Supplementary Material

Table S1: Mean, standard deviation, (SD) and range of variables and derived quantities included in the models of lactation performance of female polar bears during the onshore fasting period in Western Hudson Bay, Canada. Summary data for offspring (cubs-of-the-year and yearlings) are also shown.

Variable	Mean	SD	Minimum	Maximum
Females				
Days since arrival onshore	39	30	-4	89
Maternal body mass (kg)	208.26	34.95	148.8	319.8
Straight-line body length (cm)	197	4	189	204
γ	0.937	0.037	0.826	0.979
Energy density (MJ kg^{-1})	16.2	5.32	6.56	27.8
Maternal age (years)	14	5	6	24
Litter mass (kg)	120.15	69.45	47.17	312.10
Offspring				
Cubs-of-the-year				
Body mass (kg)	55.46	14.07	20	78
Straight-line body length (cm)	120	12	92	137
γ	0.85	0.15	0.33	0.996
Energy density (MJ kg^{-1})	12.4	4.89	2.43	24.1
Yearlings				
Body mass (kg)	133.08	21.59	100.7	180.0
Straight-line body length (cm)	164	8	149	175
γ	0.916	0.027	0.881	0.968
Energy density (MJ kg^{-1})	16.79	2.96	11.86	20.95

Table S2: Comparison of models for determining the importance of interaction terms in models of lactation performance of polar bears as a function of days since onshore arrival (Model 1). LOOIC values are given, together with the difference in LOOIC value compared to the most parsimonious model (ΔLOOIC). There was a difference in LOOIC of 2.0 between the top two models (Models 1B and 1D), and a standard error of 2.0, indicated the two models performed equally well. Since Model 1D assumed no interactive effects of litter size and days since onshore arrival on gross milk energy, but Model 1B indicated effects of litter size depended on days since onshore arrival (mean $\beta_{\text{days onshore} \times \text{litter size}}$ = -0.178; SD = 0.097; 89% credible interval [-0.332, -0.025]; overlap with zero = 0.03), we present results of Model 1B in the main text and report the results of Model 1D in Table S4.

	Model description	LOOIC	ΔLOOIC
1A	Days onshore × litter size + days onshore × cub age + energy density + maternal age + litter mass	194.3	3.5
1B	**Days onshore × litter size + cub age + energy density + maternal age + litter mass**	190.8	0
1C	Days onshore × cub age + litter size + energy density + maternal age + litter mass	195.2	4.4
1D	Days onshore + litter size + cub age + energy density + maternal age + litter mass	192.8	2

Table S3: Comparison of models for determining the importance of interaction terms in models of lactation performance of polar bears as a function of maternal energy density (Model 2). LOOIC values are given, together with the difference in LOOIC value compared to the most parsimonious model (ΔLOOIC). There was a difference in LOOIC of 0.7 between the top two models (Models 2C and 2D), and a standard error of 2.0 indicated the models performed equally well. Since Model 2D assumed no interactive effects of cub age and energy density on gross milk energy, but Model 2C indicated effects of cub age depended on maternal energy density (mean $\beta_{\text{energy density} \times \text{cub age}}$ = -0.130; SD = 0.085; 89% credible interval [-0.266, 0.003]; overlap with zero = 0.06), we present results of Model 2C in the main text and report the results of Model 2D in Table S5.

	Model description	LOOIC	ΔLOOIC
2A	Energy density × litter size + energy density × cub age + maternal age + litter mass	202.1	3.4
2B	Energy density × litter size + cub age + maternal age + litter mass	203.00	4.3
2C	**Energy density × cub age + litter size + maternal age + litter mass**	198.7	0
2D	Energy density + litter size + cub age + maternal age + litter mass	199.4	0.7

Table S4: Mean, standard deviation (SD), and 89% credible intervals of the posterior distribution for the parameters of the joint best fitting model with days since onshore arrival (Model 1D, without interactions – see Table S2), that describes lactation probability and gross milk energy (kJ g^{-1}) of female polar bears fasting on onshore in Western Hudson Bay.

Parameter	Mean	SD	Lower 89%	Upper 89%
Lactation probability				
$\psi_{\text{cub age class}}$	0.915	0.905	-0.548	2.351
$\psi_{\text{energy density}}$	-0.346	0.692	-1.475	0.718
$\psi_{\text{litter size}}$	0.25	0.872	-1.155	1.645
$\psi_{\text{days onshore}}$	1.504	0.626	0.533	2.525
$\psi_{\text{maternal age}}$	-0.097	0.63	-1.073	0.917
$\psi_{\text{litter mass}}$	0.354	0.631	-0.652	1.365
μ_{ψ_0}	-2.205	0.763	-3.504	-1.101
σ_{ψ_0}	2.122	1.492	0.267	4.708
Gross milk energy				
$\beta_{\text{cub age class}}$	-0.418	0.188	-0.714	-0.114
$\beta_{\text{energy density}}$	-0.012	0.06	-0.107	0.083
$\beta_{\text{litter size}}$	-0.158	0.131	-0.365	0.052
$\beta_{\text{days onshore}}$	-0.07	0.061	-0.168	0.026
$\beta_{\text{maternal age}}$	0	0.054	-0.086	0.085
$\beta_{\text{litter mass}}$	0.046	0.096	-0.108	0.197
μ_{β_0}	2.375	0.056	2.287	2.464
σ_{β_0}	0.097	0.058	0.012	0.195
σ	0.201	0.037	0.148	0.264
Measurement error				
χ	0.934	0.008	0.92	0.946
τ	46.328	14.548	25.789	71.562

Table S5: Mean, standard deviation (SD), and 89% credible intervals of the posterior distribution for the parameters of the joint best fitting model with energy density (Model 2D, without interactions – see Table S3), that describes lactation probability and gross milk energy (kJ g^{-1}) of female polar bears fasting on onshore in Western Hudson Bay.

Parameter	Mean	SD	Lower 89%	Upper 89%
Lactation probability				
$\psi_{\text{cub age class}}$	1.070	0.912	-0.401	2.512
$\psi_{\text{energy density}}$	-1.133	0.598	-2.135	-0.239
$\psi_{\text{litter size}}$	0.049	0.853	-1.311	1.418
$\psi_{\text{maternal age}}$	0.010	0.600	-0.916	0.990
$\psi_{\text{litter mass}}$	-0.022	0.577	-0.926	0.909
μ_{ψ_0}	-1.956	0.730	-3.226	-0.930
σ_{ψ_0}	2.021	1.430	0.256	4.526
Gross milk energy				
$\beta_{\text{cub age class}}$	-0.458	0.185	-0.748	-0.159
$\beta_{\text{energy density}}$	0.038	0.041	-0.028	0.103
$\beta_{\text{litter size}}$	-0.133	0.130	-0.338	0.077
$\beta_{\text{maternal age}}$	0.003	0.053	-0.082	0.088
$\beta_{\text{litter mass}}$	0.074	0.092	-0.074	0.219
μ_{β_0}	2.385	0.056	2.298	2.475
σ_{β_0}	0.097	0.059	0.012	0.197
σ	0.202	0.036	0.149	0.263
Measurement error				
χ	0.934	0.008	0.920	0.946
τ	46.385	14.522	25.866	71.644

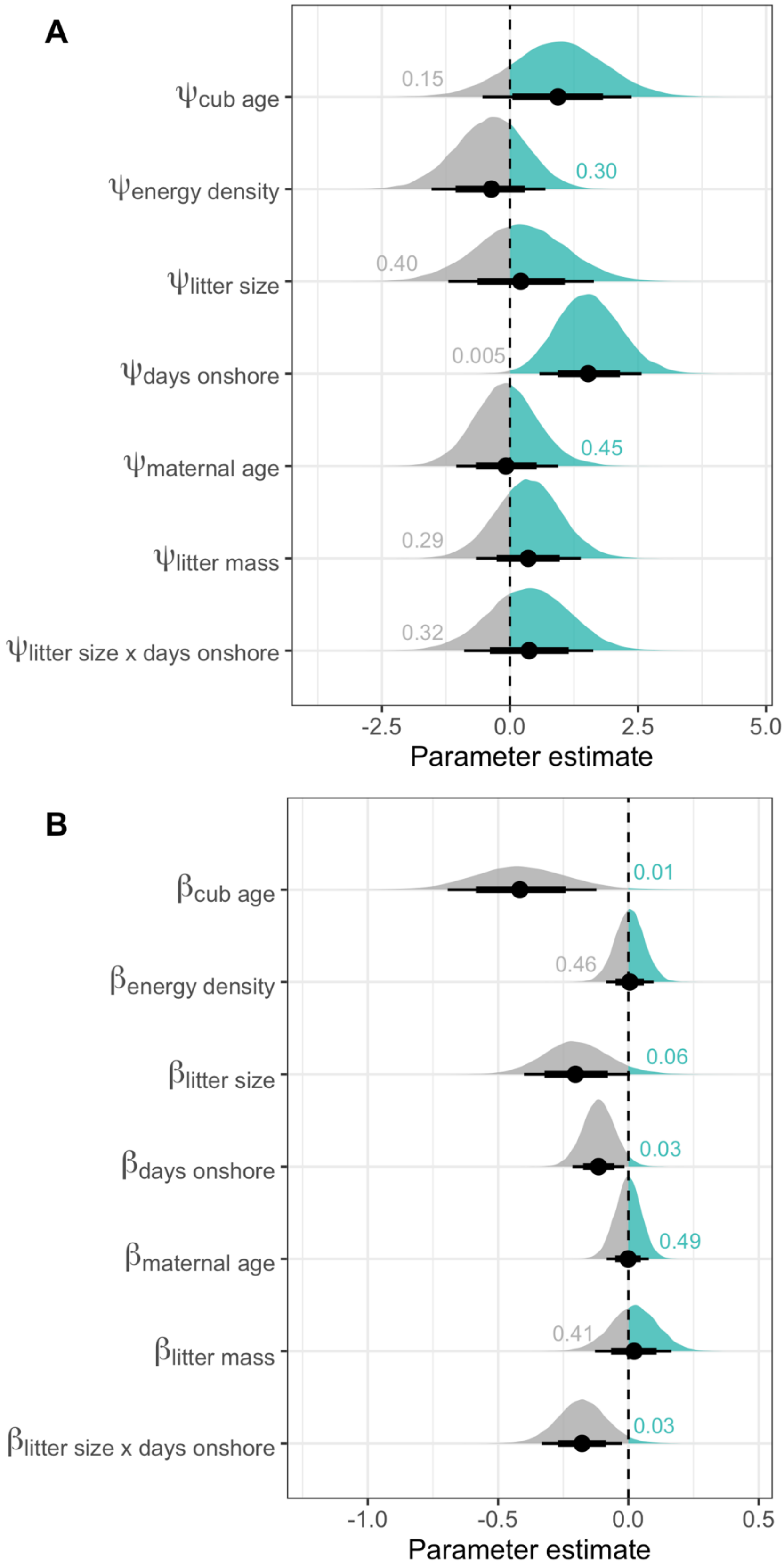

Figure S1: Posterior distribution of the parameters of Model 1 (with days since onshore arrival), describing (A) lactation probability and (B) gross milk energy (kJ g^{-1}) of female polar bears fasting onshore in Western Hudson Bay. Shaded areas show posterior distribution (negative posterior values in grey, positive in turquoise), labels indicate the proportion of the posterior distribution overlapping zero. Filled circles represent the mean, thick and thin bars represent the 67% and 89% credible intervals, respectively.

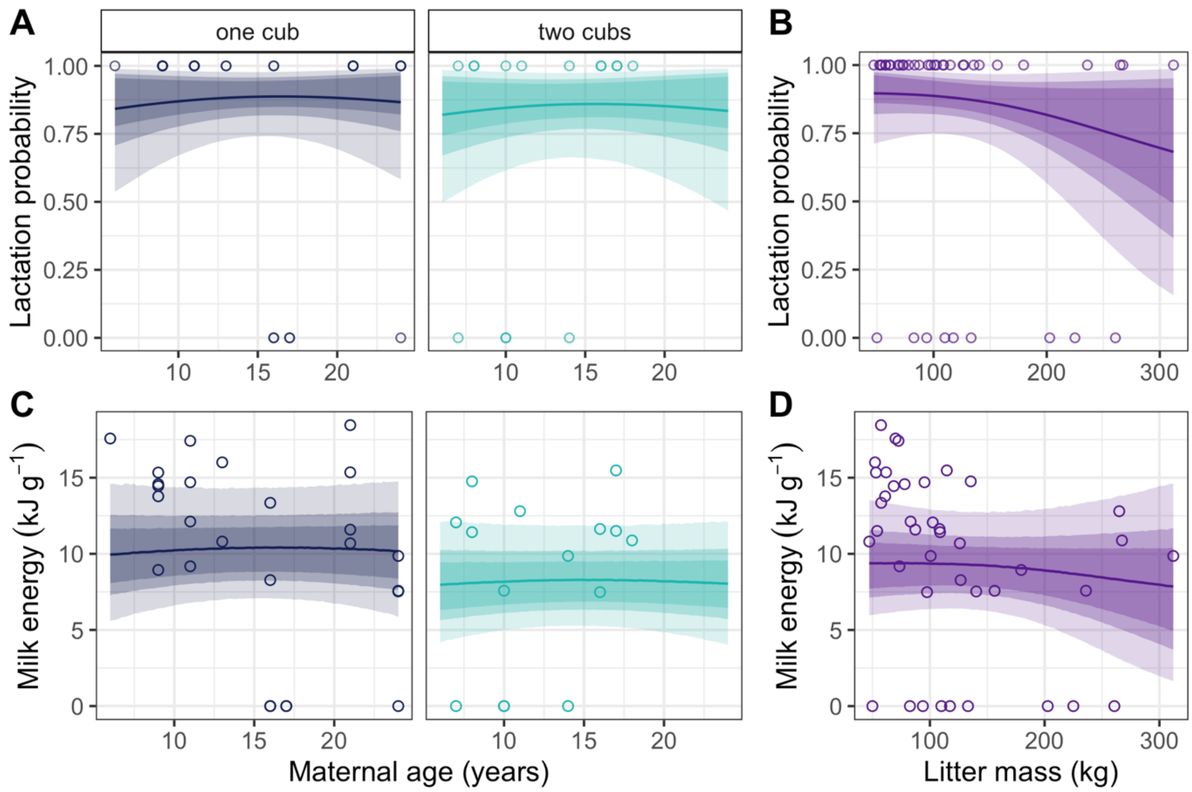

Figure S2: Predictions from Model 1 of (A) maternal age and (B) litter mass effects on lactation probability of female polar bears accompanied by one or two cubs. Also shown is the predicted gross milk energy (kJ g^{-1}) in response to (C) maternal age (D) litter mass. Lines in A-D show mean of the posterior distribution and shaded areas show the prediction intervals (light, medium, and darker shading = 89%, 67%, 50% prediction intervals). Remaining variables were held at their mean values for predictions.

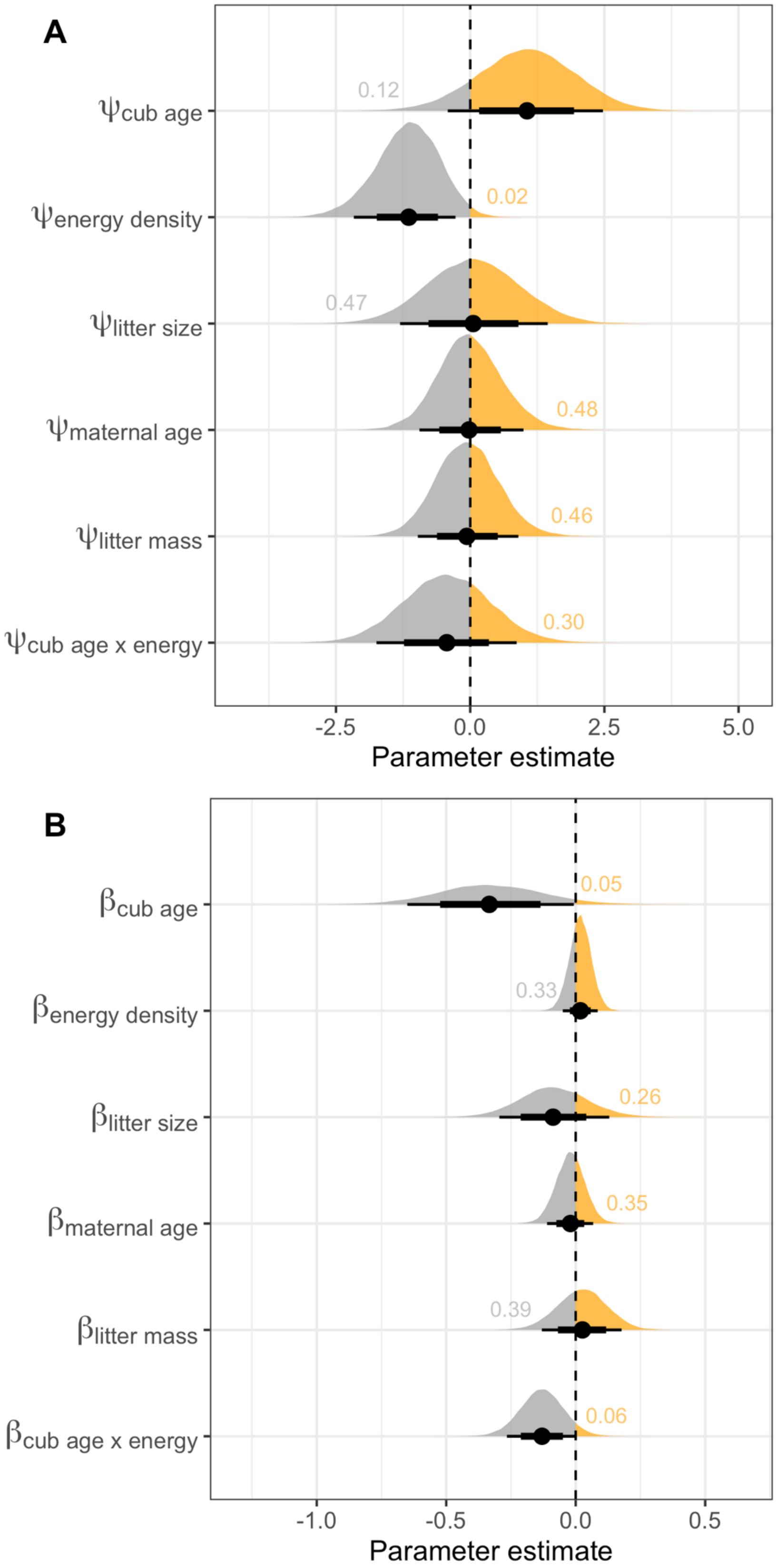

Figure S3: Posterior distribution of the parameters of Model 2 (with energy density), describing (A) lactation probability and (B) gross milk energy (kJ g^{-1}) of female polar bears fasting onshore in Western Hudson Bay. Shaded areas show posterior distribution (negative posterior values in grey, positive in yellow), labels indicate the proportion of the posterior distribution overlapping zero. Filled circles represent the mean, thick and thin bars represent the 67% and 89% credible intervals, respectively.

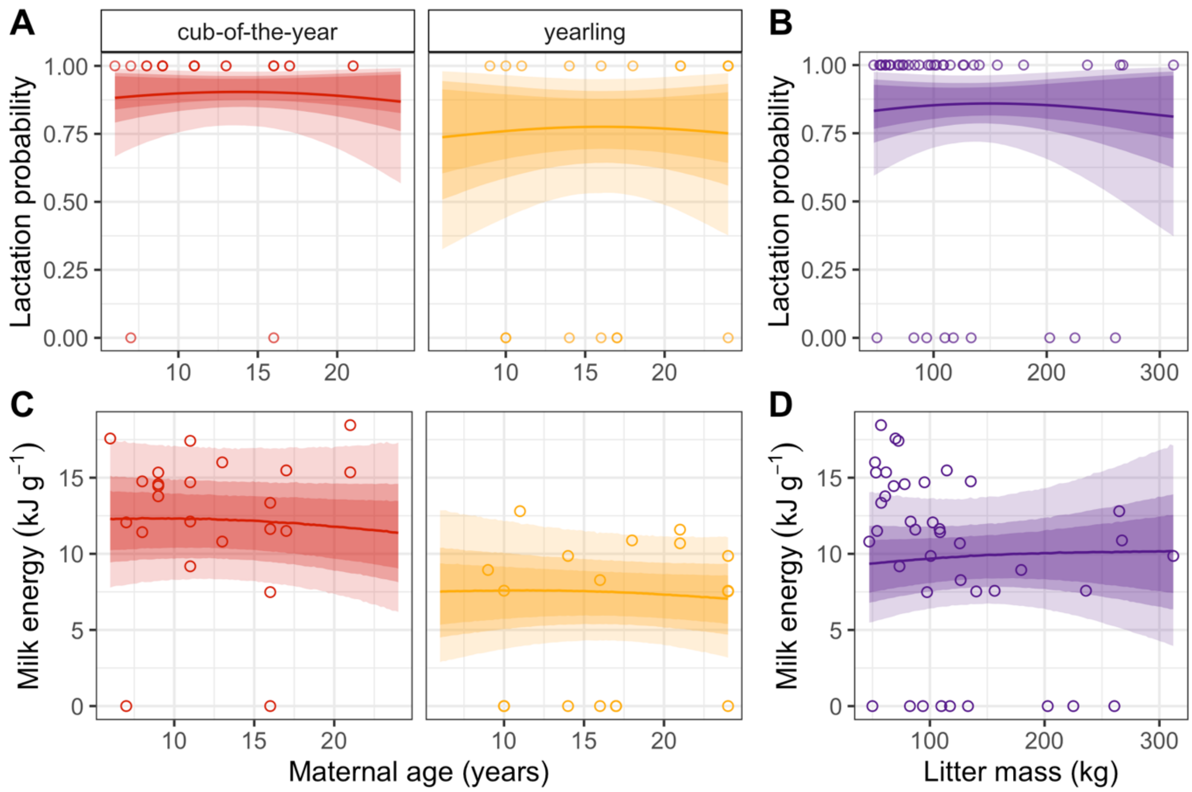

Figure S4: Predictions from Model 2 of (A) maternal age and (B) litter mass effects on lactation probability of female polar bears accompanied by cubs-of-the-year (COY) or yearlings. Also shown is the predicted gross milk energy (kJ g^{-1}) in response to (C) maternal age (D) litter mass. Lines in A-D show mean of the posterior distribution and shaded areas show the prediction intervals (light, medium, and darker shading = 89%, 67%, 50% prediction intervals). Remaining variables were held at their mean values for predictions.

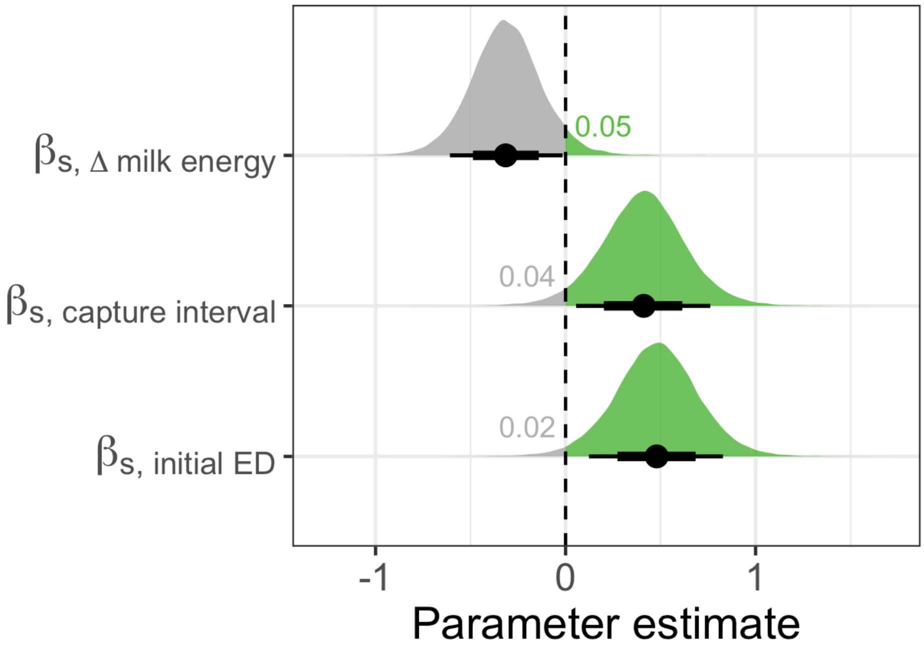

Figure S5: Posterior distribution of the parameters of the model describing storage energy loss of female polar bears fasting onshore in Western Hudson Bay. Shaded areas show posterior distribution (negative posterior values in grey, positive in green), labels indicate the proportion of the posterior distribution overlapping zero. Filled circles represent the mean, thick and thin bars represent the 67% and 89% credible intervals, respectively.

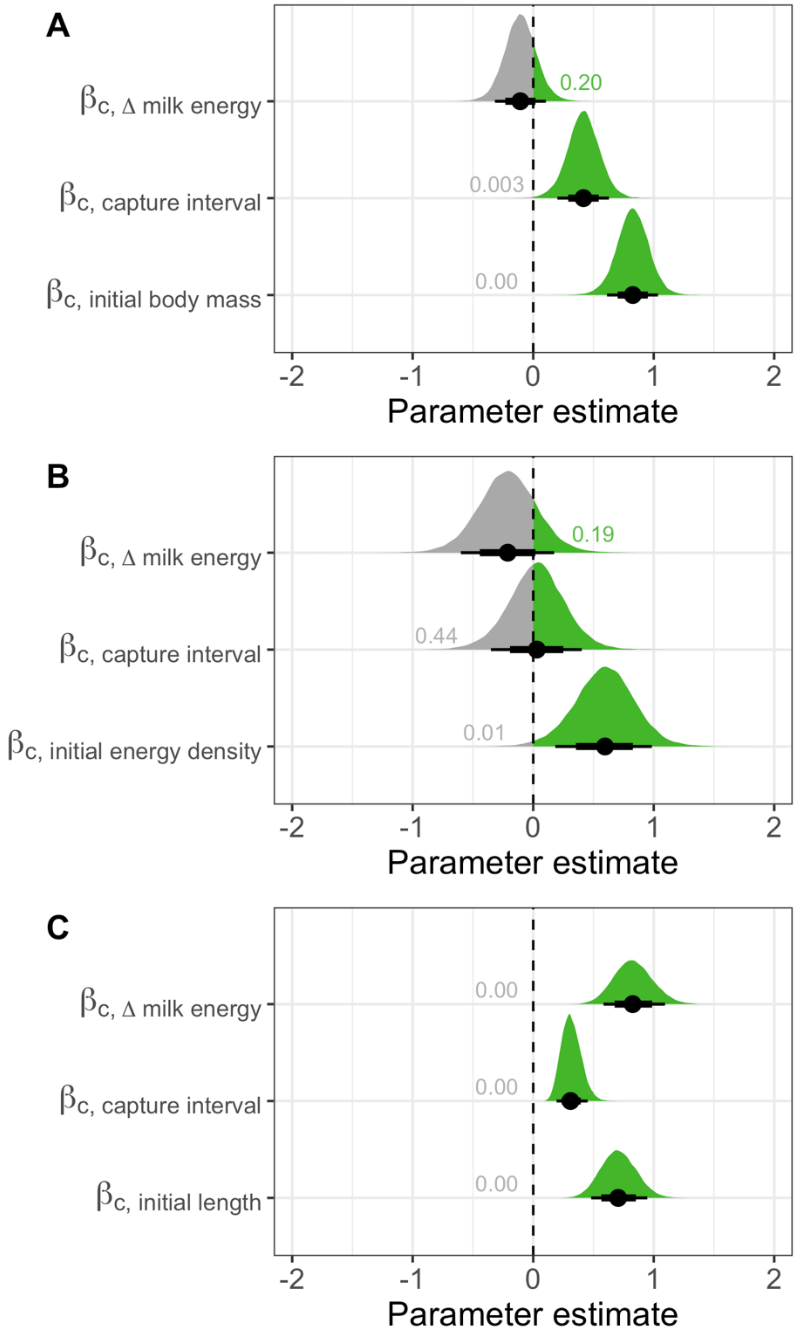

Figure S6: Posterior distribution of the parameters of the models describing: (A) difference in body mass; (B) difference in storage energy; and (C) difference in straight-line body length of polar bears cubs while onshore in Western Hudson Bay. Shaded areas show posterior distribution (negative posterior values in grey, positive in green), labels indicate the proportion of the posterior distribution overlapping zero. Filled circles represent the mean, thick and thin bars represent the 67% and 89% credible intervals, respectively.

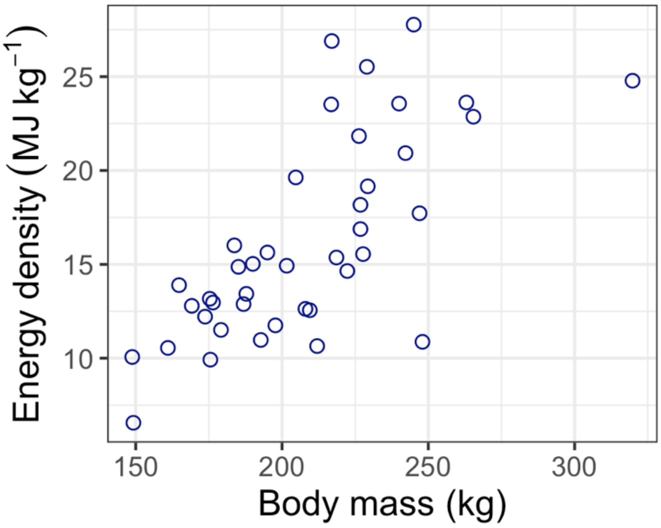

Figure S7: Relationship between energy density and body mass in adult female polar bears captured during the on shore fasting period in Western Hudson Bay. For visualization purposes, energy density was calculated using the mean of the posterior distribution for γ_{true} for each bear.