

Appendix 1

TABLE A1

Numbers of nests, average hatching dates, numbers of eggs and chicks, and estimated productivity of BLKIs on Reproductive Plots 8-17 at Bluff, Alaska, 1975-2008

Year	Nests ^a	Median Hatching Date ^b	Hatching Date Mean \pm SD (<i>n</i>) ^b	Live broods ^c	Clutches ^d	Estimates of Numbers Fledging ^e			
						Broods	2 nd chicks	Total	Fledglings Nest ⁻¹
1975	152(0)	29.0 ^f	ND	68(0)	0	68	0	68	0.45
1976	131(0)	30.0 ^f		5(0)	0	5	0	5	0.04
1977	98(0)	33.0^f		11(0)	0	11	0	11	0.11
1978	201(0)	21.0 ^f	20.4 \pm 3.6(18) ^g	151(13)	0	151	13	164	0.82
1979	209(1)	14.0^g	14.9 \pm 3.9(27)^g	177(43^h)	2(1)	175(171-178)	33(33-33)	208(204-211)	1.00(0.98-1.02)
1980	205(17)	15.0 ^g	14.4 \pm 3.3(19) ^g	162(45)	10(0)	141(121-164)	5(2-13)	146(123-177)	0.78(0.65-0.94)
1981	202(27)	14.5 ^g	15.2 \pm 3.9(30) ^g	135(23)	12(1)	130(116-146)	8(8-8)	138(124-154)	0.79(0.71-0.88)
1982	162(6)	25.0 ⁱ	ND	3(0)	64(8)	26(14-51)	2(0-2)	28(14-53)	0.18(0.09-0.34)
1983	193(8)	11.0 ^g	12.4 \pm 4.1(11) ^g	128(3)	17(4)	113(103-124)	2(2-2)	115(105-126)	0.62(0.57-0.68)
1984	58(0)	ND	ND	0	0	0	0	0	0.00
1985	44(0)	39.0 ⁱ	ND	0	2(0)	1(1-1)	0	1(1-1)	0.02 (0.02-0.02)
1986 ^j	163(2)	39.0 ⁱ	ND	63(0)	3(0)	8(3-22)	0	8(3-22)	0.05(0.02-0.14)
1987	217(0)	25.0 ^g	26.4 \pm 4.7(47) ^g	133(5)	1(0)	120(120-120)	4(4-4)	124(124-124)	0.58(0.58-0.58)
1988	238(0)	17.0 ^g	18.1 \pm 3.8(38) ^g	145-156(1)	0	156(156-156)	5(5-5)	161(161-161)	0.68(0.67-0.68)
1989	164(0)	26.5 ^f	28.4 \pm 4.8(5) ^f	0(0)	0	0	0	0.0	0.00
1990	226(1)	19.0 ^g	19.8 \pm 4.1(14) ^g	66-85(1)	0	82(82-82)	1(1-1)	83(83-83)	0.37(0.37-0.37)
1991	229(2)	24.5 ^f	24.8 5.4(58) ^f	97-113(1)	0	103(101-106)	1(1-1)	104(102-107)	0.46(0.45-0.47)
1992	ND							.	ND
1993	ND							.	ND
1994	ND							.	ND
1995 ^j	109(11)	24.5 ^k	25.9 \pm 8.7(17) ^k	19(1)	3(0)	21(21-21)	0(0-1)	21(21-22)	0.22(0.22-0.23)
1996	174(0)	25.0 ^k	25.5 \pm 6.7(85) ^k	81(0)	0	72(64-81)	0	72(64-81)	0.42(0.37-0.47)
1997	183(4)	18.5 ^k	23.0 \pm 8.0(107) ^k	97(4)	10(0)	72(53-100)	0(0-4)	73(53-104)	0.40(0.30-0.58)
1998	223(2)	22.0 ^f	21.8 \pm 5.6(81) ^f	87(0)	0	73(73-73)	0	73(73-73)	0.33(0.33-0.33)

1999	92(0)	30.5 ^k	29.4 ± 4.4(25) ^k	20(0)	0	2(0-12)	0	2(0-12)	0.02(0.00-0.13)
2000	197(5)	19.5^k	18.3 ± 5.9(171)^k	156(9)	18(3)	123(95-159)	0	123(95-159)	0.64(0.50-0.83)
2001	82(0)	ND ^l	ND ^l	0				0.0	0.00
2002	114(2)	16.5 ^k	19.1 ± 6.0(77) ^k	73(6)	7(0)	73(61-80)	0(0-6)	73(61-86)	0.65(0.55-0.77)
2003	194(3)	19.5 ^k	21.6 ± 7.1(151) ^k	143(8)	6(0)	143(134-150)	2(1-8)	145(135-158)	0.76(0.71-0.83)
2004	210(3)	13.5 ^k	15.5 ± 5.1(180) ^k	173(16)	4(1)	166(158-175)	3(0-14)	169(158-189)	0.82(0.76-0.91)
2005	124(0)	21.0^k	20.9 ± 6.7(57)^k	50(2)	2(0)	38(29-51)	1(0-2)	38(29-53)	0.31(0.23-0.43)
2006	139(0)	18.5 ^k	20.3 ± 6.6(77) ^k	58(0)	2(0)	44(35-55)	1(1-1)	45(36-56)	0.32(0.26-0.40)
2007	145(2)	22.5 ^k	22.5 ± 5.5(58) ^k	49(0)	0	18(9-34)	0	18(9-34)	0.12(0.07-0.24)
2008	186(0)	11.5 ^k	15.8 ± 7.4(98) ^k	82(1)	6(1)	48(31-78)	0(0-2)	48(31-80)	0.26(0.17-0.43)

ND: No Data.

BOLD: Years when severe storms occurred between the end of observations and the likely completion of fledging (49 days after the median hatching date).

^a*n* of nests (*n* of nests where contents were not determined).

^bMedian and mean hatching dates: 1 = 1 July.

^cTotal *n* broods alive at end of observations (*n* 2-C broods). If a range is shown, the upper number includes chicks that possibly fledged before the end of observations.

^dTotal *n* clutches still being incubated at end of observations (*n* 2-egg clutches).

^eNumbers predicted using estimates of daily survival rates of broods and second chicks (range based on lower and upper 95% Wald Confidence Limits if observations ended before fledging was complete).

^fHatching date based on direct observations (nests with ten or fewer d between last observations of eggs and first observations of chicks).

^gHatching date based on analysis of growth rates of chicks.

^hIncludes one 3-C brood.

ⁱMedian hatching date based on first hatching date of first chick plus seven d.

^jData collected on Reproductive Plots 8-14 only; estimate including Reproductive Plot 17 based on proportion in all other years.

^kHatching dates estimated from age classes of chicks.

^lND: No data, no hatching observed, no nests still active during observations.

TABLE A2

**Numbers of nests, average hatching dates, numbers of eggs and chicks, and estimated productivity of BLKIs at capes
Thompson and Lisburne, 1976-2008**

A. Cape Thompson

Year	Nests	Median Hatching Date ^a	Hatching Date Mean ± SD (<i>n</i>) ^a	Broods ^b	Clutches ^c	Estimates of survival to fledging ^d			
						Fledging broods	Fledging 2 nd chicks	Total fledging	Fledglings Nest ⁻¹
1976 ^e	ND	38.0	ND	7(0)	1(0)	0	0	0	0
1977 ^f	155	34.0 ^g	33.7 ± 4.2(17) ^g	66(3)	24(3)	64(54-78)	0(0-0)	64(54-78)	0.42(0.35-0.50)
1978 ^h	220	32.0 ⁱ	ND	97(8)	(0)	52(40-68)	3(1-5)	55(41-73)	0.25(0.19-0.33)
1979 ^f	452	28.0 ^g	29.0 ± 6.4(95) ^g	358(119)	8(1)	363(359-366)	98(95-102)	466(454-468)	1.02(1.00-1.04)
1982 ^f	179	27.0 ^g	26.5 ± 2.9(35) ^g	111(35)	14(0)	64(64-64)	13(13-13)	77(77-77)	70(61-82)
1988 ^j	973	22	ND	142	0	ND	ND	142	0.15
1990 ^k	102	20	ND	84(20)	0	84	20	104	1.02
1991 ^l	179	25	ND	104(0)	0	92(89-95)	0	92(89-95)	0.51(0.50-0.53)
1995 ^f	221	27.0 ^m	27.2 ± 7.7(18) ^m	3(0)	0	1(1-2)	0	1(1-2)	0.01(0-0.01)

B. Cape Lisburne

Year	Nests	Median Hatching Date ^a	Hatching Date Mean ± SD (<i>n</i>) ^a	Broods ^b	Clutches ^c	Estimates of survival to fledging ^d			
						Fledging broods	Fledging 2 nd chicks	Total fledging	Fledglings Nest ⁻¹
1976 ⁿ	132	ND	ND	14(0)	0	ND	0	14(0)	0.11
1977 ^o	144	45.0 ^g	44.7 ± 5.2(20) ^g	0	83(12)	34(25-45)	0	34(25-45)	0.23(0.17-0.31)
1978 ^p	189	28.0 ^g	33.4 ± 7.7(117) ^m	102(20)	14(1)	110(104-115)	18(16-21)	128(120-136)	0.68(0.63-0.72)
1979 ^f	237	23.0 ^g	25.0 ± 5.1(23) ^g	153(50)	46(34)	189(179-199)	61(49-79)	251(228-278)	1.06(0.96-1.17)
1980 ^f	164	25.0 ^g	25.4 ± 3.1(49) ^g	133(14)	4(0)	129(119-136)	0(0-2)	129(119-138)	0.79(0.73-0.84)

1981 ^f	204	24.5 ^g	25.7 ± 2.8(58) ^g	101(17 ^q)	26(10)	96(76-123)	0(0-2)	96(76-124)	0.47(0.37-0.61)
1983 ^f	106	29.5 ^g	30.7 ± 4.0(44) ^g	72(2)	4(2)	65(61-69)	0(0-0)	65(61-69)	0.61(0.58-0.65)
1984 ^r	303	36.0	ND	3(0)	4(0)	4(3-5)	0	4(3-5)	0.01(0.01-0.02)
1985 ^r	117	ND	ND	0	24(2)	13(10-16)	0		0.11(0.08-0.14)
1986 ^r	100	27.0	ND	67(39-43)	19	24-28(1)	39(31-48)	39(31-51)	0.39(0.31-0.51)
1987 ^f	120	28.5 ^m	28.0 ± 3.8(97) ^m	70(28)	28(14)	97(97-97)	0(0-0)	97(97-97)	0.81(0.81-0.81)
1992 ^f	164	28.5 ^m	28.9 ± 6.8(86) ^m	26(2)	18(0)	2(1-4)	0	2(1-4)	0.01(0.00-0.03)
1993 ^s	ND	25.0	ND	ND	ND	ND	ND	ND	0.47(0.40-0.55)
1995 ^f	218	25.5 ^m	28.3 ± 4.6(139) ^m	104(3)	0	98(96-101)	2(0-3)	100(96-104)	0.46(0.44-0.48)
1996 ^t	222	.		0	0	0	0	0	0
1997 ^f	197	24.5 ^m	27.3 ± 5.2(81) ^m	86(5)	1(0)	87(86-88)	4(3-4)	91(89-92)	0.46(0.45-0.47)
1998 ^f	265	16.5 ^m	17.6 ± 5.5(193) ^m	153(28)	4(4)	209(208-210)	65(64-65)	274(272-275)	1.03(1.03-1.04)
1999 ^r	133	27.0 ^u	ND	87(17-23)	8(0)	61(51-72)	1(0-4)	62(51-76)	0.46(0.38-0.57)
2000 ^r	157	24.0 ⁱ	ND	133(2)	0	114(107-121)	1(0-1)	115(107-122)	0.73(0.69-0.78)
2001 ^v	175	ND.	ND	0	0	0	0	0	0.00
2002 ^r	408	27.0 ⁱ	ND	1(0)	0	1(1-1)	0	1(1-1)	0.00
2003 ^r	330	23.0 ^w	ND	226(17)	0	194(182-208)	6(4-10)	200(186-218)	0.61(0.56-0.66)
2004 ^r	81	24.0 ^w	ND	32(2)	0	24(22-27)	0(0-1)	24(21-27)	0.30(0.26-0.34)
2005 ^f	170	29.0 ^w	ND	1	0	1(1-1)	0	1(1-1)	0.00
2006 ^r	156	40.0 ^w	ND	14(0)	0	9(8-11)	0	9(8-11)	0.06(0.05-0.07)
2007 ^r	293	24.0 ^w	ND	125(13)	0	104(97-112)	4(2-6)	108(99-118)	0.37(0.34-0.40)
2008 ^r	207	24.0 ^w	ND	147(0)	0	130(124-137)	0	130(124-137)	0.63(0.60-0.66)

ND: No Data.

^aMedian and mean hatching dates: 1 = 1 July.

^bTotal *n* broods alive at end of observations (*n* 2-C broods).

^cTotal *n* clutches still being incubated at end of observations (*n* two-egg clutches).

^dNumbers predicted using estimates of daily survival rates of broods and second chicks (range based on lower and upper 95% Wald Confidence Limits if observations ended before fledging was complete).

^eSource: Springer & Roseneau (1977); first egg observed on 4 July, later hatched; assumed 27-d incubation period, first hatching on 31 July, and median hatching seven d later. Tallies of clutches and broods based on observations 2-20 August throughout the colony; assumed here that productivity was zero.

^fSource: Original field notes.

^gHatching date based on analysis of growth rates of chicks.

^hSources: Roseneau *et al.* (2000) for hatching date; Springer & Roseneau (1979) for productivity (assumed all chicks had hatched during observations on 12-17 August and used colony-specific mean of daily survival rates of broods and second chicks to estimate survival to fledging).

ⁱMedian hatching date based on first hatching date of chicks plus seven d.

^jSource: Fadely *et al.* (1989); hatching 47% complete on 21 July; median estimated here as 22 July; total *n* of chicks = 142 (no data on brood size); fledging began on 27 August; fieldwork ended on 31 August; assumed here that all chicks alive when last observed fledged successfully.

^kSource: Sharp (1993); median age of kittiwake chicks 35-37 d when last observed, assumed here that all chicks alive when last observed fledged successfully.

^lSources: Nishimoto (1994), original field notes.

^mHatching date based on direct observations (nests with ten or fewer d between last observations of eggs and first observations of chicks).

ⁿSource: Springer & Roseneau (1979): nest checks on 27 August, assumed here that all “1 egg or chick” tallies were nearly fledged chicks.

^oSources: Springer & Roseneau (1979), original field notes; used colony mean estimates of daily survival rate to estimate numbers surviving to fledging.

^pSources: Springer & Roseneau (1979), original field notes.

^qIncludes one 3-C brood.

^rSource original field notes; productivity estimate based on colony mean for daily survival rate.

^sData collected by A. Sowls, 0.7 C nest^{-1} on last date of observations: (3 August); original field notes lost.

^tSource: original field notes; all eggs failed to hatch.

^uMedian estimated graphically (D. G.Roseneau).

^vSource: original field notes; complete failure before arrival on 2 August.

^wFirst hatching date based on estimated ages of chicks (DGR).

TABLE A3
Estimated growth rates (50 to 350 g) of weighed BLKI chicks at Bluff, Cape Thompson, and Cape Lisburne, Alaska

Colony	Year	1-C broods	2-C broods, older chick	2-C broods, younger chick
Bluff	1978	20.2 ± 6.4 (15) ^a	17.8 ± 2.4(4)	14.5 ± 1.2(4)
	1979	19.0 ± 4.7(34)	19.6 ± 7.8(4)	20.3 ± 5.1(5)
	1980	14. ± 3.5(15)	19.1 ± 8.1 (8)	18.8 ± 11.0(8)
	1981	17.8 ± 4.8(21)	15.6 ± 1.7(3)	16.2 ± 3.8(3)
	1983	11.7 ± 6.0(12)	ND	ND
	1987	16.3 ± 2.6(48)	ND	ND
	1988	16.2 ± 2.6(37)	16.6 ± 2.6(2)	14.9 ± 0.6(2)
	1990	17.0 ± 3.7(16)	ND	ND
Cape Thompson	1977	13.0 ± 4.9(9)	ND	ND
	1979	20.6 ± 4.7(71)	19.7 ± 4.1(33)	19.7 ± 4.5(35)
	1982	18.1 ± 2.1(21)	16.7 ± 2.8(13)	15.0 ± 3.4(12)
Cape Lisburne	1977	20.7 ± 3.9(18)	ND	ND
	1978	20.4 ± 6.9(19)	24.1 ± 8.4(2)	20.8 ± 10.8(2)
	1979	17.8 ± 1.4(2)	ND	ND
	1979 ^b	19.1 ± 2.0(13)	19.2 ± 1.2(9)	18.2 ± 1.6(8)
	1980	19.1 ± 4.0(47)	20.9 ± 1.8(3)	18.5 ± 4.0(4)
	1981	17.0 ± 5.2(40)	17.5 ± 4.7(10)	13.3 ± 4.4(7)
	1983	16.3 ± 3.4(43)	ND	ND
	1995	16.8 ± 5.9(8)	ND	ND
	1997	17.4 ± 5.0(5)	20.6(1)	15.0(1)

ND: No Data.

^aMean ± SD (*n*).

^bCalculation of growth rate of chicks includes first weighing above 350 g, as second weighing if chick was weighed only once between 50 and 350 g (storms precluded access to the cliffs after first weighings until the fastest growing chicks had exceeded 350 g).