

Ocean climate and egg investment in the black-legged kittiwake *Rissa tridactyla*

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Supplement 1. Overview of the covariates used in the regression models examining the variation in black-legged kittiwake egg and clutch sizes at Hornøya, NE Norway, 1980–2012. Sources: ICES - International Council for the Exploration of the SEAS, IMR - Norwegian Institute of Marine Research.

Covariate	Unit	Area	Time period	Source
Mature capelin	Stock size (3–5 yr old)	Barents Sea	October	ICES
Young herring	Stock size (1 yr old)	Barents Sea	January	ICES
Atlantic water inflow	Volume	Barents Sea	Dec-Feb, Mar-May, Sep-Nov	IMR

Mature capelin. Estimates of stock in number by age group from acoustic and trawl survey data, from Table 9.5 in ICES (2015a). Details of the indices are given in the report.

Young herring. Estimates of stock in number by age group from acoustic and trawl survey data, from Tables 3.7.4.1 and 7.6.2.3.1 in ICES (2006) and ICES (2015b) respectively. Details of the indices are given in the respective reports.

Atlantic water inflow. The climatic variability in the Barents Sea depends on the amount and properties of the Atlantic water flowing in from the Norwegian Sea (see 'Introduction' in the main text and Fig. S1 below). The volume flux has been measured using current-meter moorings since 1997 (Ingvaldsen et al. 2004) and modelled using the Regional Ocean Modelling System (ROMS, www.myroms.org) (details in Myksvoll et al. 2013). For the analysis, the inflow was divided into three periods: winter (Dec (in yr-1)-Feb), spring (Mar- May) and autumn (Sep-Nov).

Literature cited

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- ICES (International Council for the Exploration of the Seas) (2015a) Report of the Arctic Fisheries Working Group (AFWG). ICES CM 2015/ACOM: 05. ICES, Copenhagen
- ICES (International Council for the Exploration of the Seas) (2015b) Report of the Working Group of Widely Distributed Stocks (WGWIDE). ICES CM 2015/ACOM: 05. ICES, Copenhagen
- Ingvaldsen RB, Asplin L, Loeng H (2004) The seasonal cycle in the Atlantic transport to the Barents Sea during 1997–2001. *Continental Shelf Res* 24:1015–1032
- Myksvoll M, Erikstad KE, Barrett RT, Sandvik H, Vikebø F (2013) Climate-driven ichthyoplankton drift model predicts growth of top predator young. *PLoS ONE* 8(11): e79225. doi:10.1371/journal.pone.0079225

Fig. S1. Monthly influx (in Sv) of Atlantic Water into the Barents Sea in 1980–2012 to illustrate the especially large and variable inflow during in winter and the very low variation in summer.

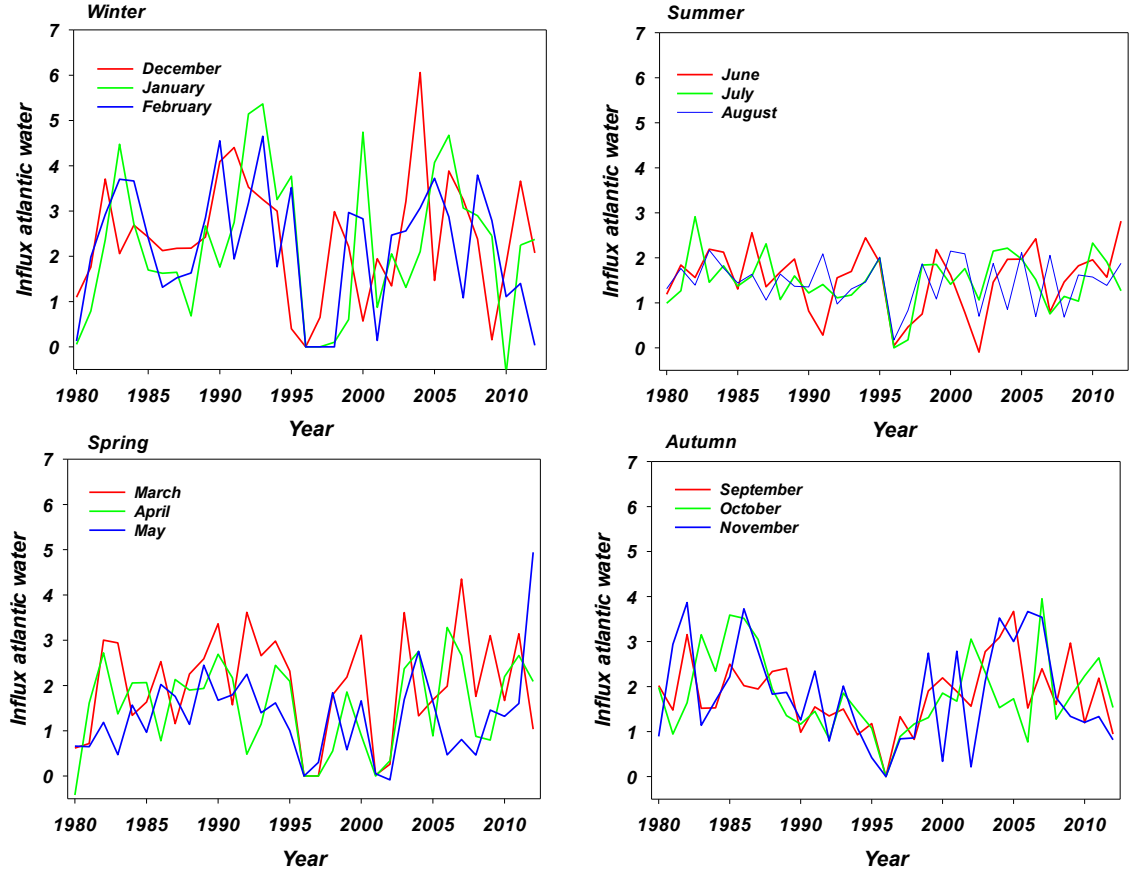


Fig. S2. Interannual variation in black-legged kittiwake clutch sizes at Hornøya, NE Norway in relation to estimates of stock size of mature capelin (no. x 10⁹) and 1-yr old herring in the Barents Sea (no. x 10⁹) (1980-2012).

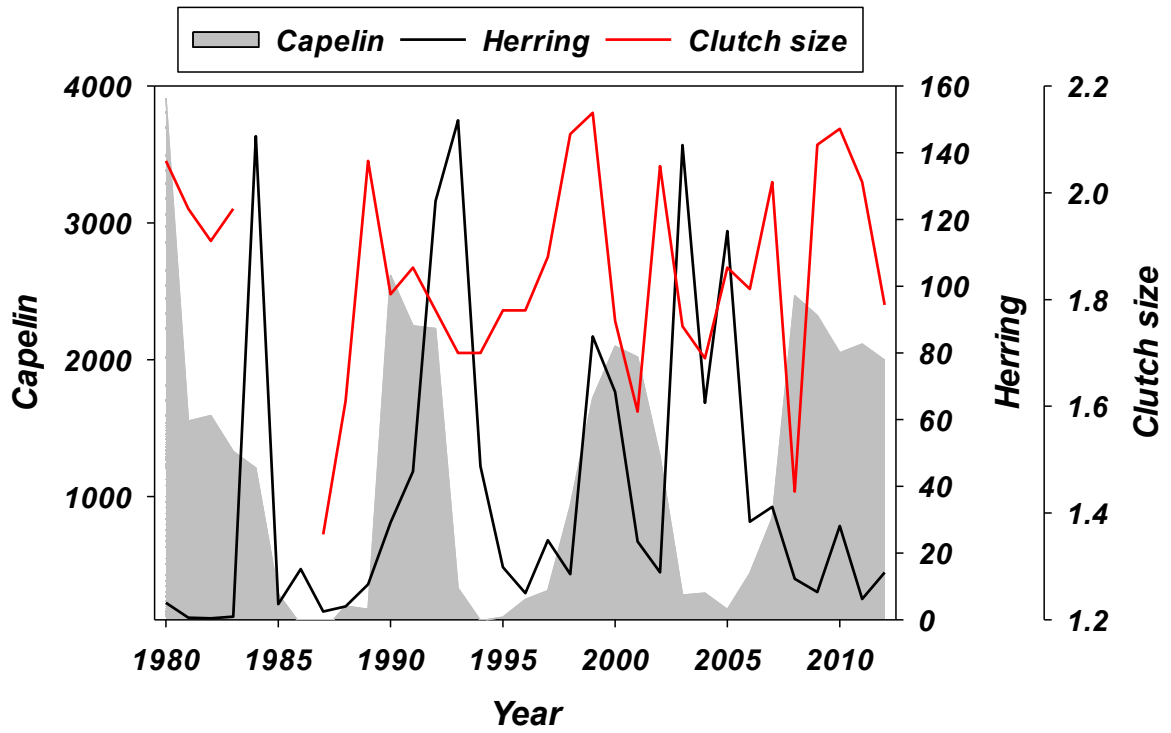
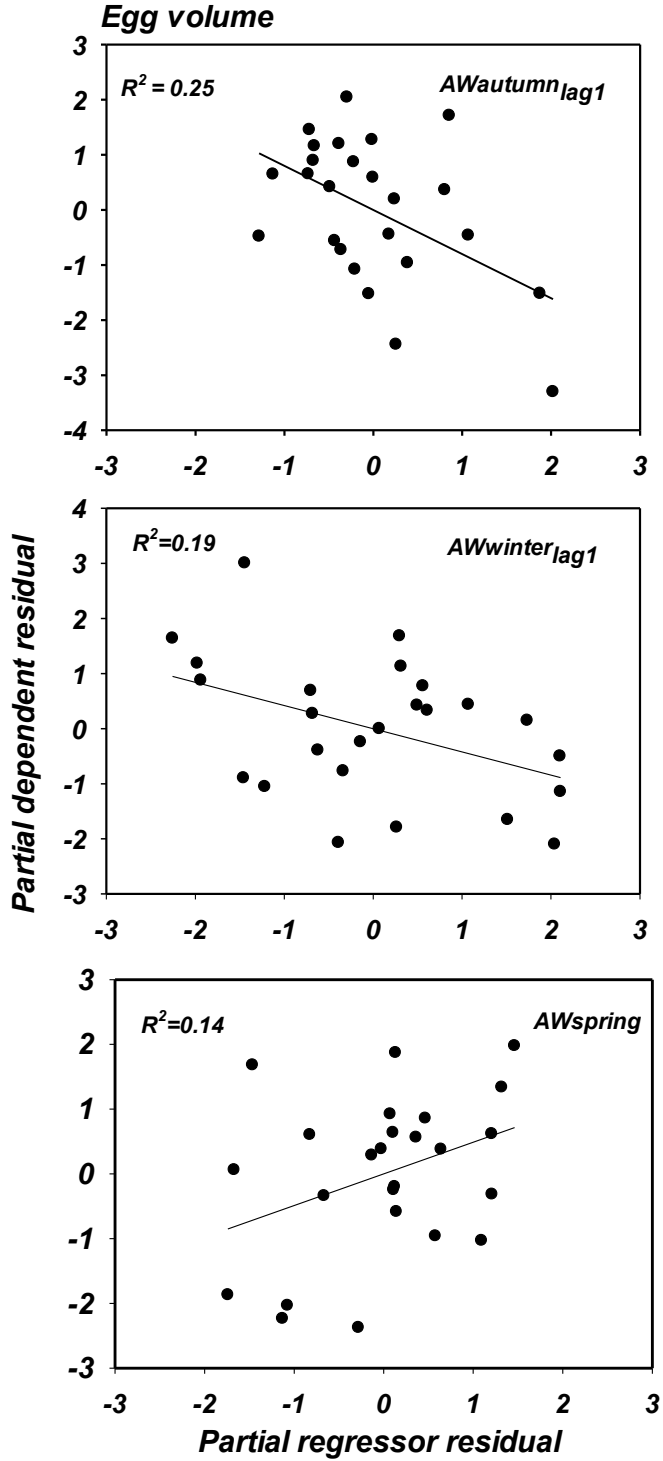
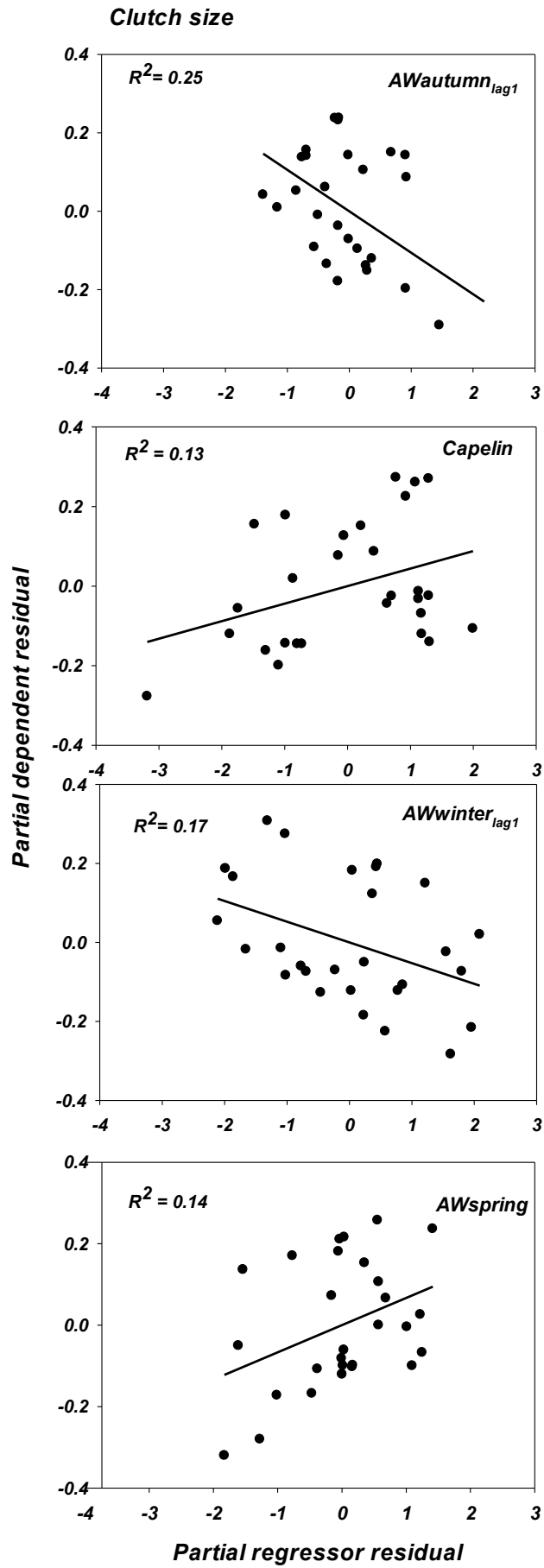


Fig. S3. Partial plots for the impact of different parameters from the top rank model. See Tables 1 and 2 in the main text for details.





Supplement 2. Mean volume (ml) of black-legged kittiwake eggs laid in all clutches and in 2-egg clutches at Hornøya, NE Norway, 1980–2012.

Year	All clutches				2-egg clutches			
	N	Vol.	SD	SE	N	Vol.	SD	SE
1980	138	47.6	3.9	0.3	75	47.7	3.6	0.4
1981	136	46.8	3.9	0.3	82	47.4	4.0	0.4
1982	115	46.0	3.4	0.3	58	45.9	3.9	0.5
1987	112	45.4	3.1	0.3	68	45.3	2.9	0.4
1988	90	46.7	3.6	0.4	60	46.5	3.8	0.5
1990	111	47.0	3.5	0.3	90	47.3	3.6	0.4
1992	176	46.9	3.6	0.3	117	47.0	3.7	0.3
1993	150	46.6	3.8	0.3	136	46.4	3.8	0.3
1994	124	44.8	3.7	0.3	98	44.8	3.5	0.4
1995	164	47.4	4.0	0.3	144	47.7	3.5	0.3
1996	155	46.7	3.5	0.3	122	47.0	3.3	0.3
1997	130	46.8	3.4	0.3	100	46.6	3.2	0.3
1998	151	48.5	3.9	0.3	89	48.4	4.3	0.5
1999	170	48.1	4.0	0.3	100	48.3	3.8	0.4
2000	341	46.2	3.6	0.2	293	46.3	3.6	0.2
2001	97	44.3	3.5	0.4	72	44.9	3.3	0.4
2002	163	48.4	3.7	0.3	110	48.7	3.9	0.4
2003	104	46.4	3.3	0.3	86	46.5	3.1	0.3
2004	127	45.7	3.6	0.3	102	46.0	3.4	0.3
2005	95	46.5	3.2	0.3	90	46.6	3.2	0.3
2006	205	46.0	3.9	0.3	185	46.0	3.8	0.3
2007	183	48.0	3.7	0.3	114	48.1	3.7	0.3
2008	113	43.3	3.6	0.3	78	43.0	3.3	0.4
2009	109	47.1	3.4	0.3	82	47.4	3.6	0.4
2010	223	48.6	3.5	0.2	127	48.6	3.8	0.3
2011	152	48.4	3.1	0.2	99	48.8	2.9	0.3
2012	152	46.4	2.8	0.2	132	44.3	2.7	0.2

Supplement 3. Counts of eggs and mean clutch size in black-legged kittiwake occupied nests at Hornøya, NE Norway, 1980–2012.

Year	Date	Number of occupied nests with					N	Clutch size - all nests		Clutch size - excl. empty nests	
		0 egg	1 egg	2 eggs	3 eggs	4 eggs		Mean	SD	Mean	SD
1980	25–28 May	95	67	267	96	0	525	1.69	0.97	2.06	0.61
1981	3–13 June	55	87	360	71	0	573	1.78	0.78	1.97	0.55
1982	4–5 June	331	130	283	87	0	831	1.15	1.06	1.91	0.65
1983	9 June	106	150	598	118	1	973	1.75	0.81	1.97	0.56
1987	14 June	216	243	138	0	0	597	0.87	0.76	1.36	0.48
1988	12–13 June	157	195	306	0	0	658	1.23	0.81	1.61	0.49
1989	14 June	42	91	342	123	0	598	1.91	0.81	2.06	0.62
1990	15–18 June	92	136	435	24	0	687	1.57	0.76	1.81	0.48
1991	3 June	652	148	256	79	1	1136	0.79	1.02	1.86	0.67
1992	12–13 June	226	140	302	34	0	702	1.21	0.95	1.78	0.56
1993	19 June	141	199	441	3	0	784	1.39	0.78	1.70	0.47
1994	14 June	247	243	550	1	0	1041	1.29	0.83	1.70	0.46
1995	19 June	129	156	502	10	0	797	1.49	0.77	1.78	0.44
1996	13 June	156	188	645	5	0	994	1.50	0.76	1.78	0.43
1997	13 June	130	210	783	80	0	1203	1.68	0.75	1.88	0.50
1998	28 May	88	94	506	182	0	870	1.90	0.84	2.11	0.58
1999	27 May	112	134	649	291	0	1186	1.94	0.86	2.15	0.61
2000	3 June	176	224	595	25	0	1020	1.46	0.8	1.76	0.49
2001	8 June	586	230	307	8	0	1131	0.77	0.87	1.59	0.52
2002	23 May	319	117	516	154	0	1106	1.46	1.05	2.05	0.58
2003	20 June	185	168	486	6	0	845	1.37	0.83	1.75	0.45
2004	19 June	199	199	451	2	0	851	1.30	0.83	1.69	0.47
2005	20 June	94	120	591	19	0	824	1.65	0.71	1.86	0.41
2006	17 June	137	111	475	6	0	729	1.48	0.8	1.82	0.41
2007	26 May	209	88	382	95	1	775	1.47	1.02	2.02	0.58
2008	10 June	190	298	230	0	0	718	1.06	0.76	1.44	0.50
2009	2 June	165	70	360	120	0	715	1.61	1.02	2.09	0.58
2010	26 May	61	69	366	138	0	634	1.92	0.84	2.12	0.59
2011	24 May	71	75	295	86	0	527	1.75	0.89	2.02	0.59
2012	12 June	26	58	170	9	0	263	1.62	0.71	1.79	0.49