Supplementary material

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Supplementary Table 1. LWfG observations in and near the study area 1997–2019

Core breeding area				Valley of River Tenojoki					
year	survey dates	conditions in early summer	rodent peak year	LWfG n	survey dates	LWfG n	individuals	comments	references / source
1997	14.6.–24.6.	very late spring	no	1					
1998	6.6.–16.6.	late summer	no	0	27.5.	2	1 adult pair		Ruokolainen et al. 1999
1999	20.5.–2.6.	late summer	no	0	17.5.–13.6.	4	1 ad pair ca 3 single adults	one ringed at Porsangerfjord	Tolvanen 2000
2000	21.6.–30.6.	rainy	no	(2–4)				31 July excrements of 2–4	
2001	12.6.–22.6.	early summer	no	0	15.5.–30.5.	5	2 ad pairs and 1 ad		Kaartinen & Pynnönen 2004
2002	9.6.–19.6.	early, dry	some	1 W of the core area with Bean Geese	2.5.–30.5.	0			Kaartinen & Pynnönen 2004
2003					05.5.–28.5.	1	1 ad		Kaartinen & Pynnönen 2004
2004					11.5.–21.5.	0			Sulkava et al. 2009
2005	20.7.–31.7.		no	0	13.5.–30.5.	2	2 ad		Sulkava et al. 2009
2006	24.7.–30.7.		no	0	22.5.–10.6.	1	1 subad		Sulkava et al. 2009
2007	9.6.–6.7.			0	16.5.–5.6.	3	2ad and 1subad		Sulkava et al. 2009
2008	11.6.–6.7.			0	6.5.–20.5	4	2 ad pairs		Sulkava et al. 2009
2009	16.6.–26.6.		no	possible old LWfG feathers In fox nest	12.5.–19.5.	0		Metsähallitus	LWfG group of Finland,
2010					14.5.–20.5.	2	1 ad pair		LWfG group of Finland, Metsähallitus
2011					12.5.–19.5.	5	1 adult male + 2 females, adult pair		LWfG group, Metsähallitus
2012	11.6.–17.6.	bad weather, few birds	no	0	14.5.–24.5.	4	1 ad pair + 1 2c-y and 1ad		LWfG group of Finland
2013					10.5.–20.5.	0			LWfG group
2014					6.5.–20.5.	3	1 ad pair + 1 2-3c-y		LWfG group, Metsähallitus
2015	5.6.–15.6.		yes?	0 (26 Bean Geese)	7.–24.5.	0			LWfG group, Metsähallitus
2016	12.6.–19.6.	early spring	yes?	0 (no Bean Geese)	3.5–15.5..	4			LWfG group, Metsähallitus
2017					8.5.–22.5.	4	1 ad pair + 1 2c-y (?) + 1 2-3-c-y		LWfG group Metsähallitus
2018	5.6.-17.6.	early spring, cold early summer	no	0 (no Bean Geese)	7.5.–20.5.	0			P.Polojärvi, Metsähallitus unpublished
2019					9.5.–16.5.	0			P.Polojärvi & P.Piisilä, Metsähallitus unpublished

Supplementary Table 2. Broods of which the size and age of goslings was determined in field, clutch size, estimated age of goslings, hatching date, duration of laying and incubation and date of laying of the 1st egg.

scannin date	*n* of broods	*n* of goslings	age days	hatching date	egg laying and incubation days	1st egg
25.7.1989	1	5	22	3.7.	31	2.6.
28.7.1989	1	4	22	6.7.	30	6.6.
28.7.1989	1	4	22	6.7.	30	6.6.
28.7.1989	1	4	22	6.7.	30	6.6.
28.7.1989	1	3	22	6.7.	29	7.6.
28.7.1989	1	3	22	6.7.	29	7.6.
30.7.1990	1	1	20	10.7.	27	13.6.
30.7.1990	1	2	20	10.7.	28	12.6.
30.7.1990	1	4	20	10.7.	30	10.6.
30.7.1990	1	4	20	10.7.	30	10.6.
17.7.1991	1	2	20	27.6.	28	30.5.
23.7.1991	1	4	26	27.6.	30	28.5.
23.7.1991	1	2	26	27.6.	28	30.5.
8.8.1991	1	5	38	1.7.	31	31.5.
8.8.1991	1	3	31	8.7.	29	9.6.
8.8.1991	1	1	31	8.7.	27	11.6.
18.7.1992	1	4	15	3.7.	30	3.6.
25.7.1992	1	1	22	3.7.	27	6.6.
27.7.1992	1	1	22	5.7.	27	8.6.
14.8.1992	1	1	43	2.7.	27	5.6.
15.7.1994	1	4	15	30.6.	30	31.5.
15.7.1994	1	3	15	30.6.	29	1.6.
31.7.1994	1	1	38	23.6.	27	27.5.
2.8.1994	1	1	35	28.6.	27	1.6.
25.6.1995	1	2	1	24.6.	28	27.5.
25.7.1995	1	5	34	21.6.	31	21.5.
total	26					

Supplementary Table 3. LWfG at Varangerfjord area, Norway in autumn 2005–2017. The staging place was found during the first satellite telemetry effort in 1994.

Year	from	to	LWfG n	aged +1cy	aged juv	individulas	reference
1995	23.8.	4.9.	*ca* 50	*ca* 15	*ca* 18	Male + female("Enni") + 5 goslings tagged in Finland	Tolvanen *et al.* 1998.
1996	20.8.	3.9.	13	8	5	incl. female "Enni"	Tolvanen *et a*l. 1998
1997	19.8.	30.8.	40–49	*ca* 29	*ca* 15	incl. Enni + 2 juv	Tolvanen *et a*l. 1998
1998	18.8.	1.9.	17–22	15	6		Ruokolainen *et al.*1999
1999	16.8.	27.8.	*ca* 10	3	2	1 ad + 2 juv, prob. LWfG 5, Enni + 1ad at Varanger penisula	Tolvanen 2000
2000	15.8.	28.8.	0				Kaartinen 2001
2001	18.8.	31.8.	0				Kaartinen & Pynnönen 2004
2002	14.8.	30.8.	0				Kaartinen & Pynnönen 2004
2003	13.8.	4.9.	0				Kaartinen & Pynnönen 2004
2004	19.8.	21.9.	0				Sulkava *et al.* 2009
2005	12.8.	29.8.	0				Sulkava *et al*. 2009
2006	15.8.	30.8.	0				Sulkava *et al.* 2009
2007	22.8.	3.9.	0				Sulkava *et al.* 2009
2008	18.8.	30.8.	0				Sulkava *et al.* 2009
2013	20.8.	26.8.	0				Petri Piisilä, Metsähallitus & LWfG group of WWF Finland
2017	26.8.	3.9.	2			2 ad	LWfG group of Finland, Metsähallitus
2018	24.8.	5.9.	1			1 in Greylag G. flock	J. Pynnönen *et al.* unpublish
2019	3.9.	7.9.	0				J. Pynnönen & R. Karvonen pers. comm.

Supplementary Table 4. Values of variables. For details, see text. y = year, LWfG pair # = running number of Lesser White-fronted Goose pairs of a given year, n= number of goslings, stag = staging peak = date of May, when 50% of all LWfG arrived at Bothian Bay, temp = the sum of effective temperatures (≥ +5°C) by 5 July, melt = ice melting (day of June), cold = cold spells in June, yes / no, birch = birch leaves budding (days of June), mam = small mammals = vole and shrew biomass (g / km^2) not used in analyse, mam2 = 0 / 1 = small mammals 0, when est. biomass < 1000 g / km^2, eggs = bird eggs g / km^2, raptors = raptors, pairs / km^2, fox = Red Fox indiv. per survey km, BG = total number of breeding Bean Geese pairs in study area, Reindeer = sum of reindeer(units) per km by 7 July (see text), hum = humans = stay of people in man-days

y	LWfG pair #	n	stag	temp	melt	cold	birch	mam	mam2	eggs	raptors	fox	BG	reindeer	hum
1989	1	3	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	2	3	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	3	4	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	4	4	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	5	4	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	6	4	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	7	4	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	8	5	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	9	0	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	10	0	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	11	0	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1989	12	0	15	287.9	11	0	16	0	0	2264	0.012	0.000	14	136.1	44
1990	1	1	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	2	2	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	3	2	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	4	3	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	5	4	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	6	4	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	7	0	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	8	0	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	9	0	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1990	10	0	18	208.5	9	0	14	3233	1	3204	0.029	0.012	8	124.6	27
1991	1	1	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	2	2	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	3	2	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	4	2	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	5	3	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	6	4	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	7	5	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	8	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	9	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	10	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	11	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	12	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	13	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	14	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1991	15	0	17	201.8	8	0	17	941	0	1892	0.034	0.011	21	137.5	55
1992	1	1	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	2	1	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	3	4	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	4	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	5	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	6	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	7	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	8	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	9	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48

1992	10	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	11	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	12	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	13	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	14	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1992	15	0	17	251.3	7	1	11	2476	1	2552	0.068	0.016	11	391.4	48
1993	1	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	2	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	3	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	4	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	5	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	6	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	7	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	8	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1993	9	0	12	99.3	28	0	26	1664	1	1943	0.032	0.017	4	57.5	14
1994	1	1	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	2	1	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	3	3	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	4	4	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	5	0	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	6	0	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	7	0	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	8	0	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1994	9	0	14.5	163.7	16	0	23	238	0	1886	0.020	0.003	4	52.0	29
1995	1	2	11	209.8	12	0	18	0	0	1900	0.028	0.011	3	145.1	18
1995	2	5	11	209.8	12	0	18	0	0	1900	0.028	0.011	3	145.1	18
1996	1	0	16	142.5	21	1	27	424	0	2267	0.025	0.000	1	44.4	11
1996	2	0	16	142.5	21	1	27	424	0	2267	0.025	0.000	1	44.4	11

Supplementary Table 5. Bird densities. Species name = breeding pairs (or individuals) counted in a year along the route, km = total length of route where the species was censused in a year, species´Densities per km^2

	Species / year	1989	1990	1991	1992	1993	1994	1995	1996
Avian predators									
	Haliaetus albicilla	0	0	4	6	2	2	4	2
	km	267.3	196	547.4	375	403.7	336.8	355.1	372.05
	Halalb / km^2	0	0	0.009	0.02	0.006	0.007	0.014	0.007
	Aquila chrsaetos	1	3	6	12	6	2	4	4
	km	267.3	196	547.4	375	403.7	336.8	355.1	372.05
	Aquchr / km^2	0.005	0.019	0.014	0.04	0.019	0.007	0.014	0.013
	Falco rusticolus	2	2	6	3	3	2	0	2
	km	267.3	196	547.4	375	403.7	336.8	355.1	372.05
	Falrus / km^2	0.007	0.01	0.011	0.008	0.007	0.006	0	0.005
Small mammal abund. Indicators									
	Circus cyaneus	0	0	0	0	0	1	0	0
	km	267.3	196	547.4	375	403.7	336.8	355.1	372.05
	Circya / km^2	0	0	0	0	0	0.003	0	0
	Buteo lagopus	2	12	25	26	87	31	12	11
	km	267.3	108.6	547.4	375	403.7	336.8	355.1	372.05
	Butlag / km^2	0.017	0.25	0.103	0.157	0.488	0.208	0.076	0.067
	Falco columbarius	3	1	8	1	7	1	4	5
	km	267.3	144	547.4	375	403.7	336.8	355.1	372.05
	Falcol / km^2	0.046	0.028	0.06	0.011	0.071	0.012	0.046	0.055
	Falco tinnunculus	0	0	0	2	1	1	2	0
	km	267.3	144	437.3	375	403.7	336.8	355.1	372.05
	Asio flammeus	0	0	5	15	46	14	0	2
	km	267.3	144	547.4	375	403.7	336.8	355.1	372.05

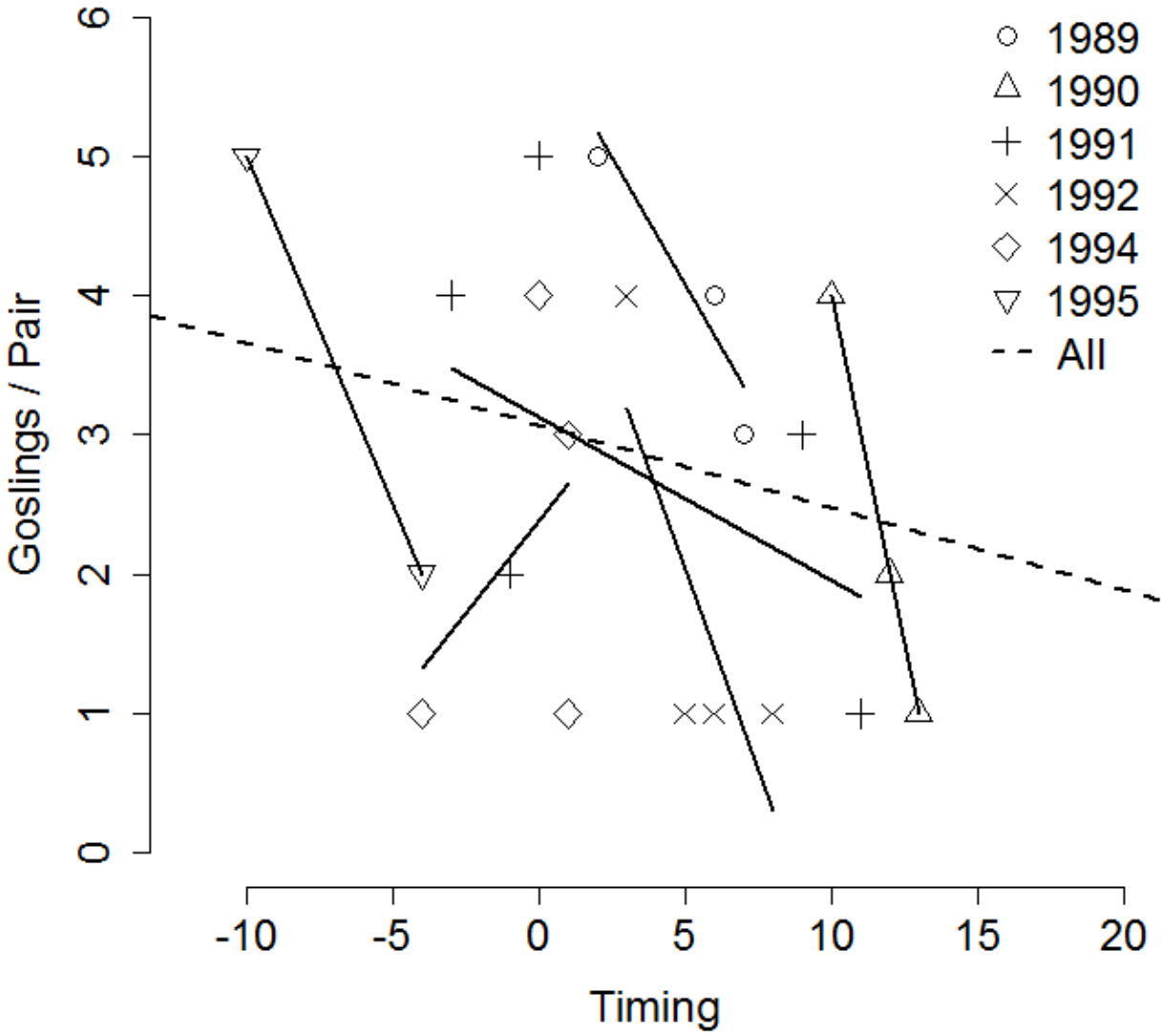
	Asifla / km^2	0	0	0.021	0.093	0.265	0.097	0	0.013
	Bubo scandiaca	0	3	0	0	2	0	0	0
	km	267.3	196	547.4	375	403.7	336.8	355.1	372.05
	Bubsca / km^2	0	0.015	0	0	0.005	0	0	0
Also included in alt fox prey	Stercorarius longicaudus	34	103	240	210	170	118	188	161
	km	99.3	108.55	437.3	348	361.7	336.8	355.1	372.05
	Stelon / km^2	0.706	1.956	1.132	1.244	0.969	0.722	1.092	0.892
Alternative fox prey (plus Stelon)	Clangula hyemalis	59	66	162	134	106	77	75	137
	km	267.3	118	535.4	375	403.7	336.8	355.1	372.05
	Clahye / km^2	0.495	1.254	0.678	0.801	0.589	0.513	0.474	0.826
	Philomachus pugnax	40	171	331	145	318	153	188	185
	km	124.3	104	502.8	375	403.7	336.8	355.1	372.05
	Phipug / km^2	1.439	7.355	2.945	1.730	3.524	2.032	2.368	2.224
	Lagopus lagopus		67	158	155	135	57	33	122
	km	267.3	104	542.4	375	403.7	336.8	231.85	372.05
	Laglag / km^2	4.626	6.395	2.892	4.103	3.319	1.680	1.413	3.255
	Lagopus mutus	6	3	4	14	15	6	10	53
	km	267.3	104	542.4	375	403.7	336.8	355.1	372.05
	Lagmut / km^2	0.127	0.163	0.042	0.211	0.21	0.101	0.159	0.805
	Pluvialis apricaria	21	199	575	576	373	220	129	98
	km	66.5	112.75	439.3	352	334.7	87.5	65.7	45.8
	Pluapr / km^2	0.715	3.994	2.962	3.703	2.522	5.689	4.443	4.842
	Anthus pratensis		14	276	40	84	61	91	54
	km		13.85	150.3	11	30.5	28.5	31.4	28.5
	Antpra / km^2	11.2	4.4	11.7	17.1	13.1	10.2	13.6	8.0
	Calcarius lapponicus		27	442	95	86	129	202	125
	km		13.85	150.3	11	30.5	28.5	31.4	28.5
	Callap / km^2	24.6	12.4	19.0	40.3	16.2	26.0	36.2	22.4

Supplementary Table 6. May and June daily mean temperatures and their sum at Kevo 1963–2014 (Ilmatieteen laitos 2015) and their deviation from the average in 1963–2014.
dMay deviation from average in May
dJune deviatuon from average in June
dMayJune deviation from average sum of May and June
study years in the frame

year	May	June	May + June	dMay	dJune	dMayJune
1963	8.7	8.1	16.8	5.09	-1.64	3.45
1964	3.6	9.2	12.8	-0.01	-0.54	-0.55
1965	0.6	8.7	9.3	-3.01	-1.04	-4.05
1966	1.3	10.6	11.9	-2.31	0.86	-1.45
1967	3.6	9.7	13.3	-0.01	-0.04	-0.05
1968	0.2	8.0	8.2	-3.41	-1.74	-5.15
1969	1.6	8.7	10.3	-2.01	-1.04	-3.05
1970	4.0	12.5	16.5	0.39	2.76	3.15
1971	2.7	8.9	11.6	-0.91	-0.84	-1.75
1972	3.0	14.1	17.1	-0.61	4.36	3.75
1973	2.9	11.0	13.9	-0.71	1.26	0.55
1974	2.9	11.4	14.3	-0.71	1.66	0.95
1975	4.0	7.3	11.3	0.39	-2.44	-2.05
1976	5.0	7.8	12.8	1.39	-1.94	-0.55
1977	2.5	8.1	10.6	-1.11	-1.64	-2.75
1978	3.6	9.2	12.8	-0.01	-0.54	-0.55
1979	3.3	10.2	13.5	-0.31	0.46	0.15
1980	2.8	11.3	14.1	-0.81	1.56	0.75
1981	2.5	6.8	9.3	-1.11	-2.94	-4.05
1982	2.9	5.3	8.2	-0.71	-4.44	-5.15
1983	3.3	9.7	13.0	-0.31	-0.04	-0.35
1984	7.0	10.2	17.2	3.39	0.46	3.85
1985	1.5	9.1	10.6	-2.11	-0.64	-2.75
1986	4.1	12.2	16.3	0.49	2.46	2.95
1987	2.7	7.9	10.6	-0.91	-1.84	-2.75
1988	3.3	10.9	14.2	-0.31	1.16	0.85
1989	5.5	11.9	17.4	1.89	2.16	4.05
1990	3.0	10.2	13.2	-0.61	0.46	-0.15
1991	3.0	9.9	12.9	-0.61	0.16	-0.45
1992	5.6	11.2	16.8	1.99	1.46	3.45
1993	3.1	6.3	9.4	-0.51	-3.44	-3.95
1994	3.0	8.9	11.9	-0.61	-0.84	-1.45
1995	2.6	10.4	13.0	-1.01	0.66	-0.35
1996	0.7	8.5	9.2	-2.91	-1.24	-4.15
1997	2.8	9.1	11.9	-0.81	-0.64	-1.45
1998	3.0	7.8	10.8	-0.61	-1.94	-2.55
1999	1.3	12.0	13.3	-2.31	2.26	-0.05
2000	4.2	9.3	13.5	0.59	-0.44	0.15
2001	3.1	12.0	15.1	-0.51	2.26	1.75
2002	5.7	11.2	16.9	2.09	1.46	3.55
2003	5.4	9.1	14.5	1.79	-0.64	1.15
2004	4.5	9.3	13.8	0.89	-0.44	0.45

2005	3.1	11.3	14.4	-0.51	1.56	1.05
2006	5.6	11.4	17.0	1.99	1.66	3.65
2007	4.0	10.1	14.1	0.39	0.36	0.75
2008	3.1	8.8	11.9	-0.51	-0.94	-1.45
2009	5.6	8.6	14.2	1.99	-1.14	0.85
2010	5.3	8.8	14.1	1.69	-0.94	0.75
2011	4.6	11.2	15.8	0.99	1.46	2.45
2012	4.6	8.6	13.2	0.99	-1.14	-0.15
2013	8.1	13.9	22.0	4.49	4.16	8.65
2014	3.4	9.2	12.6	-0.21	-0.53	-0.73
average	3.6	9.7	13.3			

Supplementary Fig 1. (cf. Fig. 1.) Seasonal decline in the gosling production of the Lesser White-fronted Goose in 1989–1995. 0 = 31 May. N = 6 years.



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