

Influence of sea ice phenology on the movement ecology of ringed seals across their latitudinal range

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Table S1. Morphometric, tracking duration and distances traveled for each ringed seal in this study from 1999–2013. Total distance was estimated by the total tracking period for each individual. Movement rates and time spent in a resident (R) state were only calculated during the ice-free season (ice concentration <50%) in the summer and fall.

ID	Tag type	Age class	Standard length (cm)	Body mass (kg)	Deployment date (mm/dd/yyyy)	Last transmission date (mm/dd/yyyy)	Tag duration (days)	Total distance (km)	Movement rate (km*day ⁻¹)	Time spent in R (%)
Resolute										
107832	SMRU-9000x	Subadult	75	25	7/31/2012	3/27/2013	238	4724	33	36
107833	SMRU-9000x	Adult	110	55	9/5/2013	10/24/2013	49	636	16	86
107834	SMRU-9000x	Subadult	117	59	9/25/2012	10/23/2012	28	365	13	91
107836	SMRU-9000x	Subadult	96	35	8/30/2013	11/27/2013	90	3620	40	42
107838	SMRU-9000x	Subadult	109	50	9/21/2012	10/10/2012	20	193	10	61
107839	SMRU-9000x	Subadult	101	30	8/28/2013	9/11/2013	73	3405	47	21
107840	SMRU-9000x	Adult	120	60	9/5/2013	5/6/2014	243	11856	35	39
Melville Bay										
34954	SMRU-CTD	Adult	120	64	9/6/2011	5/14/2012	251	2299	8	100
34963	SMRU-CTD	Adult	115	63	9/7/2011	5/10/2012	246	2150	9	99
110302	WC-MK10	Subadult	103	45	9/4/2011	1/13/2012	131	1329	18	98
110303	WC-MK10	Subadult	91	35	9/4/2011	11/30/2011	87	2441	19	96
110304	WC-MK10	Subadult	105	44	9/6/2011	12/6/2011	91	881	6	100
110305	WC-MK10	Adult	110	62	9/6/2011	4/26/2012	233	612	12	99
110306	WC-MK10	Adult	94	40	9/6/2011	5/22/2012	259	706	5	100
110314	WC-SPOT5	Adult	113	51	9/7/2011	11/27/2011	81	389	4	100

ID	Tag type	Age class	Standard length (cm)	Body mass (kg)	Deployment date (mm/dd/yyyy)	Last transmission date (mm/dd/yyyy)	Tag duration (days)	Total distance (km)	Movement rate (km*day ⁻¹)	Time spent in R (%)
110315	WC-SPOT5	Adult	112	63	9/9/2011	11/7/2011	59	1125	16	100
110316	WC-SPOT5	Adult	120	60	9/9/2011	11/3/2011	55	375	7	100
110317	WC-SPOT5	Adult	111	56	9/9/2011	11/10/2011	62	1144	18	100
Amundsen Gulf										
5056*	WC-SLTDR-16	Subadult	100	29	9/19/2001	9/30/2001	11	136	31	0
5056a	WC-SLTDR-10	Adult	127	101	6/20/1999	11/13/1999	146	1812	12	94
5092*	WC-SLTDR-16	Subadult	108	33	9/16/2001	10/23/2001	37	2757	75	17
5092a	WC-SLTDR-10	Adult	132	85	6/8/1999	11/4/1999	149	3721	25	71
5092-1*	WC-SLTDR-16	Subadult	91	22	9/6/2002	10/29/2002	53	2756	42	7
11747*	WC-SLTDR-16	Subadult	110	40	9/16/2001	11/12/2001	57	2295	54	4
11747a	WC-SLTDR-10	Subadult	104	36	7/1/1999	11/27/1999	149	3901	27	58
21212*	WC-SLTDR-16	Adult	115	47	9/16/2001	11/24/2001	69	2180	54	6
23526	WC-SLTDR-16	Adult	120	80	7/19/2000	11/9/2000	113	3064	29	87
23527*	WC-SLTDR-16	Subadult	88	20	9/6/2002	12/31/2002	116	5017	49	21
23527a	WC-SLTDR-16	Adult	110	50	7/17/2000	12/3/2000	139	2749	23	69
23528*	WC-SLTDR-16	Subadult	102	30	9/6/2002	12/30/2002	115	3636	38	29
23528a	WC-SLTDR-16	Subadult	100	36	7/16/2000	11/2/2000	109	3348	31	24
23529*	WC-SLTDR-16	Subadult	110	30	9/6/2002	11/7/2002	62	3971	64	6
23529a	WC-SLTDR-16	Adult	111	50	7/16/2000	10/27/2000	103	3456	34	35
44391	WC-SPLASH	Adult	121	87	7/9/2010	11/25/2010	139	4020	33	82
44392	WC-SPLASH	Adult	130	74	7/6/2010	12/9/2010	156	5206	36	41
44393	WC-SPLASH	Subadult	104	41	7/4/2010	11/29/2010	148	5687	42	67
44395	WC-SPLASH	Subadult	116	48	7/10/2010	11/28/2010	141	4756	39	33
44396	WC-SPLASH	Adult	126	64	7/6/2010	11/15/2010	132	6111	46	50
44397	WC-SPLASH	Adult	136	62	7/6/2010	11/29/2010	146	6302	51	58
44399	WC-SPLASH	Adult	134	78	7/6/2010	11/7/2010	124	2239	18	77
44400	WC-SPLASH	Adult	126	69	7/10/2010	11/29/2010	142	3975	31	64
44402	WC-SPLASH	Adult	117	61	7/5/2010	11/15/2010	133	4111	31	93
Igloolik										
94529	WC-SPLASH	Subadult	119	44	7/22/2009	3/29/2010	250	2924	18	81
94531	WC-SPLASH	Subadult	113	51	7/22/2009	5/9/2010	291	2792	13	91
94532	WC-SPLASH	Subadult	89	29	7/21/2009	8/7/2009	17	128	-	-
94533	WC-SPLASH	Subadult	86	28	7/21/2009	10/16/2009	87	2453	28	57
94538	WC-SPLASH	Adult	121	60	7/24/2009	10/21/2009	89	2097	24	69
94540	WC-SPLASH	Subadult	99	40	7/21/2009	3/7/2010	229	5932	18	75

ID	Tag type	Age class	Standard length (cm)	Body mass (kg)	Deployment date (mm/dd/yyyy)	Last transmission date (mm/dd/yyyy)	Tag duration (days)	Total distance (km)	Movement rate (km*day ⁻¹)	Time spent in R (%)
Sanikiluaq										
39374	WC-SPLASH	Adult	122	68	9/10/2007	12/9/2007	90	1075	12	99
39379	WC-SPLASH	Subadult	82	17	9/10/2007	12/31/2007	112	2519	22	20
39380	WC-SPLASH	Subadult	105	37	9/9/2007	12/12/2007	94	1600	17	99
39383	WC-SPLASH	Subadult	89	33	9/17/2007	12/8/2007	82	1457	19	90
39384	WC-SPLASH	Subadult	89	27	9/17/2007	11/29/2007	73	1938	27	85
39385	WC-SPLASH	Subadult	78	24	9/10/2007	12/8/2007	89	2834	32	46
42999	WC-SPLASH	Subadult	89	26	9/11/2006	6/4/2007	266	5604	22	74
43000	WC-SPLASH	Subadult	113	58	10/2/2006	12/17/2006	76	988	13	100
43001	WC-SPOT5	Subadult	109	39	9/15/2006	1/20/2007	127	1524	12	98
43002	WC-SPOT5	Subadult	75	16	9/12/2006	1/5/2007	115	4435	42	14
43835	SMRU-9000x	Subadult	108	46	10/17/2010	2/9/2011	115	3160	32	45
43836	SMRU-9000x	Subadult	103	36	8/21/2010	1/22/2011	154	2907	19	86
43837	SMRU-9000x	Subadult	102	30	8/24/2010	12/15/2010	113	3008	25	60
43838	SMRU-9000x	Subadult	98	43	8/22/2010	1/23/2011	154	1682	11	91
43842	SMRU-9000x	Adult	118	53	10/19/2010	1/26/2011	99	1744	18	93
43843	SMRU-9000x	Adult	104	59	10/16/2010	10/30/2010	14	350	24	97
43845	SMRU-9000x	Adult	118	74	8/21/2010	4/24/2011	246	2640	12	97
43847	SMRU-9000x	Subadult	103	60	10/20/2010	4/6/2011	168	3787	37	60
43851	SMRU-9000x	Subadult	116	41	8/22/2010	2/10/2011	172	3799	24	69
43852	SMRU-9000x	Adult	100	37	8/22/2010	1/19/2011	150	2778	19	94
43853	SMRU-9000x	Subadult	99	40	8/22/2010	1/17/2011	148	1979	13	91
43857	SMRU-9000x	Subadult	101	33	8/21/2010	3/10/2011	201	3661	21	88
43858	SMRU-9000x	Subadult	98	38	8/21/2010	12/31/2010	132	2173	16	90
43864	SMRU-9000x	Subadult	74	27	10/19/2010	12/16/2010	58	2049	37	45
43865	SMRU-9000x	Subadult	112	51	10/18/2010	1/17/2011	91	2349	26	88
43867	SMRU-9000x	Adult	98	43	8/21/2010	4/4/2011	226	452		-
57265	WC-SPLASH	Subadult	99	30	9/14/2006	1/23/2007	131	2324	18	92
60485	WC-SPLASH	Adult	105	55	9/13/2006	1/8/2007	117	2454	22	99
60486	WC-SPLASH	Adult	122	95	9/10/2006	12/14/2006	95	1794	19	98
60488	WC-SPLASH	Subadult	97	40	9/15/2006	1/8/2007	115	2067	18	79
60489	WC-SPLASH	Subadult	105	39	9/10/2006	1/9/2007	121	2578	23	61
77974	WC-SPLASH	Subadult	91	27	9/14/2007	12/10/2007	87	1458	17	86
77975	WC-SPLASH	Subadult	119	50	9/23/2007	12/11/2007	79	1182	15	91
83982	WC-SPLASH	Adult	120	69	9/1/2008	12/14/2008	104	1341	13	100

ID	Tag type	Age class	Standard length (cm)	Body mass (kg)	Deployment date (mm/dd/yyyy)	Last transmission date (mm/dd/yyyy)	Tag duration (days)	Total distance (km)	Movement rate (km*day ⁻¹)	Time spent in R (%)
83983	WC-SPLASH	Adult	112	57	9/5/2008	12/12/2008	98	1449	15	100
83983a	WC-SPLASH	Adult	104	57	9/3/2008	1/10/2009	129	2322		95
83984	WC-SPLASH	Subadult	86	24	9/26/2008	12/23/2008	88	868	10	97
83985	WC-SPLASH	Subadult	88	30	9/11/2008	12/16/2008	96	824	9	98
83986	WC-SPLASH	Adult	135	74	9/3/2008	12/17/2008	105	1859	18	78
83987	WC-SPLASH	Subadult	132	68	9/1/2008	12/31/2008	121	736	7	99
83988	WC-SPLASH	Subadult	102	37	10/13/2008	12/17/2008	65	777	12	89
83989	WC-SPLASH	Subadult	89	35	9/2/2008	12/12/2008	101	1643	16	91
83990	WC-SPLASH	Subadult	153	102	9/11/2008	1/9/2009	120	951	8	98
94526	WC-SPLASH	Subadult	103	33	8/9/2009	4/21/2010	255	3931	18	64
94527	WC-SPLASH	Adult	121	54	8/9/2009	3/30/2010	233	2241	11	96
94528	WC-SPLASH	Adult	113	47	8/9/2009	4/9/2010	243	2200	12	97
94530	WC-SPLASH	Subadult	74	16	8/1/2009	2/5/2010	188	5167	30	36
94535	WC-SPLASH	Subadult	91	31	8/1/2009	2/5/2010	188	4068	26	42
94536	WC-SPLASH	Adult	102	60	8/24/2009	2/12/2010	172	1291	10	99
94537	WC-SPLASH	Adult	95	38	8/9/2009	4/28/2010	262	2914	19	78
94539	WC-SPLASH	Subadult	89	23	8/1/2009	12/29/2009	150	2095	14	82
106373	SMRU-9000x	Adult	105	58	10/30/2011	6/5/2012	219	2856	23	60
106384	SMRU-9000x	Subadult	89	39	10/29/2011	12/29/2011	61	1174	20	80
106385	SMRU-9000x	Subadult	104	43	10/28/2011	2/11/2012	106	1545	15	91
106387	SMRU-9000x	Subadult	104	38	10/29/2011	4/4/2012	158	2765	25	72
106388	SMRU-9000x	Subadult	104	40	10/29/2011	2/3/2012	97	1710	22	73
116482	SMRU-9000x	Subadult	96	42	10/29/2012	5/21/2013	204	3347	28	31
116483	SMRU-9000x	Subadult	81	30	10/25/2012	4/23/2013	180	2862	21	82
116484	SMRU-9000x	Subadult	99	47	10/29/2012	4/28/2013	181	2948	26	64
116485	SMRU-9000x	Adult	102	49	10/29/2012	11/23/2012	25	884	35	27
116486	SMRU-9000x	Subadult	98	51	10/24/2012	5/17/2013	205	2643	23	73
116487	SMRU-9000x	Subadult	77	27	10/28/2012	11/27/2012	30	947	32	16
116488	SMRU-9000x	Subadult	101	46	10/29/2012	1/6/2013	69	883	16	80
116489	SMRU-9000x	Subadult	78	21	10/25/2012	3/4/2013	130	2542	21	83
116490	SMRU-9000x	Subadult	82	26	10/29/2012	1/14/2013	77	2288	41	26
116491	SMRU-9000x	Subadult	80	20	10/25/2012	2/5/2013	103	2883	31	54
116492	SMRU-9000x	Adult	99	55	10/26/2012	12/3/2012	38	1546	41	41
116493	SMRU-9000x	Subadult	90	37	10/29/2012	4/5/2013	158	3636	28	48
116494	SMRU-9000x	Subadult	106	48.5	10/23/2012	12/29/2012	67	978	15	80

ID	Tag type	Age class	Standard length (cm)	Body mass (kg)	Deployment date (mm/dd/yyyy)	Last transmission date (mm/dd/yyyy)	Tag duration (days)	Total distance (km)	Movement rate (km*day ⁻¹)	Time spent in R (%)
116495	SMRU-9000x	Subadult	92	30	10/23/2012	6/12/2013	232	4063	24	66
116496	SMRU-9000x	Adult	104	67	10/23/2012	1/12/2013	81	2349	30	69
Saglek Bay										
44428	WC-SPLASH	Adult	128	73	8/11/2011	1/27/2012	169	4154	27	87
44429	WC-SPLASH	Subadult	90	38	8/13/2011	12/15/2011	124	1187	10	100
83865	WC-SPLASH	Subadult	96	31	9/1/2010	1/15/2011	136	1931	14	89
83866	WC-SPLASH	Subadult	91	23	9/1/2009	10/12/2009	41	1509	37	63
83964	WC-SPLASH	Adult	124	84	8/14/2008	1/7/2009	146	1718	13	100
83965	WC-SPLASH	Subadult	95	29	9/2/2010	1/25/2011	145	4374	30	71
83973	WC-SPLASH	Subadult	95	24	9/3/2009	12/1/2009	89	1910	28	85
83975	WC-SPLASH	Subadult	94	32	9/1/2009	10/21/2009	50	670	13	96
83976	WC-SPLASH	Subadult	96	37	8/19/2008	10/25/2008	67	676	10	99
83977	WC-SPLASH	Subadult	113	34	9/2/2010	6/3/2011	274	7162	26	97
83978	WC-SPLASH	Subadult	91	27	9/1/2010	3/6/2011	186	3013	14	97
83979	WC-SPLASH	Subadult	83	26	9/1/2010	4/20/2011	231	3621	37	86
83980	WC-SPLASH	Subadult	90	25	8/11/2008	12/31/2008	142	2711	19	83

*represents individuals that were tagged at Cape Parry within the Amundsen Gulf

Table S2. Depth intervals by bin for each transmitter type deployed on ringed seals in this study.

Transmitter type	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Bin 6	Bin 7	Bin 8	Bin 9	Bin 10	Bin 11	Bin 12	Bin 13	Bin 14
WC-SLTDR	0-4	4-10	10-20	20-40	40-80	80-100	100-150	150-200	200-300	>300	-	-	-	-
WC-SPLASH ¹	0-4	4-10	10-20	20-40	40-80	80-100	100-150	150-200	200-300	300-500	500-700	700-800	800-900	>900
WC-SPLASH ²	0-4	4-10	10-20	20-30	30-40	40-50	50-60	60-80	80-100	100-140	140-180	180-220	220-300	>300
WC-MK10	0-4	4-10	10-25	25-50	50-75	75-100	125-150	150-175	175-200	200-300	300-400	400-500	500-600	>600

¹represents Wildlife Computer transmitters deployed in Amundsen Gulf

²represents Wildlife Computer transmitters deployed in Igloolik, Sanikiluaq and Saglek Bay

Dive depths for SMRU-9000x transmitters were binned at every 4m up to 942m. The SMRU-CTD transmitters were binned every 2m up to 950m.

Table S3. Generalized linear mixed-models predicting behavioral state as a function of biometric, environmental and dive covariates ranked by AICc at each location for ringed seals deployed with satellite telemetry transmitters from 1999-2013. Marginal and conditional- R^2 estimate the relative fit of each model to the data. k: number of parameters, W_i : Akaike weights of each model, AC: age-class; DS: distance to shore, CA: chlorophyll- a ; SIC: sea ice concentration, AO: Arctic oscillation phase, MD: mean maximum dive depth, CVD: CV dive depth, ND: number of dives, DI: dive index, JD: Julian date, ID: Individual number. Null represents the null model with only the random effects.

Model	k	AICc	Δ_i	w_i	marginal R^2	conditional R^2
Resolute						
AC + CA + SIC + CVD + ND + DI + AC*SIC + (JD ID)	11	627.9	0	0.38	0.22	0.74
AC + DS + CA + SIC + CVD + ND + DI + AC*SIC + (JD ID)	12	628.4	0.5	0.29	0.20	0.75
AC + CA + SIC + CVD + DI + (JD ID)	10	629.1	1.2	0.21	0.21	0.76
AC + DS + CA + SIC + CVD + ND + DI + AO + AC*SIC + (JD ID)	13	630.3	2.4	0.11	0.19	0.75
NULL	4	728.1	100.2	0.00	0.00	0.64
Amundsen Gulf						
AC + DS + CA + SIC + MD + CVD + ND + DI + AO + AC*DS + AC*CA + AC*SIC + AC*CVD + AC*DI + AC*AO + (JD ID)	19	1789.6	0	0.18	0.17	0.49
AC + DS + SIC + MD + CVD + ND + DI + AO + AC*DS + AC*SIC + AC*DI + AC*AO + (JD ID)	16	1789.6	0	0.18	0.17	0.48
AC + DS + SIC + MD + DI + AO + AC*DS + AC*SIC + AC*DI + AC*AO + (JD ID)	14	1789.7	0.03	0.18	0.17	0.45
AC + DS + SIC + MD + CVD + DI + AO + AC*DS + AC*SIC + AC*DI + AC*AO + (JD ID)	15	1790.1	0.45	0.15	0.18	0.45
AC + DS + CA + SIC + MD + CVD + ND + DI + AO + AC*DS + AC*CA + AC*SIC + AC*CVD + AC*ND + AC*DI + AC*AO + (JD ID)	20	1790.3	0.69	0.13	0.19	0.44
AC + DS + CA + SIC + MD + CVD + ND + DI + AO + AC*DS + AC*CA + AC*SIC + AC*CVD + AC*ND + AC*AO + (JD ID)	19	1790.5	0.91	0.12	0.17	0.46
AC + DS + CA + SIC + MD + CVD + ND + DI + AO + AC*DS + AC*CA + AC*SIC + AC*MD + AC*CVD + AC*ND + AC*DI + AC*AO + (JD ID)	21	1792.1	2.52	0.05	0.18	0.45
AC + DS + SIC + MD + CVD + ND + DI + AO + AC*DS + AC*CA + AC*SIC + AC*DI + AC*AO + (JD ID)	17	1796.1	6.48	0.01	0.20	0.43
NULL	4	1891.7	102.1	0.00	0.00	0.48
Igloolik						
AC + CA + MD + CVD + ND + DI + AO + AC*MD + (JD ID)	12	1189.4	0.0	0.82	0.17	0.41
AC + CA + SIC + MD + CVD + ND + DI + AO + AC*MD + (JD ID)	14	1192.9	3.5	0.14	0.22	0.32
AC + DS + CA + MD + CVD + ND + DI + AO + AC*MD + (JD ID)	13	1195.7	6.3	0.04	0.24	0.27
CA + MD + CVD + DI + AO + (JD ID)	9	1237.7	48.4	0.00	0.17	0.33
CA + MD + CVD + DI + (JD ID)	8	1241.2	51.8	0.00	0.16	0.33
CA + MD + CVD + ND + DI + AO + (JD ID)	10	1241.5	52.2	0.00	0.18	0.29
NULL	4	1338.9	149.6	0.00	0.00	0.01

Model	k	AICc	Δ_i	w_i	marginal R^2	conditional R^2
Sanikiluaq						
AC + DS + CA + SIC + MD + CVD + ND + DI + AO + (JD ID)	13	9677.24	0	0.78	0.12	0.37
AC + DS + CA + SIC + MD + CVD + DI + AO + (JD ID)	12	9679.78	2.54	0.22	0.12	0.38
NULL	4	10239.9	562.67	0.00	0.00	0.38
Saglek Bay						
DS + SIC + MD + CVD + DI + AO + (1 TY) + (JD ID)	11	1359.8	0.0	0.49	0.10	0.80
DS + SIC + MD + CVD + ND + DI + AO + (1 TY) + (JD ID)	12	1360.6	0.8	0.33	0.15	0.67
DS + CA + SIC + MD + CVD + ND + DI + AO + (1 TY) + (JD ID)	13	1361.9	2.0	0.18	0.14	0.72
DS + CA + SIC + MD + CVD + DI + AO + (1 TY) + (JD ID)	12	1376.0	16.2	0.00	0.19	0.59
NULL	5	1594.4	234.6	0.00	0.00	0.91