

Population Size and Production of Geese and Eiders Nesting on the Yukon-Kuskokwim Delta, Alaska in 2003



Julian B. Fischer¹, Timothy D. Bowman¹, Robert A. Stehn¹, and George Walters²

¹ U.S. Fish and Wildlife Service, Migratory Bird Management, Waterfowl Management Branch, 1011 E. Tudor Rd., Anchorage, AK 99503

² U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, P.O. Box 346, Bethel, AK 99559

SUMMARY: Production was poor for most waterfowl species in 2003. Numbers of nests were down from 2002 for geese and eiders. Depredation rates were high resulting in substantial nest destruction and egg loss. Predation by arctic foxes contributed significantly to poor production.

INTRODUCTION:

Annual assessment of nesting populations of geese and eiders on the Yukon-Kuskokwim Delta (YKD) provides information for biologists, participants in cooperative goose management plans, Pacific Flyway technical committees, and the spectacled eider recovery team. A ground-based sampling procedure has been used since 1986 to estimate the number of nests, active nests, and eggs for cackling Canada geese (*Branta canadensis minima*), emperor geese (*Chen canagica*), greater white-fronted geese (*Anser albifrons frontalis*), and spectacled eiders (*Somateria fischeri*). Annual information on the size of the nesting population and potential number of young produced contributes long term data needed to understand goose and eider population ecology and better manage these species.

METHODS:

Ground-based nest surveys provide a long-term monitoring procedure for most spectacled eider and goose nesting habitat on the coast of the YKD. Boundaries of the ground sampled area included all refuge-owned lands containing medium and high densities of aerial observations or nests for spectacled eiders based on 1985 to 1993 data. We excluded high density nesting habitat

near Kokechik Bay, two patches on south Nelson Island, and several tracts near Hazen Bay because the land was owned by native corporations and in those areas permission to sample plots every year was not assured. The remaining areas formed one stratum totaling 716 km², or 5.6% of the total coastal zone (Fig. 1). In years prior to 1994, a variety of strata were selected for ground plot sampling. The coastal zone outside of the ground-sampled stratum is sampled annually by aerial transects (Fig. 2).

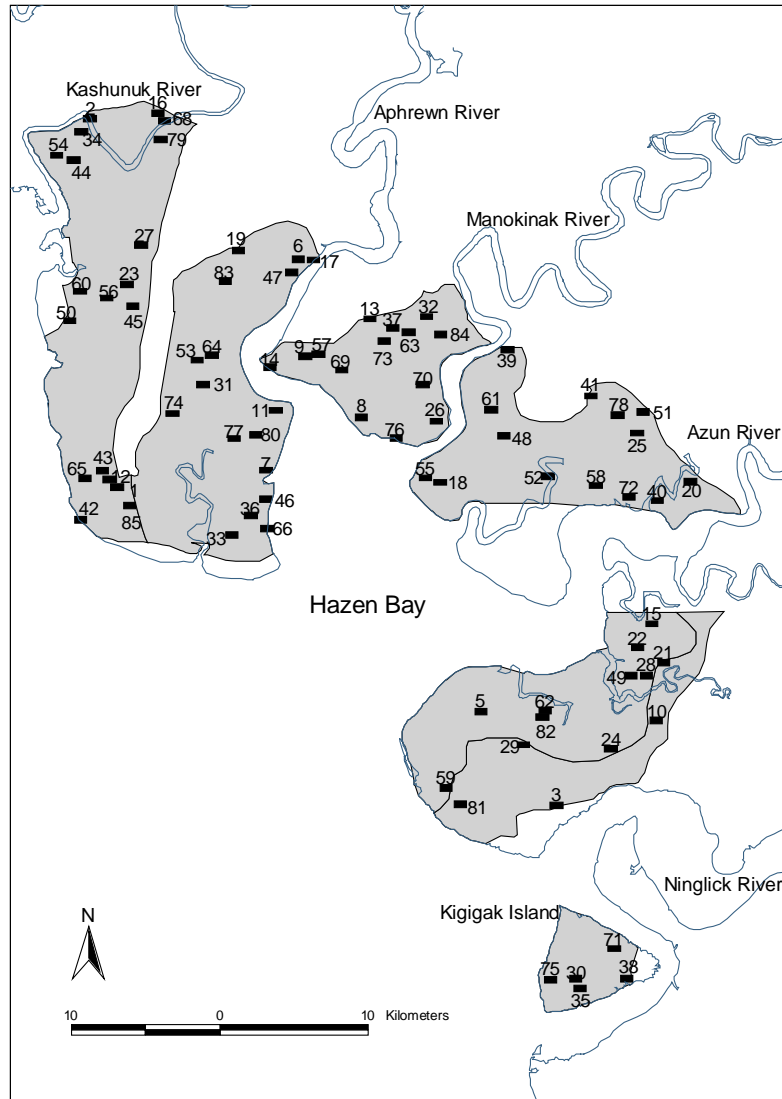


Figure 1. Nest plot survey study area (shaded) and plot locations (solid rectangles), Yukon-Kuskokwim Delta, Alaska, 2003.

The ground plot survey is linked to an aerial transect survey in the entire coastal area of the YKD (12,852 km²), which has been conducted by USFWS, Migratory Bird Management Division, Anchorage, since 1985 (Butler et al. 1988, Platte and Stehn 2002, Eldridge and Hodges 2003). A pilot and an observer recorded singles, pairs, and flocks of geese, brant, swans, and cranes along approximately 100 systematic transects. Beginning in 1988, a rear-seat observer recorded eiders, other ducks, loons, and in 1992, gulls. This has provided a precise index to total waterfowl populations on the coastal YKD. Aerial survey data were used to expand the ground-

based estimates of nests, active nests, and eggs from the ground-sampled strata to the entire YKD coastal region. The number of nests outside the ground sampled area was estimated for each species using the ratio of the aerial survey breeding population index found outside the ground plot sampled area to the aerial index within the ground plot sampled area. Variance estimates of nest populations expanded to the entire coast incorporate the variance of the out/in ratio. The breeding population index for most species was based on twice the number of singles plus number of birds in pairs observed because single geese, cranes, and male eiders observed are assumed to be the mates of unobserved females on nests. For brant, loons, and gulls, the total number of birds observed was used, and for swans, the number of singles plus the number of birds in pairs observed was used as the aerial index to breeding population size to calculate the expansion factor.

We used GIS and custom-written TrueBASIC computer programs to randomly select 85 plots within the sample area and draw boundaries directly onto 1:63,360 scale topographic maps. We then transferred plot boundaries to scanned images of color infrared aerial photographs (1:15,000 or 1:10,000) for field use. We included plots regardless of juxtaposition to lakes and rivers. Plot size was 402 x 805 m (0.32 km²), identical to plots searched from 1986-94 and 1997-2002. Plots were 0.45 km² in 1995 and 0.36 km² in 1996.

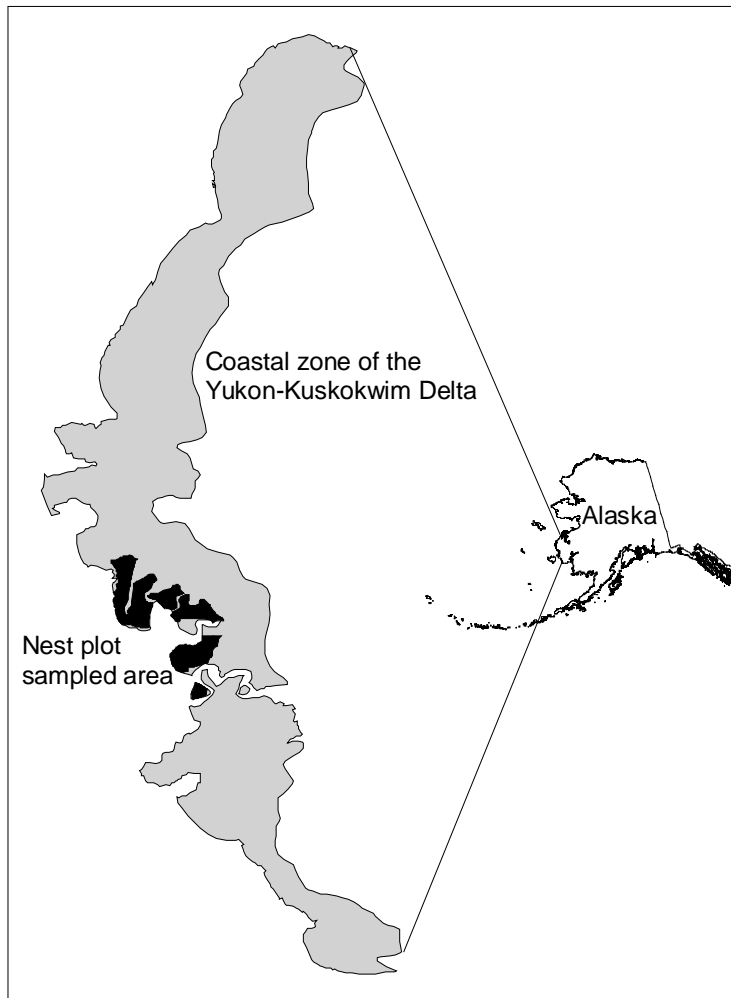


Figure 2. Location of the ground sampled area relative to the entire Yukon-Kuskokwim Delta coastal zone, Alaska.

Most plots were searched by two biologists who were transported either by Cessna 185 float-equipped aircraft or by motorboat. One boat crew originated from the Kanararaq camp and worked areas in the lower Aphrewn and Opagayrak Rivers. A second boat crew worked the Naskonat Peninsula. Most plots were within 2 km walking distance of a river or lake suitable for landing aircraft. All sites dry enough for a nest were examined for active and destroyed goose, brant, eider, swan, crane, loon, and gull nests. Nests of other species were recorded as encountered but most shorebird, passerine, and duck nests were likely missed.

We recorded species, nest site, number of eggs, evidence of predation, and other pertinent data on a card for each nest. A few eggs in most clutches were floated to determine the approximate stage of incubation. Nests were identified to species based on down or contour feathers in the nest bowl. A photographic field guide to nests and eggs was provided to nest searchers to aid in species identification and improve overall data quality. Nest cards were tabulated, edited, and sorted using Excel, and data were summarized using TrueBASIC programs.



The estimated total number of nests measured the effective breeding population size (i.e., the number of pairs with nests). The estimated total number of viable eggs found at mid- to late-incubation directly measured the number of young that could potentially augment the fall population if they survived. The mean and variance of the number of nests or eggs per plot was based on a simple random sample of plots. The proportion of nests remaining active when the plots were searched was an

index to nesting success; the actual proportion of nests that produced young is lower because of nest loss after the plot search. Also, because the detection rate is lower for nests that fail during laying or early incubation, the nest success index is an overestimate of the proportion surviving even to mid-incubation. Clutch size and average predicted hatch date were based on all active nests found on random plots.

Because red-throated and Pacific loon nests are essentially indistinguishable from each other and adult birds are usually not seen at the nest site, we lumped data into a general “loon” category. We estimated species-specific nest population size using the ratio of loon species observed during the 2003 Yukon Delta coastal zone aerial survey (R. Platte, USFWS, unpubl. data).

We searched 83 plots from 28 May to 12 June, 2003. Crews based at the Kanaryaraq field camp searched 36 plots and 2 boat-based crews searched 31 plots. A crew based at Kigigak Island searched 5 plots and biologists with USGS/BRD and University of Nevada Reno searched 11 plots near Hock Slough, Manokinak, and Tutakoke field camps. We were unable to search two of the 85 randomly selected plots due to poor access for float planes and boats. Training and previous field experience varied among participants and was comparable to previous years.



Photo by Judy Jacobs

RESULTS:

Field personnel located a total of 2,614 nests comprised of 1,026 cackling Canada goose, 265 emperor goose, 423 white-fronted goose, 309 brant, 62 spectacled eider, and 529 nests of other species. Estimates of total nests, active nests, and active eggs are presented in Table 1. Proportion of nests that were active at the time of visit, clutch size, and hatch date are presented in Table 2.

Numbers of nests were down from 2002 for geese and spectacled eiders (Table 1, Fig. 3). The proportion of nests that were active was also down from 2002 (Table 2) indicating high rates of predation and nest abandonment. Further, clutch size was lower than 2002 and below the long term average (1982-2002; Table 2). The combination of low nesting effort, high nest failure and reduced clutch size resulted in poor goose and eider egg production (Table 1). The effect was particularly pronounced among cackling Canada geese where the number of active eggs was the lowest in 13 years.



Average hatch date for geese was three days earlier than 2002 and approximately 7 days earlier than the long-term average (1986-2002; Table 2). Mean hatch date of spectacled eiders was similar to 2002 but was four days earlier than the long-term average. Despite early mean hatch, nesting chronology was protracted with hatch occurring from early June to early July.

Unlike geese and eiders, tundra swans and sandhill cranes were relatively successful in 2003. The nesting population of tundra swans increased in 2003 and continued a long-term annual growth rate of 4.5% (Fig. 3). The estimate of sandhill crane nests in 2003 was above the long-term average (Fig. 3) and the population appears stable. The high proportion of nests that were active among these two species (Table 2) suggests that fox predation did not significantly impact their nesting success.

DISCUSSION:

Nesting effort and success were poor in 2003. Similar to the poor productivity seen in 2001, indices of potential production (total nests, active nests, clutch size, active eggs) were lower than long-term averages for geese and eiders. Fox predation was a significant factor leading to poor nest success in both 2001 and 2003, but timing of nest initiation differed. Unlike 2001 where breakup was later than the long-term average, mild spring temperatures and little winter snow pack resulted in an early breakup in 2003, making nest sites available in the first few weeks of May. As a result, nest initiation was relatively early in 2003.



While early nest initiation can be a harbinger of good production in some years, relatively few nests were initiated overall in 2003. The reasons behind the low numbers of nests detected are not clear, however, low water levels may have contributed to poor nesting effort by suppressing growth of forage (J. Schmutz, pers. comm.) and limiting high quality island nesting habitat. Alternatively, more nests may have been constructed early but were destroyed soon after completion. In this case, our reported estimate of total nests constructed would be biased low because detection of destroyed nests is lower than that of active nests. Weather conditions during the survey were not likely a factor in the poor nesting success. Temperatures were mild in June and precipitation was light with the exception of persistent showers on 8-9 June.

While total nests were down for cacklers, emperors, and white-fronts, the long-term population trend of nesting geese is positive (Fig. 3). However, growth of nesting goose populations has slowed considerably since 1994. In contrast, the spectacled eider nesting population declined rapidly between 1988 and 1993 followed by a slow but steady population increase.

This survey is not designed to estimate species with clumped or colonial, distributions, such as brant and gulls. Consequently, large annual fluctuations and poor precision in annual estimates of population size for these species are



likely, although long term averages should be accurate. Estimates of loon populations are highly variable because few nests are found and possibly because unequal attention has been given to finding loon nests among years.

A primary advantage of the ground plot random sampling procedure over intensive local studies was that it assured applicability to the entire population within the sampled area, not just the immediate areas around intensive biological study camps. Moreover, the single brief visit to scattered plots ensures that the monitoring of populations occurs with a minimum amount of disturbance. The expansion of estimated nests and eggs from the ground sampled area to the entire coastal zone is based the assumption that breeding indices obtained from aerial surveys provide an accurate ratio of nesting within vs. outside of the ground sampled area. These resulting expansion factors do not require that the ratios are the same among years, only that they were constant among strata within a given year.

Annual changes in nest population size are less informative than long-term trends because of sampling error, changes in observers, distribution of plots, and small sample size for less common species. Only several years of consistent declines or increases are likely to indicate a true population change. We believe that a graphical presentation (Fig. 3) enables better interpretation of data than analysis of year-to-year changes in population size. Large annual changes in nest population size probably reflect sampling error or result from extremes in nesting effort and success, rather than a dramatic, or real, population change.

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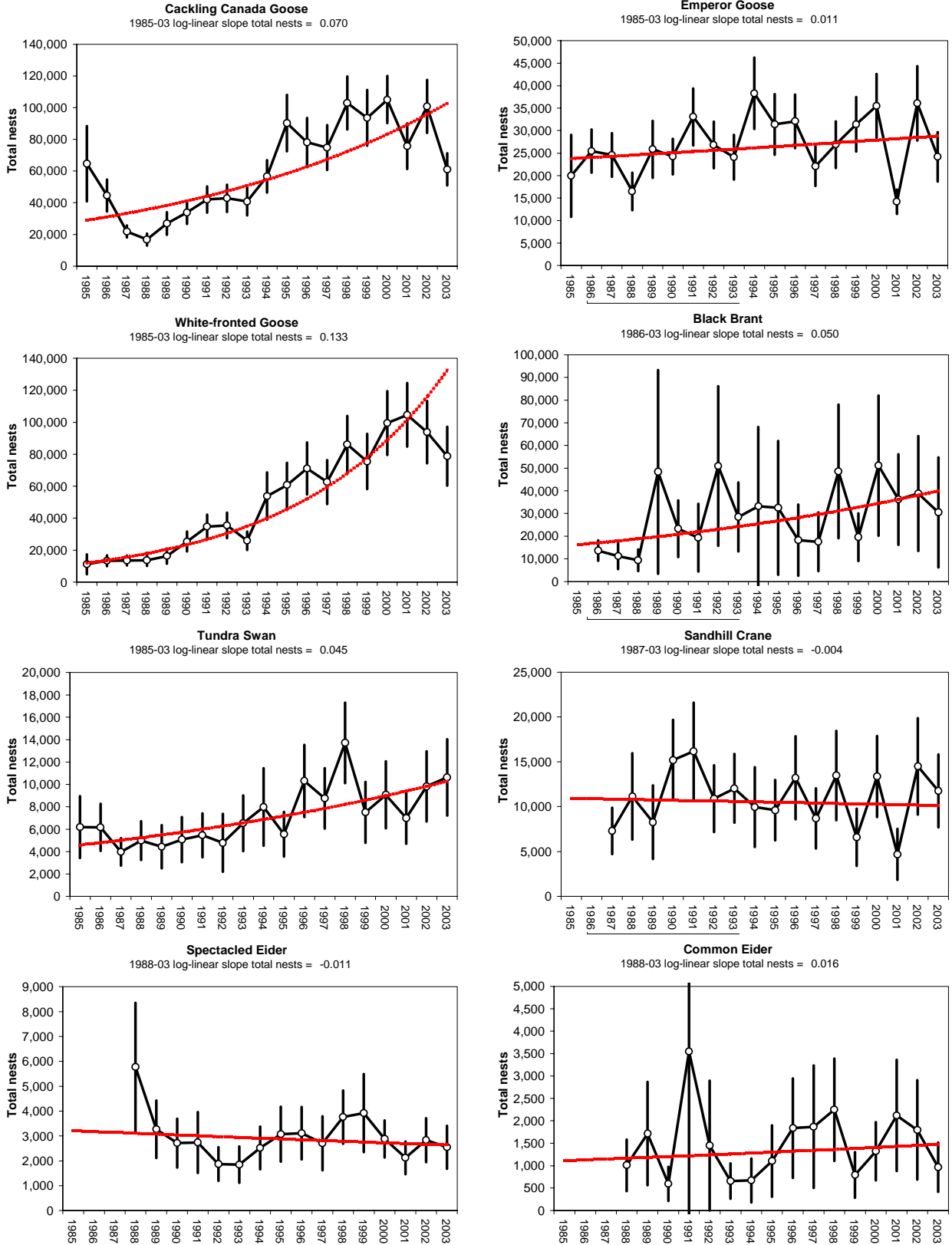


Figure 3. Estimated total nest population sizes on the Yukon-Kuskokwim Delta, Alaska, 1985-2003. Vertical lines indicate 90% confidence intervals. Log-linear regression estimates the average annual growth rates.

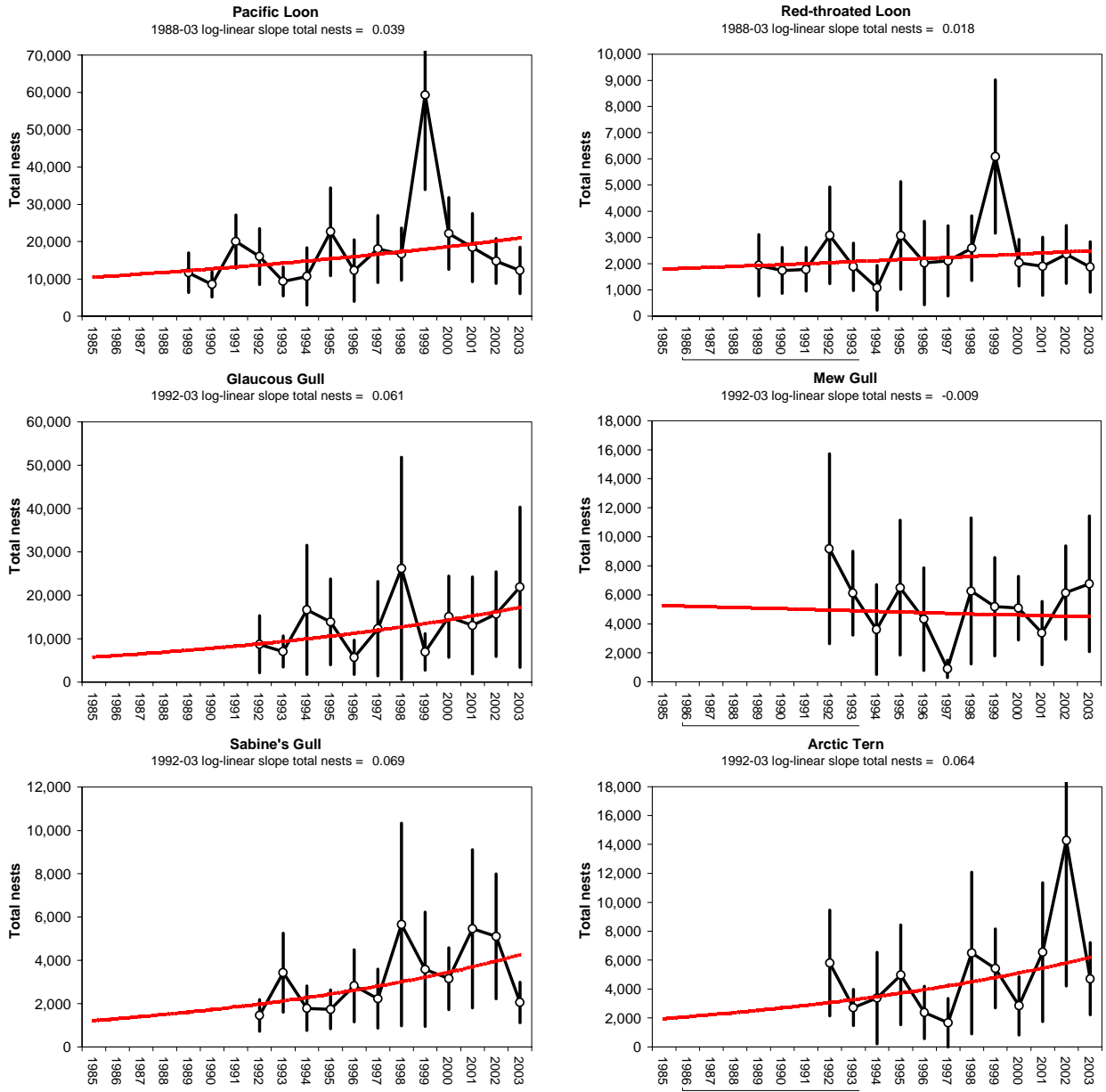


Figure 3 (continued). Estimated total nest population sizes on the Yukon-Kuskokwim Delta, Alaska, 1985-2003. Vertical lines indicate 90% confidence intervals. Log-linear regression estimates the average annual growth rates.

Table 1. Population size of nests and eggs sampled by random plots on the Yukon-Kuskokwim Delta (YKD), Alaska 1985-2003. Expanded estimates were determined by the proportion of aerial observations within the ground sampled area to the entire coastal YKD survey area. Aerial population indices were based on twice the number of singles plus the number of birds in pairs observed, except for brant, loons, and gulls where the total number of birds observed was used, and for swans, where the number of singles plus the number of birds in pairs observed was used.

Year	Ground plot sampled area				Expanded to entire coast							
	No. plots	Area (km ²)	Total nests	SE	Aerial obs out/in sampled area	Estimated nests out of sampled area	Total nests	SE	Active nests	SE	Active eggs	SE
Cackling Canada Goose												
1985	48	1421.6	14794	2768	3.371	49872	64666	12144	22411	6051	92689	28038
1986	101	3961.3	35844	4771	0.243	8715	44559	5128	28496	3121	136847	15606
1987	125	4536.1	19840	1906	0.101	2011	21851	1967	20352	1910	104416	10122
1988	95	3961.3	13640	1855	0.231	3152	16792	1948	12375	1421	57442	7193
1989	89	4137.4	22351	3497	0.205	4577	26928	3630	21596	3115	103234	14953
1990	101	3961.3	27430	3424	0.232	6361	33791	3690	24428	2956	113853	14770
1991	97	2661.9	37017	4066	0.134	4966	41983	4212	35252	3461	170854	17617
1992	66	1974.4	28088	3514	0.524	14705	42793	4424	37375	3832	178452	18552
1993	99	2263.2	33852	4216	0.205	6926	40778	4419	36392	4209	166089	19465
1994	43	715.7	27094	3039	1.090	29526	56620	5190	47381	4589	216920	20700
1995	50	715.7	43841	5413	1.058	46380	90221	9092	78795	7932	353310	35459
1996	54	715.7	39763	4828	0.964	38312	78075	7826	71279	7368	323286	33546
1997	75	715.7	36136	4411	1.070	38680	74816	7205	61818	6405	249772	26224
1998	72	856.6	50713	5149	1.030	52229	102942	8485	96028	8120	437407	37037
1999	59	856.6	43427	5389	1.155	50165	93592	8987	81217	8093	332514	32917
2000	80	715.7	46281	3884	1.270	58796	105077	7592	99859	7330	470706	35033
2001	81	715.7	32939	3999	1.299	42802	75741	7323	45995	4934	168486	17500
2002	84	715.7	40440	3989	1.492	60319	100759	8500	86176	7443	386482	32722
2003	83	715.7	27324	2905	1.233	33701	61025	5174	40268	4089	166243	16815
Emperor Goose												
1985	48	1421.6	5023	1268	2.970	14918	19941	4653	9452	2967	49422	15312
1986	101	3961.3	19633	2129	0.295	5799	25432	2447	17830	1752	90482	8933
1987	125	4536.1	20749	2273	0.184	3820	24569	2491	22728	2320	114672	12048
1988	95	3961.3	14430	2055	0.142	2050	16480	2133	15033	2081	77714	11937
1989	89	4137.4	22980	3163	0.125	2882	25862	3236	23089	2816	116311	14387
1990	101	3961.3	19754	1837	0.227	4485	24239	2015	21438	1957	107902	9741
1991	97	2661.9	22857	2470	0.447	10209	33066	3232	31432	3076	155655	16039
1992	66	1974.4	15071	1798	0.779	11736	26807	2645	25548	2608	127809	13305
1993	99	2263.2	16545	1736	0.456	7540	24085	2524	22851	2428	108142	11652
1994	43	715.7	13367	1629	1.865	24927	38294	4053	36231	3949	179393	20344
1995	50	715.7	9739	1127	2.223	21649	31388	3431	30367	3363	147737	16140
1996	54	715.7	11008	1105	1.915	21078	32086	3031	30264	2947	155068	15507
1997	75	715.7	7074	725	2.119	14988	22062	2227	21142	2184	101024	10497
1998	72	856.6	9996	1042	1.690	16894	26890	2653	25515	2583	119215	12226
1999	59	856.6	9822	807	2.196	21569	31391	3087	28971	2878	128247	12718
2000	80	715.7	9716	929	2.653	25774	35490	3607	34982	3549	174409	17979
2001	81	715.7	4503	478	2.148	9671	14174	1390	10995	1207	52486	6179
2002	84	715.7	8700	942	3.145	27362	36062	4226	33546	3952	168609	19806
2003	83	715.7	7057	768	2.424	17109	24166	2784	19334	2407	92930	12085

Table 1 (continued)

Year	Ground plot sampled area				Aerial obs out/in sampled area	Estimated nests out of sampled area	Expanded to entire coast					
	No. plots	Area (km ²)	Total nests	SE			Total nests	SE	Active nests	SE	Active eggs	SE
White-fronted Goose												
1985	48	1421.6	2009	633	4.545	9131	11140	3180	6138	2228	21619	7836
1986	101	3961.3	6697	1019	0.991	6638	13335	1738	12045	1667	52336	7561
1987	125	4536.1	9115	1226	0.482	4397	13512	1569	12887	1526	58456	6824
1988	95	3961.3	7721	1266	0.767	5923	13644	1778	13071	1665	56037	6925
1989	89	4137.4	9308	1751	0.753	7007	16315	2397	16197	2384	71062	9738
1990	101	3961.3	14270	2216	0.780	11128	25398	3174	22771	3073	104493	14656
1991	97	2661.9	17394	2378	1.001	17414	34808	3854	32539	3567	156609	19495
1992	66	1974.4	13784	1739	1.575	21708	35492	4052	34223	3996	156391	19294
1993	99	2263.2	11974	1544	1.167	13973	25947	2937	25082	2771	109240	12070
1994	43	715.7	8637	1066	5.228	45154	53791	7562	52514	7364	230857	32617
1995	50	715.7	9993	1093	5.074	50705	60698	7143	58961	6968	249724	29842
1996	54	715.7	12849	1303	4.534	58260	71109	8320	68663	8117	308892	36740
1997	75	715.7	10847	1127	4.772	51761	62608	7011	61586	6997	264711	30918
1998	72	856.6	14538	1339	4.931	71686	86224	9089	83947	8843	361604	38520
1999	59	856.6	11881	1236	5.350	63567	75448	8815	71390	8393	298427	35270
2000	80	715.7	13646	1258	6.294	85884	99530	10178	97312	10076	433252	45263
2001	81	715.7	11407	935	8.172	93222	104629	10163	97869	9848	377719	39187
2002	84	715.7	11995	1002	6.825	81861	93856	9993	91790	9830	402850	44260
2003	83	715.7	11265	1151	5.993	67506	78771	9408	74121	9024	314351	38626
Black Brant												
1985	48	1421.6	3424	1534								
1986	101	3961.3	9586	1623	0.422	4048	13634	2296	9754	1647	37109	6417
1987	125	4536.1	8965	2626	0.254	2274	11239	2930	9972	2635	42111	11823
1988	95	3961.3	6394	2003	0.473	3024	9418	2422	6996	1752	24586	6019
1989	89	4137.4	37201	21808	0.300	11143	48344	22908	44448	21662	171083	85834
1990	101	3961.3	15524	5381	0.499	7739	23263	6364	16081	4414	52199	14519
1991	97	2661.9	14546	7119	0.327	4751	19297	7637	16558	7350	59840	26785
1992	66	1974.4	19026	8566	1.676	31885	50911	17941	48869	17634	183820	65280
1993	99	2263.2	18303	6205	0.556	10176	28479	7767	24521	7384	86144	26732
1994	43	715.7	8277	5430	3.007	24890	33167	17840	30903	17423	117017	66421
1995	50	715.7	6186	3119	4.255	26320	32506	15042	23505	10395	86683	38166
1996	54	715.7	4050	2022	3.505	14196	18246	7989	15921	7362	59710	28191
1997	75	715.7	3655	1368	3.801	13893	17548	6579	16559	6288	57877	21950
1998	72	856.6	15213	5499	2.190	33310	48523	15026	41545	13455	151532	49292
1999	59	856.6	5012	1491	2.908	14575	19587	5363	15546	4243	49851	13548
2000	80	715.7	15141	5069	2.377	35987	51128	15754	45614	14796	169088	54444
2001	81	715.7	8487	2391	3.266	27714	36201	10194	19208	6539	56804	18729
2002	84	715.7	11178	4344	2.474	27660	38838	12904	34074	12233	121729	42653
2003	83	715.7	8229	4048	2.705	22260	30489	12392	14802	8688	49436	29943
Tundra Swan												
1985	48	1421.6	1447	379	3.280	4746	6193	1411	5255	1218	20448	4903
1986	101	3961.3	3021	706	1.041	3145	6166	1073	5358	1007	20506	3991
1987	125	4536.1	2196	468	0.806	1770	3966	625	3863	624	15008	2543
1988	95	3961.3	2208	520	1.260	2781	4989	888	4989	888	22817	4077
1989	89	4137.4	2398	734	0.850	2038	4436	989	4436	989	18972	4215
1990	101	3961.3	2422	673	1.096	2655	5077	1030	5014	1029	21391	4617
1991	97	2661.9	2150	520	1.539	3310	5460	1005	5241	994	22823	4753
1992	66	1974.4	1366	477	2.502	3418	4784	1321	4784	1321	17697	4720
1993	99	2263.2	2166	538	2.017	4369	6535	1271	6481	1270	25944	5004
1994	43	715.7	977	222	7.178	7013	7990	1763	7990	1763	33218	7205
1995	50	715.7	730	135	6.609	4825	5555	1021	5068	954	19068	3633
1996	54	715.7	1141	177	8.038	9171	10312	1645	9987	1576	48914	7657
1997	75	715.7	1032	151	7.491	7730	8762	1380	8261	1312	34786	5639
1998	72	856.6	1697	207	7.082	12017	13714	1837	12389	1746	42606	5954
1999	59	856.6	907	172	7.283	6606	7513	1387	6759	1337	25024	5111
2000	80	715.7	913	153	8.938	8160	9073	1525	8527	1460	31910	5372
2001	81	715.7	819	134	7.535	6171	6990	1170	5821	977	19802	3510
2002	84	715.7	1054	166	8.330	8780	9834	1602	8854	1534	38375	6700
2003	83	715.7	1198	187	7.876	9435	10633	1735	10403	1698	49643	8230

Table 1 (continued)

Year	Ground plot sampled area				Expanded to entire coast							
	No. plots	Area (km ²)	Total nests	SE	Aerial obs out/in sampled area	Estimated nests out of sampled area	Total nests	SE	Active nests	SE	Active eggs	SE
Sandhill Crane												
1985	48	1421.6	1024	253								
1986	101	3961.3	3309	916								
1987	125	4536.1	3330	784	1.193	3972	7302	1318	7131	1303	11030	2247
1988	95	3961.3	4091	1131	1.722	7045	11136	2465	11136	2465	21888	4891
1989	89	4137.4	2609	849	2.167	5654	8263	2099	7734	2082	15107	4139
1990	101	3961.3	5257	893	1.889	9932	15189	2286	15036	2274	25299	3929
1991	97	2661.9	4560	902	2.547	11614	16174	2763	15628	2678	29673	4912
1992	66	1974.4	2683	522	3.058	8206	10889	1904	10706	1883	20926	3886
1993	99	2263.2	3062	557	2.930	8972	12034	1955	11220	1917	19006	3312
1994	43	715.7	1182	245	7.423	8775	9957	2267	9957	2267	17757	4218
1995	50	715.7	983	154	8.768	8619	9602	1722	8987	1687	17046	3242
1996	54	715.7	1362	213	8.705	11857	13219	2361	12860	2344	24303	4412
1997	75	715.7	1002	181	7.671	7686	8688	1709	8688	1709	16102	3258
1998	72	856.6	1287	205	9.463	12179	13466	2545	13466	2545	23720	4475
1999	59	856.6	728	183	8.052	5862	6590	1633	5757	1560	9866	2919
2000	80	715.7	969	139	12.790	12394	13363	2298	12977	2261	23664	4197
2001	81	715.7	355	111	12.171	4321	4676	1458	4307	1419	7547	2554
2002	84	715.7	1054	149	12.752	13440	14494	2748	13779	2677	27558	5354
2003	83	715.7	1092	155	9.759	10656	11748	2070	11458	2046	22346	4025
Spectacled Eider												
1985	48	1421.6	2051	513								
1986	101	3961.3	5060	846								
1987	125	4536.1	4357	802								
1988	95	3961.3	3344	725	0.726	2428	5772	1315	5190	1208	26786	6274
1989	89	4137.4	2359	433	0.385	908	3267	589	2940	541	14529	2459
1990	101	3961.3	2078	414	0.307	637	2715	501	2476	478	13237	2597
1991	97	2661.9	1905	398	0.439	836	2741	624	2458	556	12891	2923
1992	66	1974.4	1324	263	0.412	546	1870	344	1613	315	8787	1700
1993	99	2263.2	1696	367	0.089	151	1847	375	1618	349	7419	1670
1994	43	715.7	1697	333	0.483	819	2516	439	1982	357	9223	1743
1995	50	715.7	2094	417	0.468	981	3075	563	2468	498	12437	2593
1996	54	715.7	1988	377	0.563	1119	3107	539	2532	458	12830	2360
1997	75	715.7	1680	389	0.612	1029	2709	555	2423	525	10645	2352
1998	72	856.6	2330	372	0.614	1431	3761	547	3500	498	16980	2401
1999	59	856.6	2401	577	0.633	1521	3922	799	3549	731	17483	3528
2000	80	715.7	1965	295	0.465	913	2878	382	2676	369	14310	1967
2001	81	715.7	1474	275	0.440	649	2123	336	1336	213	5580	956
2002	84	715.7	2135	407	0.326	696	2831	450	2341	428	12163	2402
2003	83	715.7	1651	350	0.540	892	2543	442	1969	374	8574	1748
Common Eider												
1985	48	1421.6	35	23								
1986	101	3961.3	178	57								
1987	125	4536.1	746	237								
1988	95	3961.3	651	200	0.550	358	1009	292	806	227	3806	1083
1989	89	4137.4	1446	549	0.186	269	1715	588	1715	588	9434	3183
1990	101	3961.3	448	150	0.329	148	596	194	526	181	2686	997
1991	97	2661.9	2970	2191	0.193	575	3545	2252	3455	2250	17808	11644
1992	66	1974.4	1169	710	0.238	278	1447	739	1425	739	7232	3697
1993	99	2263.2	506	176	0.297	150	656	201	429	133	2293	742
1994	43	715.7	411	196	0.635	261	672	250	589	225	2607	918
1995	50	715.7	539	247	1.048	565	1104	405	1040	398	5262	2058
1996	54	715.7	773	271	1.375	1063	1836	565	1748	522	9270	2822
1997	75	715.7	707	274	1.641	1160	1867	698	1711	647	7782	2984
1998	72	856.6	868	229	1.590	1380	2248	582	1754	455	8652	2225
1999	59	856.6	470	177	0.690	324	794	259	537	192	2614	920
2000	80	715.7	775	212	0.705	546	1321	332	1273	313	6229	1551
2001	81	715.7	901	292	1.352	1218	2119	632	1926	581	7767	2343
2002	84	715.7	685	191	1.625	1113	1798	565	1730	551	8167	2617
2003	83	715.7	639	225	0.513	328	967	281	725	238	3102	1064

Table 1 (continued)

Year	Ground plot sampled area				Expanded to entire coast							
	No. plots	Area (km ²)	Total nests	SE	Aerial obs out/in sampled area	Estimated nests out of sampled area	Total nests	SE	Active nests	SE	Active eggs	SE
Pacific Loon												
1985	48	1421.6										
1986	101	3961.3										
1987	125	4536.1										
1988	96	3961.3										
1989	89	4137.4	4169	1067	1.795	7481	11650	2688	11553	2680	20978	4936
1990	101	3961.3	4109	1018	1.071	4401	8511	1710	6884	1471	12452	2730
1991	97	2661.9	5608	1101	2.567	14396	20005	3642	18830	3517	33628	6202
1992	69	1974.4	2861	712	4.595	13147	16008	3816	14429	3474	25514	6053
1993	99	2263.2	2487	586	2.731	6792	9279	1962	9165	1956	17522	3844
1994	43	715.7	648	236	15.430	9995	10643	3927	10643	3927	19160	6673
1995	50	715.7	976	167	22.195	21665	22642	6012	22642	6012	40644	11034
1996	54	715.7	462	142	25.535	11797	12259	4206	12259	4206	20914	7458
1997	75	715.7	789	168	21.845	17238	18027	4584	17471	4475	33312	8616
1998	72	856.6	1240	205	12.401	15374	16613	3575	15127	3206	27224	5904
1999	59	856.6	1929	305	29.738	57349	59278	12940	56624	12641	100003	23137
2000	80	715.7	1202	181	17.468	20989	22190	4906	21479	4735	40449	9057
2001	81	715.7	1195	231	14.381	17183	18377	4664	17728	4573	28688	7498
2002	84	715.7	1227	173	11.046	13551	14778	3056	14321	3008	25228	5359
2003	83	715.7	698	151	16.596	11590	12288	3159	11677	3023	20284	5491
Red-throated Loon												
1985	48	1421.6										
1986	101	3961.3										
1987	125	4536.1										
1988	96	3961.3										
1989	89	4137.4	769	197	1.519	1169	1938	600	1922	596	3489	1090
1990	101	3961.3	735	182	1.369	1006	1741	448	1408	376	2547	691
1991	97	2661.9	931	183	0.917	853	1784	424	1679	404	2998	716
1992	69	1974.4	625	156	3.926	2454	3079	940	2775	852	4907	1495
1993	99	2263.2	594	140	2.171	1289	1883	461	1860	458	3556	893
1994	43	715.7	123	45	7.761	956	1079	435	1079	435	1943	753
1995	50	715.7	420	72	6.324	2655	3075	1052	3075	1052	5520	1908
1996	54	715.7	164	51	11.344	1861	2025	812	2025	812	3454	1419
1997	75	715.7	184	39	10.454	1922	2106	684	2041	666	3892	1276
1998	72	856.6	559	93	3.632	2031	2591	634	2359	572	4245	1043
1999	59	856.6	774	122	6.861	5314	6089	1493	5816	1446	10271	2615
2000	80	715.7	514	78	2.961	1523	2038	451	1972	436	3714	829
2001	81	715.7	361	70	4.270	1542	1904	565	1836	550	2972	896
2002	84	715.7	487	69	3.835	1868	2356	564	2283	551	4021	977
2003	83	715.7	367	79	4.102	1504	1871	494	1778	472	3088	846
Glaucous Gull												
1985	48	1421.6	2520	684								
1986	101	3961.3	3375	637								
1987	125	4536.1	2516	439								
1988	95	3961.3	3253	735								
1989	89	4137.4	2412	574								
1990	101	3961.3	3227	1065								
1991	97	2661.9	7121	2373								
1992	66	1974.4	4035	1756	1.156	4663	8698	3352	7957	3012	21493	8126
1993	99	2263.2	2463	574	1.860	4582	7045	1814	6839	1782	17643	4560
1994	43	715.7	2211	1053	6.538	14455	16666	7593	16274	7534	46117	21964
1995	50	715.7	2252	643	5.154	11607	13859	5034	13859	5034	36118	13130
1996	54	715.7	957	278	4.965	4751	5708	2020	5708	2020	14273	4967
1997	75	715.7	2446	1141	4.023	9840	12286	5541	12140	5429	31092	13951
1998	72	856.6	3760	1821	5.964	22424	26184	13068	25676	12820	67974	33901
1999	59	856.6	1564	398	3.446	5390	6954	2167	6544	2034	17744	5647
2000	80	715.7	3709	974	3.064	11366	15075	4781	14738	4670	38701	12332
2001	81	715.7	2347	955	4.557	10696	13043	5711	12281	5551	30025	13130
2002	84	715.7	2531	579	5.189	13134	15665	4985	14031	4478	38014	12113
2003	83	715.7	3835	1748	4.709	18058	21893	9411	18548	8575	45762	21420

Table 1 (continued)

Year	Ground plot sampled area				Expanded to entire coast							
	No. plots	Area (km ²)	Total nests	SE	Aerial obs out/in sampled area	Estimated nests out of sampled area	Total nests	SE	Active nests	SE	Active eggs	SE
Mew Gull												
1985	48	1421.6	1174	407								
1986	101	3961.3	2310	732								
1987	125	4536.1	1845	505								
1988	95	3961.3	2528	1917								
1989	89	4137.4	2444	687								
1990	101	3961.3	1365	648								
1991	97	2661.9	1559	334								
1992	66	1974.4	2031	752	3.521	7152	9183	3334	8717	3259	21386	7784
1993	99	2263.2	2366	282	1.586	3751	6117	1474	6117	1474	16480	3959
1994	43	715.7	1028	522	2.515	2585	3613	1576	3434	1556	9036	4181
1995	50	715.7	1396	403	3.655	5103	6499	2368	6499	2368	16834	6173
1996	54	715.7	773	234	4.599	3555	4328	1803	4328	1803	11546	4921
1997	75	715.7	265	82	2.416	640	905	302	905	302	2214	752
1998	72	856.6	1308	455	3.795	4964	6272	2565	6272	2565	15008	6174
1999	59	856.6	1365	396	2.800	3822	5187	1732	5016	1699	12841	4314
2000	80	715.7	1024	189	3.967	4063	5087	1113	4813	1071	12652	2847
2001	81	715.7	982	300	2.429	2385	3367	1110	3367	1110	7954	2593
2002	84	715.7	1687	378	2.645	4463	6150	1641	5956	1600	15952	4232
2003	83	715.7	1465	387	3.612	5292	6757	2387	6144	2217	15599	5462
Sabine's Gull												
1985	48	1421.6										
1986	101	3961.3	664	233								
1987	125	4536.1	875	326								
1988	95	3961.3	747	301								
1989	89	4137.4	1559	986								
1990	101	3961.3	2406	1350								
1991	97	2661.9	1304	387								
1992	66	1974.4	840	282	0.738	620	1460	374	1460	374	3186	801
1993	99	2263.2	2388	813	0.436	1041	3429	928	3359	898	8011	2031
1994	43	715.7	617	210	1.892	1168	1785	524	1785	524	4460	1342
1995	50	715.7	698	185	1.486	1038	1736	457	1736	457	4180	1077
1996	54	715.7	736	216	2.834	2086	2822	849	2684	813	6495	1951
1997	75	715.7	442	130	4.048	1789	2231	699	2231	699	5210	1787
1998	72	856.6	1454	741	2.890	4202	5656	2388	5656	2388	11199	4484
1999	59	856.6	1248	604	1.870	2334	3582	1348	3582	1348	8079	3026
2000	80	715.7	775	182	3.074	2382	3157	727	3157	727	8005	1959
2001	81	715.7	1201	423	3.544	4257	5458	1866	5330	1851	11411	4131
2002	84	715.7	1239	404	3.120	3866	5105	1474	5105	1474	12056	3418
2003	83	715.7	692	186	1.979	1370	2062	477	1984	471	4365	970
Arctic Tern												
1985	48	1421.6	340	172								
1986	101	3961.3	911	588								
1987	125	4536.1	760	318								
1988	95	3961.3	200	99								
1989	89	4137.4	414	175								
1990	101	3961.3	1047	387								
1991	97	2661.9	652	290								
1992	66	1974.4	1024	323	4.669	4781	5805	1863	5805	1863	11282	3611
1993	99	2263.2	1068	304	1.542	1647	2715	637	2715	637	6083	1407
1994	43	715.7	308	156	9.989	3077	3385	1614	3385	1614	7912	3959
1995	50	715.7	539	165	8.226	4434	4973	1762	4973	1762	9955	3538
1996	54	715.7	221	85	9.758	2157	2378	928	2378	928	4357	1728
1997	75	715.7	147	75	10.408	1530	1677	856	1677	856	3365	1721
1998	72	856.6	764	208	7.499	5729	6493	2848	6493	2848	13615	5965
1999	59	856.6	755	199	6.179	4665	5420	1392	5420	1392	10847	2812
2000	80	715.7	277	90	9.252	2563	2840	1024	2840	1024	5106	1820
2001	81	715.7	682	269	8.605	5868	6550	2446	6291	2242	12054	4332
2002	84	715.7	1529	434	8.330	12737	14266	5127	14266	5127	29269	10436
2003	83	715.7	506	136	8.307	4203	4709	1272	4709	1272	8422	2340

Table 2. Annual proportion of nests active at time of plot visit, mean clutch size of apparently viable eggs found in actively incubated nests, and predicted mean date of hatch based on egg float angles. Means are calculated considering each nest found on a random ground plot as a sample unit.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			n
	Prop	n	Eggs	n	Mean	Min	Max	
Cackling Canada Goose								
1982	0.307	584	4.5	168	04 July	25 June	18 July	170
1983	0.693	518	5.2	355	25 June	15 June	14 July	284
1984	0.477	214	4.6	102	25 June	16 June	11 July	92
1985	0.472	667	4.1	284	03 July	24 June	15 July	278
1986	0.642	648	4.7	404	29 June	13 June	15 July	346
1987	0.906	575	5.0	504	28 June	20 June	18 July	204
1988	0.742	306	4.6	223	24 June	15 June	08 July	66
1989	0.844	443	4.8	373	01 July	22 June	10 July	55
1990	0.745	514	4.6	377	24 June	13 June	06 July	194
1991	0.852	675	4.7	571	22 June	12 June	03 July	352
1992	0.890	674	4.8	590	30 June	20 June	21 July	391
1993	0.885	705	4.5	616	24 June	09 June	06 July	358
1994	0.814	625	4.6	501	19 June	08 June	09 July	409
1995	0.873	1382	4.5	1189	20 June	11 June	05 July	725
1996	0.913	1080	4.5	978	17 June	07 June	05 July	755
1997	0.826	1226	4.0	1010	17 June	03 June	04 July	812
1998	0.937	1602	4.5	1483	25 June	12 June	09 July	889
1999	0.869	1113	4.1	931	27 June	17 June	16 July	772
2000	0.950	1672	4.7	1509	24 June	14 June	10 July	1014
2001	0.607	1207	3.7	729	28 June	15 June	09 July	522
2002	0.855	1534	4.5	1293	20 June	10 June	04 July	930
2003	0.660	1026	4.1	648	17 June	03 June	04 July	562
Emperor Goose								
1982	0.699	133	4.9	78	03 July	16 June	11 July	71
1983	0.831	177	5.4	141	22 June	14 June	06 July	100
1984	0.728	81	5.5	58	23 June	16 June	02 July	43
1985	0.618	191	5.2	113	01 July	23 June	11 July	107
1986	0.696	335	5.2	218	27 June	18 June	09 July	196
1987	0.934	395	5.1	361	27 June	18 June	07 July	141
1988	0.894	217	5.1	192	21 June	16 June	04 July	67
1989	0.916	322	5.1	292	30 June	18 June	07 July	63
1990	0.875	336	4.9	288	21 June	11 June	06 July	99
1991	0.947	380	5.0	356	20 June	10 June	02 July	256
1992	0.959	270	5.0	259	29 June	21 June	09 July	182
1993	0.954	306	4.9	285	21 June	11 June	04 July	139
1994	0.939	328	4.9	308	19 June	12 June	30 June	192
1995	0.967	307	4.9	297	18 June	10 June	06 July	188
1996	0.943	299	5.1	280	16 June	04 June	23 June	185
1997	0.958	240	4.8	230	15 June	06 June	30 June	153
1998	0.954	281	4.7	266	24 June	16 June	03 July	215
1999	0.919	247	4.5	224	27 June	17 June	06 July	188
2000	0.986	351	5.0	344	23 June	13 June	08 July	280
2001	0.776	165	4.8	127	27 June	19 June	02 July	104
2002	0.930	330	5.0	303	18 June	09 June	29 June	249
2003	0.800	265	4.8	211	15 June	05 June	26 June	153

Table 2. (Continued) Annual proportion of active nests, mean clutch size, and predicted mean date of hatch.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			
	Prop	n	Eggs	n	Mean	Min	Max	n
White-fronted Goose								
1982	0.643	28	3.7	15	04 July	26 June	12 July	14
1983	0.922	51	4.3	38	21 June	13 June	19 July	25
1984	0.903	31	4.6	28	23 June	16 June	01 July	25
1985	0.741	58	4.1	42	30 June	23 June	07 July	42
1986	0.878	123	4.3	104	26 June	17 June	12 July	102
1987	0.944	144	4.7	133	26 June	19 June	03 July	60
1988	0.963	81	4.5	78	22 June	15 June	03 July	32
1989	0.991	112	4.5	111	28 June	22 June	04 July	21
1990	0.936	173	4.6	161	22 June	11 June	29 June	52
1991	0.935	214	4.7	198	21 June	12 June	03 July	138
1992	0.971	204	4.5	197	29 June	19 June	24 July	110
1993	0.970	199	4.3	191	23 June	17 June	05 July	84
1994	0.973	222	4.4	214	19 June	11 June	28 June	129
1995	0.971	315	4.2	306	21 June	09 June	01 July	178
1996	0.966	349	4.5	337	18 June	07 June	30 June	144
1997	0.984	368	4.3	360	18 June	07 June	29 June	184
1998	0.974	392	4.3	380	25 June	17 June	06 July	261
1999	0.947	263	4.2	246	27 June	19 June	10 July	208
2000	0.978	493	4.5	478	25 June	14 June	09 July	334
2001	0.935	418	3.9	390	28 June	19 June	07 July	311
2002	0.978	455	4.4	444	22 June	14 June	30 June	306
2003	0.941	423	4.2	397	19 June	06 June	01 July	272
Black Brant								
1982	0.043	47	2.0	1	28 June	28 June	28 June	1
1983	0.462	52	3.4	24	23 June	15 June	03 July	11
1984	0.294	17	4.2	5	20 June	19 June	20 June	4
1985	0.129	271	3.6	21	27 June	23 June	08 July	29
1986	0.735	298	3.8	215	25 June	19 June	06 July	126
1987	0.952	652	4.2	615	25 June	22 June	03 July	167
1988	0.698	222	3.4	155	20 June	14 June	03 July	38
1989	0.929	1011	3.8	939	27 June	19 June	06 July	40
1990	0.727	428	3.2	310	21 June	15 June	01 July	119
1991	0.867	542	3.6	373	19 June	12 June	01 July	183
1992	0.963	898	3.9	551	26 June	19 June	06 July	152
1993	0.852	562	3.3	328	21 June	12 June	27 June	107
1994	0.883	274	3.7	119	17 June	10 June	27 June	93
1995	0.723	195	3.7	103	18 June	12 June	01 July	41
1996	0.873	110	3.8	96	17 June	11 June	26 June	44
1997	0.944	124	3.5	110	14 June	03 June	24 June	100
1998	0.875	488	3.7	427	23 June	16 June	04 July	260
1999	0.821	156	3.2	126	26 June	17 June	07 July	108
2000	0.892	547	3.7	372	23 June	16 June	03 July	216
2001	0.531	311	3.0	165	26 June	19 June	05 July	77
2002	0.877	424	3.6	324	19 June	06 June	03 July	163
2003	0.485	309	3.0	62	16 June	07 June	26 June	56

Table 2. (Continued) Annual proportion of active nests, mean clutch size, and predicted mean date of hatch.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			
	Prop	n	Eggs	n	Mean	Min	Max	n
Tundra Swan								
1982	0.824	17	3.7	13	05 July	23 June	14 July	11
1983	0.933	15	4.8	14	24 June	15 June	30 June	6
1984	0.933	15	4.6	14	27 June	20 June	05 July	6
1985	0.839	31	3.8	24	04 July	26 June	10 July	14
1986	0.872	47	3.6	38	28 June	19 June	10 July	23
1987	0.962	26	3.8	24	30 June	23 June	06 July	12
1988	1.000	24	4.6	23	27 June	17 June	04 July	4
1989	1.000	24	4.3	24	01 July	29 June	03 July	4
1990	0.964	28	4.1	26	25 June	21 June	27 June	4
1991	0.926	27	4.2	25	24 June	17 June	08 July	12
1992	1.000	20	3.8	20	30 June	24 June	07 July	8
1993	0.964	28	4.0	26	26 June	19 June	01 July	6
1994	1.000	27	4.3	27	22 June	13 June	30 June	9
1995	0.913	23	3.8	21	25 June	21 June	02 July	9
1996	0.968	31	4.9	30	19 June	10 June	28 June	9
1997	0.943	35	4.2	33	21 June	14 June	25 June	13
1998	0.905	42	3.4	36	30 June	23 June	12 July	20
1999	0.900	20	3.7	18	01 July	24 June	09 July	14
2000	0.939	33	3.7	30	26 June	18 June	05 July	22
2001	0.833	30	3.4	25	30 June	19 June	09 July	16
2002	0.900	40	4.3	36	26 June	20 June	01 July	10
2003	0.978	45	4.8	44	18 June	11 June	24 June	21
Sandhill Crane								
1982	0.889	9	2.0	6	24 June	22 June	25 June	4
1983	1.000	27	1.8	24	26 June	17 June	11 July	14
1984	0.929	14	1.9	13	19 June	15 June	21 June	6
1985	0.958	24	1.5	20	30 June	19 June	04 July	13
1986	0.805	41	1.6	30	27 June	16 June	09 July	25
1987	0.973	37	1.6	34	25 June	18 June	10 July	16
1988	1.000	34	1.9	34	19 June	17 June	25 June	6
1989	0.850	20	1.9	17	19 June	17 June	21 June	2
1990	0.979	47	1.8	45	18 June	15 June	22 June	9
1991	0.980	50	2.0	48	16 June	10 June	26 June	25
1992	0.967	30	1.8	29	30 June	24 June	05 July	9
1993	0.943	35	1.7	33	19 June	15 June	27 June	14
1994	1.000	32	1.8	31	14 June	11 June	16 June	5
1995	0.935	31	1.9	29	18 June	12 June	30 June	10
1996	0.973	37	1.9	35	14 June	10 June	25 June	14
1997	1.000	34	1.8	32	15 June	11 June	24 June	8
1998	1.000	35	1.8	35	21 June	15 June	26 June	19
1999	0.875	16	1.7	14	23 June	19 June	28 June	12
2000	0.971	35	1.8	34	19 June	13 June	29 June	22
2001	0.923	13	1.8	12	21 June	19 June	23 June	7
2002	0.950	40	2.0	38	19 June	08 June	03 July	12
2003	0.976	41	2.0	40	14 June	07 June	25 June	13

Table 2. (Continued) Annual proportion of active nests, mean clutch size, and predicted mean date of hatch.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			n
	Prop	n	Eggs	n	Mean	Min	Max	
Spectacled Eider								
1982	0.287	87	3.6	21	08 July	30 June	22 July	18
1983	0.550	111	4.5	61	29 June	20 June	06 July	22
1984	0.500	18	3.9	8	02 July	25 June	05 July	3
1985	0.545	99	4.2	50	04 July	26 June	18 July	20
1986	0.683	101	4.6	66	02 July	22 June	20 July	38
1987	0.848	105	5.0	87	28 June	17 June	09 July	27
1988	0.806	67	5.0	52	26 June	20 June	02 July	19
1989	0.927	41	5.1	37	02 July	22 June	07 July	5
1990	0.927	41	5.3	36	23 June	18 June	27 June	15
1991	0.875	40	5.4	35	22 June	16 June	10 July	25
1992	0.889	27	5.6	24	02 July	26 June	14 July	17
1993	0.868	38	4.4	31	25 June	17 June	09 July	18
1994	0.743	35	4.6	25	23 June	12 June	06 July	15
1995	0.803	66	5.0	51	24 June	14 June	04 July	44
1996	0.815	54	5.1	44	18 June	12 June	02 July	33
1997	0.895	57	4.4	50	19 June	11 June	30 June	39
1998	0.928	69	4.8	64	28 June	17 June	07 July	52
1999	0.911	56	4.9	51	28 June	18 June	09 July	51
2000	0.930	71	5.4	66	28 June	18 June	09 July	52
2001	0.630	54	4.2	34	03 July	25 June	16 July	32
2002	0.827	81	5.2	67	22 June	15 June	02 July	59
2003	0.774	62	4.4	48	22 June	09 June	02 July	36
Common Eider								
1982	1.000	4	4.8	4	09 July	08 July	10 July	4
1983	0.600	5	4.3	3	26 June	21 June	30 June	3
1984	0.000	0	0.0	0				0
1985	0.333	3	6.0	1				0
1986	0.667	6	3.7	3				0
1987	0.941	34	5.4	31	29 June	25 June	08 July	10
1988	0.704	27	4.5	19	10 July	13 July	13 July	1
1989	1.000	31	5.5	31	02 July	29 June	08 July	4
1990	0.929	14	5.3	13	22 June	21 June	24 June	3
1991	0.865	37	5.0	32	26 June	19 June	05 July	27
1992	0.941	17	5.3	16	02 July	26 June	06 July	12
1993	0.600	15	5.1	9	24 June	18 June	27 June	5
1994	0.857	14	4.2	11	24 June	16 June	04 July	9
1995	0.941	17	5.1	16	23 June	14 June	02 July	13
1996	0.952	21	5.3	20	19 June	10 June	02 July	14
1997	0.917	24	4.6	22	19 June	10 June	01 July	15
1998	0.781	32	5.0	25	28 June	20 June	04 July	18
1999	0.765	17	4.5	13	30 June	22 June	09 July	12
2000	0.964	28	4.9	27	29 June	24 June	05 July	23
2001	0.909	33	4.0	30	30 June	20 June	08 July	23
2002	0.962	26	4.7	25	24 June	15 June	30 June	17
2003	0.750	24	4.3	18	22 June	14 June	04 July	16

Table 2. (Continued) Annual proportion of active nests, mean clutch size, and predicted mean date of hatch.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			n
	Prop	n	Eggs	n	Mean	Min	Max	
Red-throated and Pacific Loons (combined)								
1982	0.886	35	1.7	31	08 July	03 July	24 July	25
1983	0.947	38	1.8	36	29 June	21 June	29 July	15
1984	0.909	11	2.0	10	02 July	26 June	08 July	5
1985	0.898	59	1.7	53	07 July	25 June	21 July	15
1986	0.867	75	1.6	64	05 July	26 June	25 July	37
1987	0.938	81	1.9	76	03 July	27 June	12 July	34
1988	0.846	52	1.7	42	27 June	16 June	05 July	5
1989	0.956	45	1.8	43	02 July	22 June	15 July	5
1990	0.915	47	1.8	43	01 July	25 June	09 July	11
1991	0.925	67	1.8	62	26 June	18 June	05 July	21
1992	0.927	41	1.8	38	05 July	29 June	18 July	12
1993	0.979	47	1.9	45	26 June	18 June	05 July	12
1994	1.000	29	1.9	29	24 June	19 June	29 June	6
1995	1.000	44	1.8	44	26 June	21 June	01 July	10
1996	1.000	17	1.7	17	22 June	15 June	01 July	9
1997	0.970	33	1.9	32	22 June	15 June	29 June	17
1998	0.911	56	1.8	51	01 July	20 June	14 July	37
1999	0.937	63	1.8	58	03 July	22 June	14 July	48
2000	0.968	62	1.9	60	30 June	15 June	09 July	40
2001	0.965	57	1.6	55	04 July	27 June	15 July	27
2002	0.969	65	1.8	62	25 June	12 June	03 July	42
2003	0.950	40	1.7	38	24 June	12 June	03 July	14
Glaucous Gull								
1982	0.797	59	2.5	45	05 July	29 June	22 July	23
1983	0.945	55	2.4	52	22 June	13 June	04 July	14
1984	0.875	8	2.3	7	23 June	18 June	26 June	5
1985	0.835	115	2.2	92	03 July	23 June	12 July	23
1986	0.768	69	2.3	51	27 June	22 June	05 July	18
1987	0.987	77	2.4	67	28 June	20 June	10 July	19
1988	0.932	74	2.4	66	22 June	15 June	03 July	9
1989	0.894	47	2.5	38	22 June	22 June	22 June	3
1990	0.839	56	2.6	47	17 June	16 June	18 June	2
1991	0.826	92	2.8	61	18 June	12 June	03 July	26
1992	0.947	75	2.8	71	27 June	22 June	04 July	23
1993	0.983	59	2.7	54	20 June	15 June	07 July	11
1994	0.981	54	2.8	53	17 June	10 June	27 June	17
1995	1.000	71	2.6	65	17 June	14 June	26 June	17
1996	1.000	26	2.5	26	14 June	11 June	20 June	15
1997	0.988	83	2.5	58	17 June	10 June	29 June	19
1998	0.983	116	2.7	114	22 June	15 June	09 July	64
1999	0.949	39	2.7	37	27 June	19 June	07 July	25
2000	0.978	134	2.6	124	22 June	12 June	09 July	72
2001	0.942	86	2.4	79	24 June	17 June	07 July	50
2002	0.896	96	2.7	83	17 June	06 June	04 July	56
2003	0.847	144	2.4	83	13 June	04 June	26 June	58

Table 2. (Continued) Annual proportion of active nests, mean clutch size, and predicted mean date of hatch.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			n
	Prop	n	Eggs	n	Mean	Min	Max	
Mew Gull								
1982	0.800	20	2.1	16	10 July	07 July	22 July	11
1983	0.946	37	2.6	35	26 June	17 June	03 July	6
1984	1.000	2	2.0	2				0
1985	0.909	44	1.9	38	04 July	27 June	12 July	8
1986	0.919	37	2.3	34	02 July	21 June	12 July	18
1987	1.000	29	2.4	23	26 June	21 June	04 July	8
1988	0.977	43	2.7	41	18 June	14 June	24 June	4
1989	0.918	49	2.6	45	22 June	22 June	22 June	1
1990	0.960	25	2.5	24	21 June	17 June	26 June	2
1991	0.857	42	2.6	36	20 June	14 June	02 July	8
1992	0.941	34	2.6	32	27 June	23 June	04 July	10
1993	1.000	92	2.8	92	24 June	17 June	02 July	7
1994	0.963	27	2.5	26	15 June	11 June	21 June	8
1995	1.000	44	2.6	44	18 June	15 June	22 June	16
1996	1.000	21	2.7	21	14 June	08 June	20 June	10
1997	1.000	9	2.4	9	19 June	16 June	27 June	8
1998	1.000	40	2.4	40	24 June	19 June	04 July	19
1999	0.972	36	2.5	35	25 June	21 June	09 July	25
2000	0.946	37	2.6	35	25 June	17 June	05 July	17
2001	1.000	36	2.4	36	26 June	19 June	07 July	18
2002	0.969	64	2.7	62	16 June	06 June	03 July	40
2003	0.909	55	2.5	50	17 June	08 June	27 June	20
Sabine's Gull								
1982	1.000	2	1.0	2	29 June	29 June	29 June	1
1983	1.000	5	2.4	5	21 June	14 June	02 July	3
1984	1.000	1	0.0	0				0
1985	1.000	5	1.6	5	02 July	26 June	18 July	3
1986	1.000	11	1.9	10	24 June	15 June	07 July	7
1987	1.000	17	2.2	17	21 June	15 June	04 July	7
1988	1.000	14	2.4	14	24 June	18 June	08 July	7
1989	1.000	15	2.7	15	01 July	21 June	11 July	2
1990	1.000	20	2.5	14				0
1991	1.000	20	2.0	19	15 June	09 June	22 June	9
1992	1.000	18	2.2	18				0
1993	0.967	60	2.3	57	17 June	14 June	23 June	8
1994	1.000	38	2.7	38	11 June	09 June	16 June	6
1995	1.000	22	2.4	22	18 June	12 June	28 June	6
1996	0.950	20	2.4	19	11 June	07 June	14 June	3
1997	1.000	15	2.3	15	14 June	08 June	22 June	8
1998	1.000	44	2.0	44	21 June	15 June	06 July	11
1999	1.000	28	2.3	28	21 June	16 June	03 July	20
2000	1.000	28	2.5	28	22 June	14 June	02 July	7
2001	0.977	44	2.1	43	27 June	19 June	04 July	10
2002	1.000	47	2.4	47	14 June	08 June	26 June	28
2003	0.962	26	2.2	25	12 June	06 June	17 June	5

Table 2. (Continued) Annual proportion of active nests, mean clutch size, and predicted mean date of hatch.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			n
	Prop	n	Eggs	n	Mean	Min	Max	
Arctic Tern								
1982	0.857	7	1.5	6				0
1983	1.000	4	2.5	4				0
1984	1.000	2	1.5	2				0
1985	1.000	17	1.9	16	29 June	22 June	04 July	8
1986	1.000	8	2.1	8	26 June	16 June	24 July	6
1987	1.000	9	1.3	9	24 June	20 June	26 June	3
1988	0.857	7	1.7	6	24 June	24 June	24 June	2
1989	1.000	7	1.9	7	22 June	22 June	22 June	1
1990	1.000	10	1.6	8	24 June	24 June	24 June	1
1991	1.000	8	1.9	8	17 June	12 June	20 June	4
1992	1.000	15	1.9	15	01 July	25 June	10 July	6
1993	1.000	28	2.2	28	17 June	15 June	20 June	3
1994	1.000	8	2.1	8	15 June	15 June	15 June	1
1995	1.000	17	2.0	17	16 June	13 June	20 June	3
1996	1.000	6	1.8	6	11 June	11 June	11 June	1
1997	1.000	5	2.0	5				0
1998	1.000	21	2.1	21	26 June	19 June	05 July	5
1999	1.000	16	2.0	15	25 June	21 June	02 July	8
2000	1.000	10	1.8	10	26 June	23 June	01 July	5
2001	0.960	25	1.9	24	22 June	15 June	29 June	5
2002	1.000	58	2.1	58	18 June	08 June	26 June	37
2003	1.000	19	1.8	19	13 June	08 June	21 June	5
Diving Ducks								
1982	0.500	14	4.7	6	10 July	13 July	22 July	5
1983	0.714	7	6.6	5	24 June	24 June	24 June	1
1984	0.727	11	5.0	8				0
1985	0.556	9	5.4	5	10 July	25 July	25 July	1
1986	0.929	14	6.9	13	08 July	01 July	11 July	4
1987	0.824	17	7.1	14	07 July	02 July	11 July	4
1988	0.824	17	6.7	14	08 July	08 July	08 July	1
1989	1.000	18	7.3	18	08 July	08 July	08 July	1
1990	1.000	9	6.3	9	07 July	06 July	08 July	2
1991	0.571	7	6.5	4	28 June	23 June	02 July	2
1992	0.967	30	7.4	29	06 July	30 June	22 July	19
1993	0.909	33	6.1	30	02 July	29 June	08 July	18
1994	0.941	17	5.6	16	02 July	30 June	03 July	7
1995	0.857	28	6.8	24	03 July	20 June	10 July	14
1996	0.917	12	6.3	11	28 June	17 June	05 July	7
1997	0.917	12	6.4	11	27 June	17 June	04 July	10
1998	0.960	25	6.9	24	04 July	26 June	10 July	14
1999	0.800	15	7.0	12	08 July	01 July	13 July	10
2000	0.935	31	7.8	29	06 July	28 June	11 July	26
2001	1.000	7	3.3	7	07 July	04 July	17 July	6
2002	0.833	12	6.9	10	01 July	29 June	04 July	8
2003	1.000	3	7.0	3	30 June	29 June	01 July	3

Table 2. (Continued) Annual proportion of active nests, mean clutch size, and predicted mean date of hatch.

Year	Proportion of Nests Active		Clutch Size (Active nests)		Predicted Hatch Date			n
	Prop	n	Eggs	n	Mean	Min	Max	
Dabbling Ducks								
1982	0.190	21	6.7	3	10 July	12 July	12 July	1
1983	1.000	4	4.0	4	23 June	23 June	23 June	1
1984	0.500	6	5.0	3	03 July	03 July	03 July	1
1985	0.500	10	5.8	5	08 July	06 July	15 July	2
1986	0.773	22	6.1	17	03 July	22 June	17 July	13
1987	0.833	36	6.3	30	03 July	18 June	14 July	12
1988	0.811	37	6.7	30	01 July	28 June	03 July	2
1989	0.722	36	6.4	25	06 July	03 July	11 July	4
1990	0.700	20	5.6	14	28 June	24 June	03 July	4
1991	0.929	28	6.8	26	24 June	12 June	04 July	13
1992	0.831	59	6.8	49	04 July	21 June	13 July	16
1993	0.852	54	6.5	46	28 June	24 June	01 July	16
1994	0.762	21	6.8	16	28 June	26 June	29 June	5
1995	0.722	36	5.3	26	27 June	18 June	06 July	11
1996	0.762	21	7.6	15	25 June	13 June	02 July	10
1997	0.900	10	7.4	9	17 June	13 June	21 June	4
1998	0.720	82	6.8	59	01 July	18 June	10 July	39
1999	0.794	34	7.2	27	02 July	20 June	12 July	17
2000	0.898	49	6.3	44	30 June	21 June	08 July	28
2001	0.667	30	6.7	20	02 July	27 June	08 July	13
2002	0.750	40	6.0	30	24 June	13 June	03 July	21
2003	0.647	17	8.2	11	20 June	10 June	29 June	8
Small Shorebirds (sandpipers, dunlin, phalaropes, turnstones)								
1982	1.000	5	3.4	5	30 June	30 June	30 June	1
1983	1.000	17	3.9	17				0
1984	1.000	2	4.0	2				0
1985	1.000	19	3.3	19	03 July	22 June	17 July	4
1986	0.943	53	3.5	50	27 June	16 June	11 July	23
1987	0.969	32	3.6	31	21 June	15 June	25 June	7
1988	0.930	43	3.8	40	17 June	16 June	18 June	2
1989	1.000	71	3.5	71	24 June	18 June	04 July	3
1990	0.952	83	3.8	79	25 June	21 June	30 June	2
1991	1.000	90	3.9	90	22 June	08 June	06 July	21
1992	0.975	81	3.8	79	26 June	22 June	29 June	8
1993	0.989	91	3.6	90	21 June	14 June	29 June	15
1994	1.000	55	3.8	55	18 June	13 June	24 June	2
1995	1.000	72	3.8	72	19 June	10 June	25 June	6
1996	0.986	71	3.7	69	20 June	08 June	02 July	10
1997	1.000	76	3.5	75	12 June	09 June	14 June	3
1998	0.955	67	3.6	64	22 June	14 June	28 June	8
1999	0.977	88	3.8	83	25 June	16 June	05 July	17
2000	1.000	92	3.7	92	23 June	14 June	27 June	13
2001	0.965	113	3.7	109	27 June	18 June	04 July	22
2002	0.980	98	3.9	96	19 June	12 June	25 June	21
2003	0.989	88	3.8	87	16 June	13 June	17 June	3