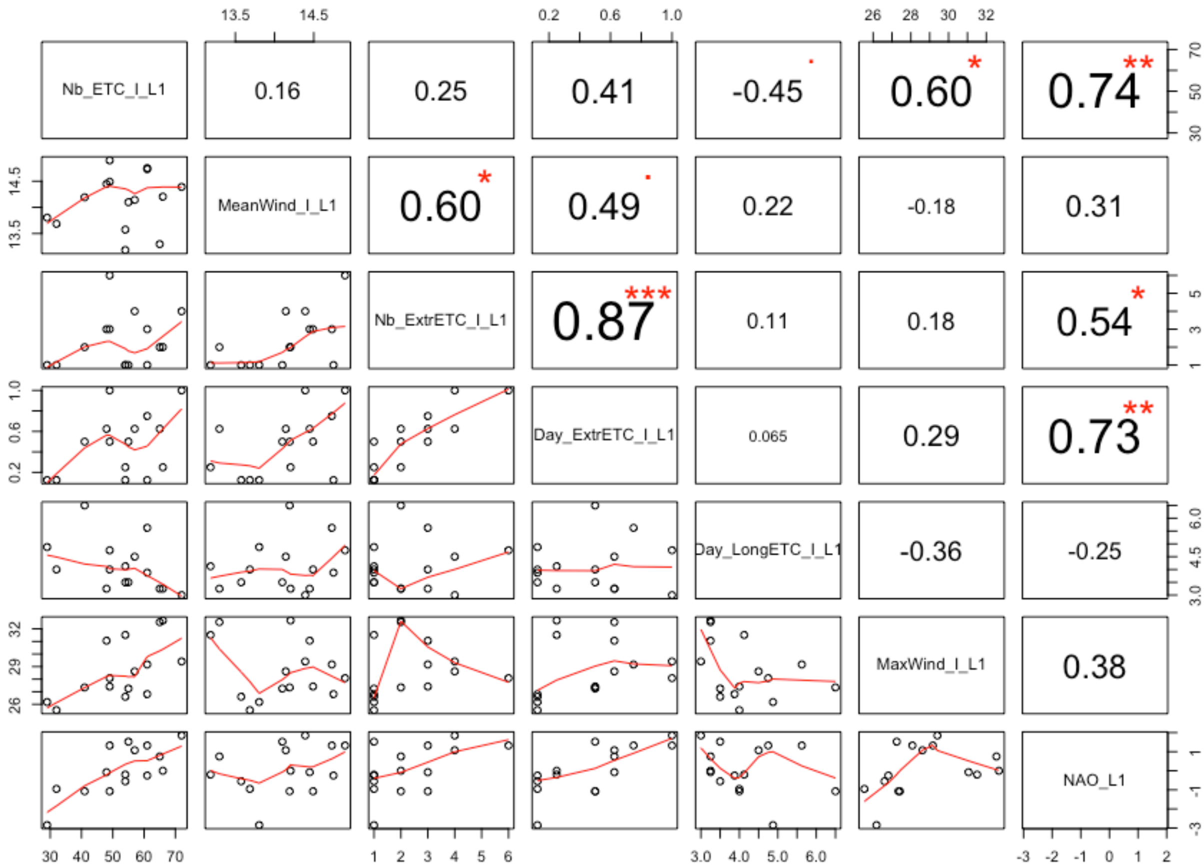

Figure S4: Correlations between one-year lagged (L1) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables in Iceland (I), one of the wintering areas of eiders breeding in Svalbard (Prins Heinrich: PH; 1999-2014).

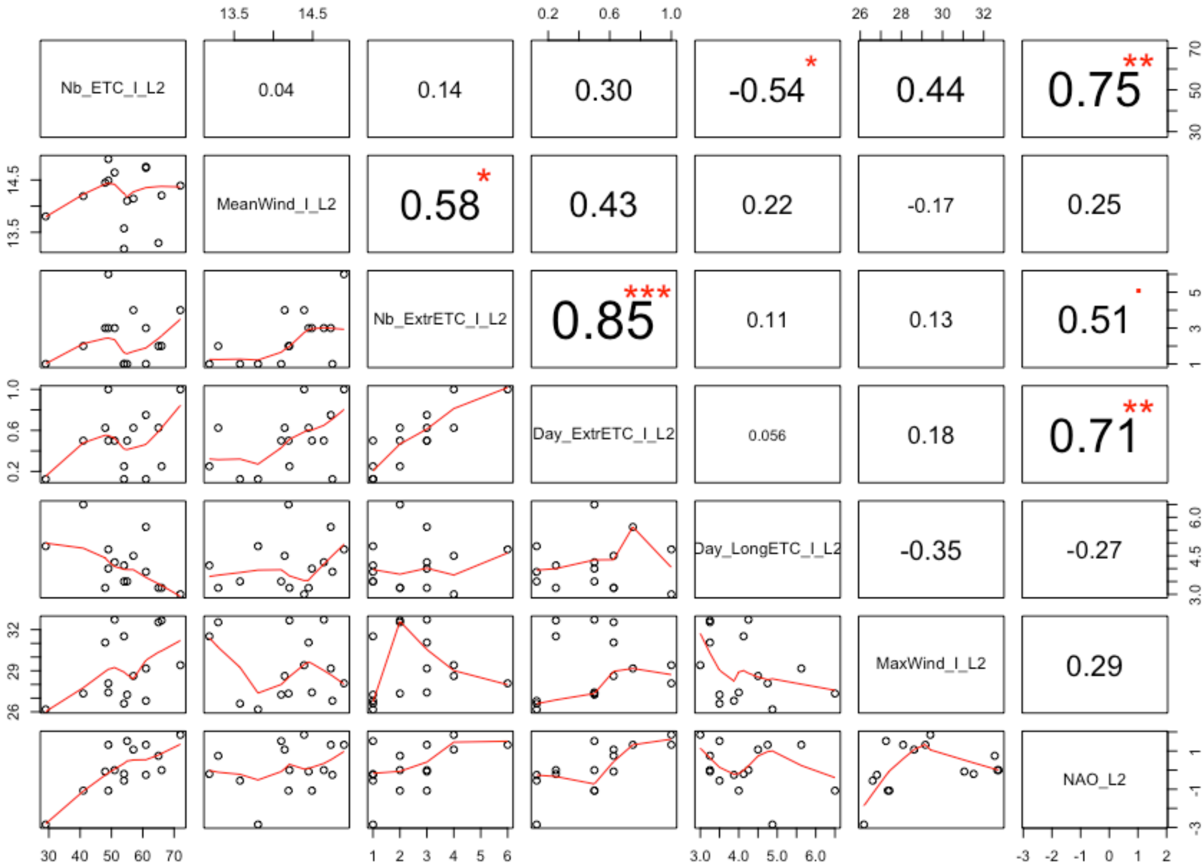

Figure S5: Correlations between two-years lagged (L2) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables in Iceland (I), one of the wintering areas of eiders breeding in Svalbard (Prins Heinrich: PH; 1999-2014).

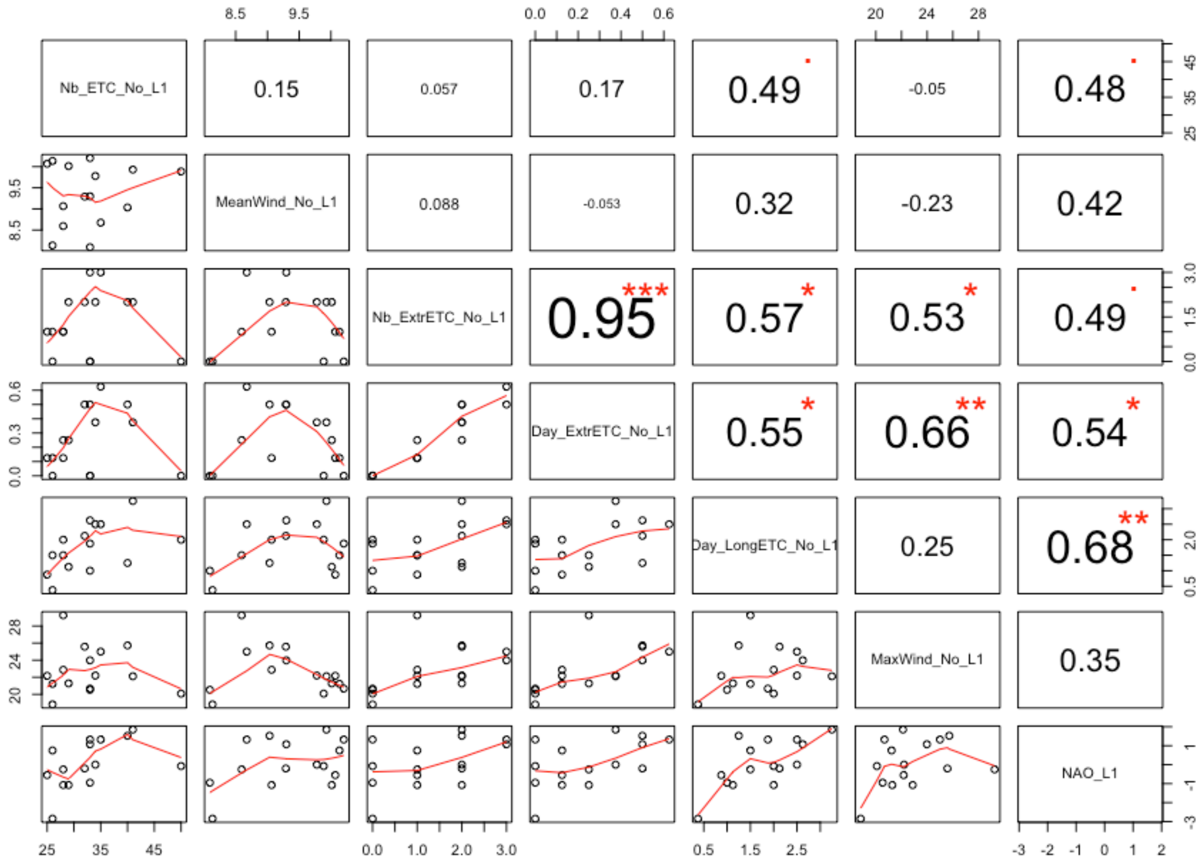

Figure S6: Correlations between one-year lagged (L1) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables Norway (No), one of the wintering areas of eiders breeding in Svalbard (Prins Heinrich: PH; 1999-2014).

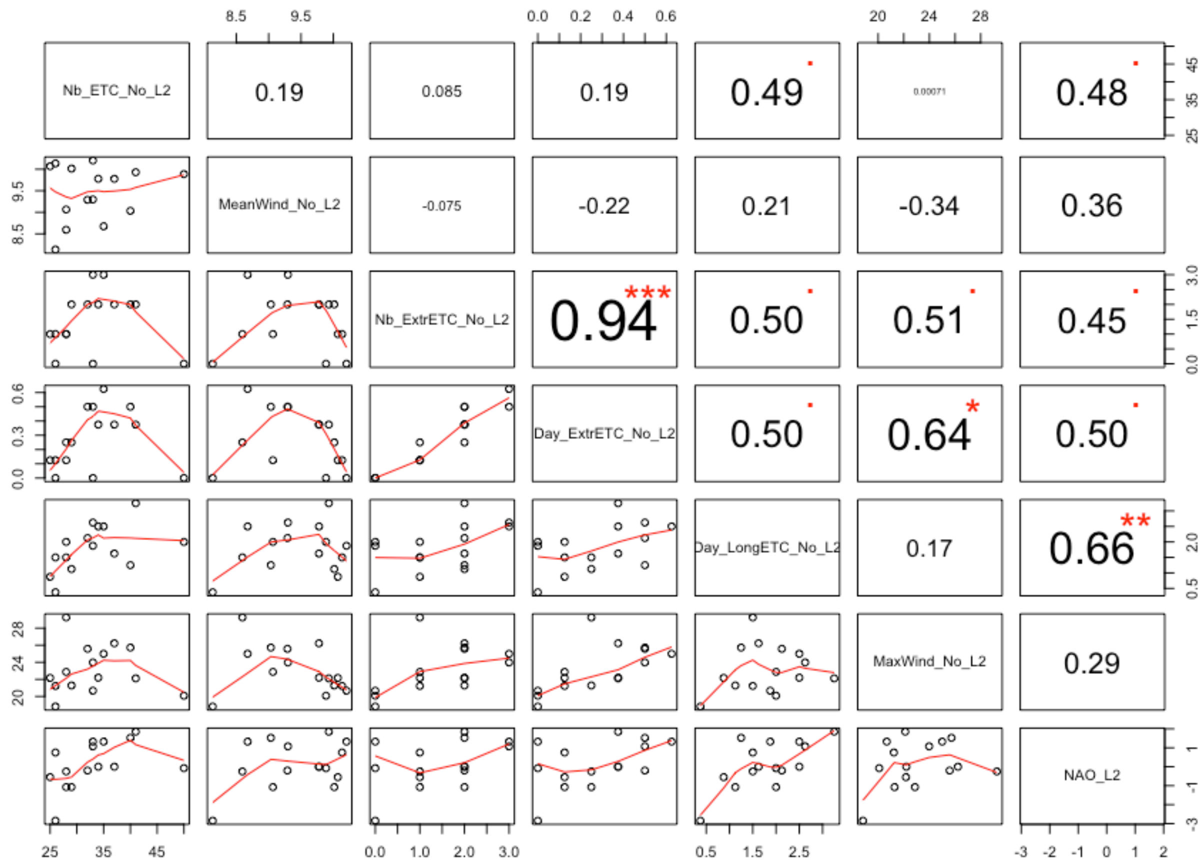

Figure S7: Correlations between two-years lagged (L2) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables Norway (No), one of the wintering areas of eiders breeding in Svalbard (Prins Heinrich: PH; 1999-2014).

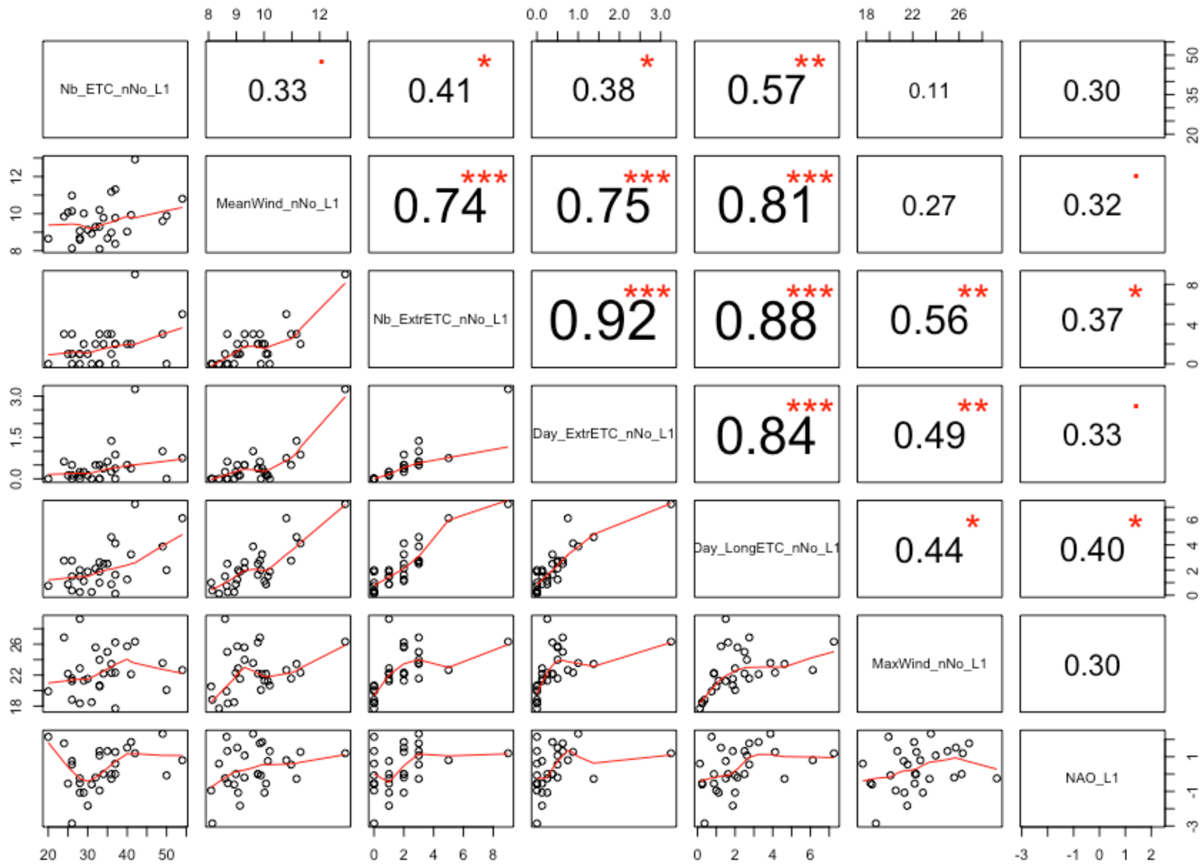

Figure S8: Correlations between one-year lagged (L1) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables in Northern Norway (Nno), wintering area of eiders resident in Northern Norway (Grindøya: G; 1985-2014).

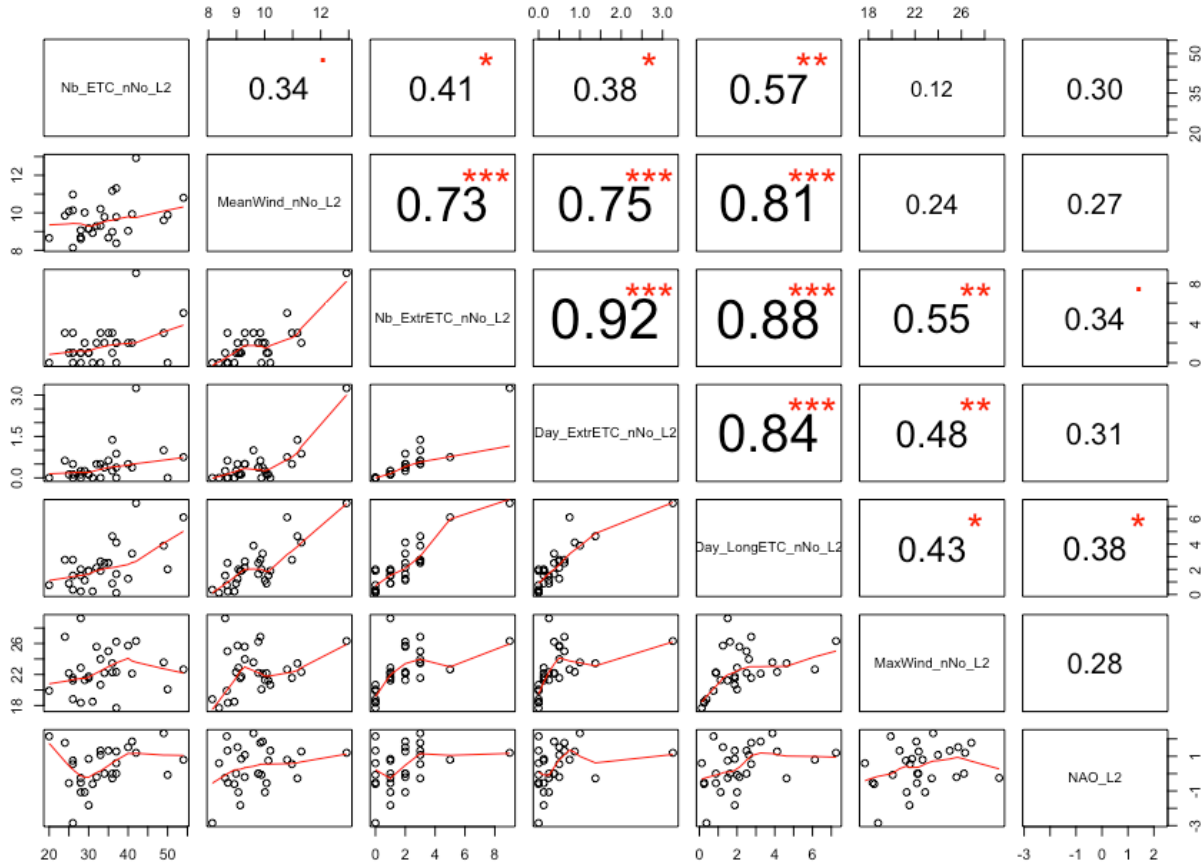

Figure S9: Correlations between two-years lagged (L2) winter North Atlantic Oscillation (NAO) and local winter ETC-related variables in Northern Norway (Nno), wintering area of eiders resident in Northern Norway (Grindøya: G; 1985-2014).