The following supplement accompanies the article

Year-round haul-out behaviour of male walruses (*Odobenus rosmarus*) in the Northern Barents Sea

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Supplement

Haul-out duration

Cox-Proportional Hazard (CPH) models are ideal for data that models time until an event occurs. In this situation, the CPH models uses the time until a haul-out ends i.e. haul-out duration. The hazard function represents the risk of ending a haul-out event at time *t*, given that this has not already occurred. The hazard function (λ) for observation (i.e. haul-out event) *i* is,

$$\lambda_i(t) = \lambda_0(t)e^{X_i\beta + Z_i w + \varepsilon_i}$$

where *X* represents the fixed covariates for haul-out event *i*, β a vector of the coefficients, *w* a vector containing the unknown random effects (frailties) for each walrus, *Z* a design matrix equalling 1 if a haul-out event *i* is performed by walrus *j* and 0 if the situation is otherwise, and λ_0 represents the baseline hazard, which is an unspecified non-negative function of time (Therneau & Grambsch 2000). The β's for each coefficient are estimated by maximization of the partial likelihood functions (Therneau & Gramsch 2000). A hazard ratio above 1 indicates an increased risk of ending a haul-out event, while a hazard ratio below 1 indicates a decreased risk of ending a haul-out event. A hazard ratio of 0.8 for a continuous variable indicates that for every unit increase of the variable there is a 20% decrease in the risk of ending a haul-out event. A hazard ratio of 1.4 for a given level of a factor variable indicates that for the specified factor level there is a 40% increase in the risk of ending a haul-out event compared to the reference level. Because the hazard ratio for two observations (i.e. haul-out events) *i* and *k* with fixed covariate vectors is,

$$\frac{\lambda_i(t)}{\lambda_k(t)} = \frac{\lambda_0(t)e^{\eta_i}}{\lambda_0(t)e^{\eta_k}} = \frac{e^{\eta_i}}{e^{\eta_k}}$$

hazard ratios are constant over time (Therneau & Grambsch 2000).

Table S1. Haul-out probability analyses results showing the intercept value and standard error (SE), the estimate, SE and p-value for the linear terms, the estimated degrees of freedom (edf) and p-value for the smooth term and phi, the level of temporal autocorrelation, for 17 male walruses equipped with Satellite-Relay Data Loggers in Svalbard, Norway in 2003 and 2004. Significant results ($p \leq 0.05$) are in bold font.

	Intercept		**Wind chill**			**Air pressure**			**Solar hour**		**Phi**
	value	**SE**	**estimate**	**SE**	**p-value**	**estimate**	**SE**	**p-value**	**edf**	**p-value**	
Jul	-1.277	0.312	0.400	0.239	0.094	-0.261	0.156	0.094	<0.001	0.477	0.928
Aug	-1.281	0.213	0.091	0.123	0.458	0.297	0.104	**0.004**	0.530	0.256	0.931
Sep	-1.593	0.145	0.438	0.137	**0.001**	0.197	0.063	**0.002**	0.295	0.309	0.922
Oct	-1.713	0.105	0.379	0.127	**0.003**	0.331	0.063	**<0.001**	1.000	0.383	0.892
Nov	-1.464	0.095	0.471	0.110	**<0.001**	0.277	0.068	**<0.001**	0.764	0.198	0.874
Dec	-1.149	0.147	0.410	0.100	**<0.001**	0.176	0.073	**0.017**	<0.001	0.718	0.833
Jan	-1.355	0.142	0.310	0.104	**0.003**	0.258	0.100	**0.010**	0.884	0.189	0.837
Feb	-1.814	0.213	0.315	0.151	**0.037**	0.075	0.127	0.555	1.453	**0.024**	0.834
Mar	-1.802	0.182	0.262	0.132	**0.048**	0.123	0.116	0.292	2.427	**0.034**	0.860
Apr	-1.522	0.204	0.358	0.143	**0.013**	0.322	0.133	**0.016**	1.326	**0.052**	0.888
May	-1.447	0.264	0.720	0.264	**0.006**	0.015	0.161	0.925	1.334	**0.050**	0.911
Jun	-1.729	0.352	0.755	0.230	**0.012**	0.540	0.208	**0.010**	<0.001	0.635	0.928

Table S2. Cox proportional mixed effects model results for haul-out duration analyses, showing the hazard ratio (exp(coef)), 95% CI and p-value for the fixed effects and the exp (standard deviation) for the random effects for 17 male walruses equipped with Satellite Relay Data Loggers in Svalbard, Norway in 2003 and 2004. Significant results ($p \leq 0.05$) are in bold font. Hazard ratios beneath one indicate a decreased risk of ending a haul-out event and hazard ratios above one indicate an increased risk of ending a haul-out event for a unit increase of the fixed effect.

	Wind chill		**Air pressure**		**Aquatic time before a haul-out event**		**Duration of previous haul-out event**		**Random variables**	
	Hazard ratio (± 95% CI)	**p-value**	**Hazard ratio (± 95% CI)**	**p-value**	**Hazard ratio (± 95% CI)**	**p-value**	**Hazard ratio (± 95% CI)**	**p-value**	**Year/ID**	**Year**
Jul	0.692 (0.170-2.823)	0.610	1.253 (0.748-2.099)	0.390	0.777 (0.465-1.298)	0.340	0.967 (0.744-1.256)	0.800	1.193	1.177
Aug	1.240 (0.752-2.051)	0.400	0.705 (0.535-0.930)	**0.013**	0.702 (0.592-0.832)	**<0.001**	0.943 (0.848-1.049)	0.280	1.010	1.128
Sep	0.795 (0.539-1.175)	0.250	0.847 (0.722-0.993)	**0.041**	0.707 (0.614-0.814)	**<0.001**	1.141 (1.006-1.294)	**0.041**	1.279	1.004
Oct	0.436 (0.318-0.597)	**<0.001**	0.804 (0.713-0.908)	**<0.001**	0.770 (0.672-0.883)	**<0.001**	1.061 (0.924-1.218)	0.400	1.007	1.133
Nov	0.616 (0.495-0.765)	**<0.001**	0.941 (0.794-1.114)	0.480	0.796 (0.691-0.919)	**0.002**	1.210 (0.994-1.464)	**0.058**	1.004	1.020
Dec	0.723 (0.592-0.883)	**0.002**	0.898 (0.781-1.033)	0.130	0.761 (0.653-0.887)	**<0.001**	1.061 (0.866-1.300)	0.570	1.267	1.012
Jan	0.447 (0.344-0.581)	**<0.001**	0.821 (0.682-0.987)	**0.036**	0.887 (0.739-1.064)	0.200	1.181 (0.944-1.477)	0.140	1.327	1.655
Feb	0.864 (0.574-1.300)	0.480	1.041 (0.808-1.341)	0.760	0.739 (0.594-1.919)	**0.007**	2.927 (1.584-5.408)	**<0.001**	1.360	1.694
Mar	0.874 (0.629-1.215)	0.420	0.884 (0.660-1.183)	0.410	0.983 (0.786-1.228)	0.880	0.840 (0.476-1.483)	0.550	1.003	1.007
Apr	0.796 (0.587-1.078)	0.140	0.746 (0.584-0.953)	**0.019**	0.686 (0.517-0.912)	**0.009**	1.110 (0.811-1.519)	0.520	1.004	1.006
May	0.279 (0.099-0.783)	**0.015**	0.546 (0.355-0.839)	**0.006**	0.575 (0.361-0.916)	**0.020**	1.170 (0.853-1.617)	0.320	1.004	1.018
Jun	0.331 (0.058-1.901)	0.220	0.973 (0.638-1.484)	0.900	0.477 (0.282-0.806)	**0.006**	1.188 (0.896-1.576)	0.230	1.192	1.017