

MONITORING EMPEROR GOOSE POPULATIONS BY AERIAL COUNTS AND FALL AGE RATIO

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Abstract

In 1995, we photographed flocks of emperor geese (*Chen canagica*) during fall migration at lagoons along the north side of the Alaska Peninsula for the 11th consecutive year. The gray head plumage of juvenile geese differed from the uniform white heads of older geese. Cluster sampling by photographs within each lagoon and stratified sampling among lagoons provided unbiased estimates of age ratio for the entire population. The number of geese counted at each lagoon during an independent aerial shoreline survey determined the strata weights. Annual estimation of age ratio and total fall population size were used to monitor annual production, population size, and estimate average survival rate.

Averaging from 1985-1995, 22.4% of the fall emperor goose population were first-year birds; the age ratio ranged from 22-26% except for 1985 and 1992 with 15-16% young. Total population size increased from 1985 to 1995 at a average annual rate of 1.065 and the combined-age, annual survival rate averaged 0.820.

Acknowledgements

In 1985, W.I. Butler, Jr. and M.R. Petersen initiated and conducted aerial photographic sampling for 8 years to estimate age ratio of emperor geese along the AK peninsula. W.W. Larned flew the survey beginning in 1994 and G.R. Balogh photographed geese beginning in 1993. C.P. Dau has contributed additional photographs from Izembek and Nelson Lagoons. Many others have contributed to data collection efforts over the years, especially W.D. Eldridge and S.F. Cantor. Cooperation and logistic support from the Alaska Peninsula/Becharof National Wildlife Refuge in King Salmon and Izembek National Wildlife Refuge in Cold Bay were essential and much appreciated.

Objectives

Our objectives in this report are to present the results obtained in 1995, and compare these results with data from earlier years. See Butler et. al (1995) for a detailed discussion of the survey and management recommendations.

Methods

Butler et al. (1995) described, in detail, the methods used for both data acquisition and analysis with regards to both the Fall Population Survey and the Age Ratio Survey. Following recommendations made in 1994 by Stehn (pers. commun.), we used 400 ASA speed film this year, with a wide open aperture to minimize the camera's shutter speed. Results were improved over the previous year. It has been the photographer's mistaken impression that photos of emperor geese taken over a green vegetation background were easier to interpret due to the increased contrast between the geese and the background. Upon closer examination of the photos, however, it became obvious that the best backgrounds for this endeavor were sand and smooth water.

Results

The 1995 Fall Population Survey indicated 91,009 emperor geese present between Egegik and Izembek Lagoons on 14 October. Nelson Lagoon was, again, the most used lagoon as a staging area (Table 1, Fig. 1). The mean proportion of young in the 1995 fall population was 0.255; the highest since the inception of this survey (Table 2), although not significantly higher than the proportions obtained in 1986-1991, or in 1993-1994. All years except 1985 and 1992 had age ratios ranging from 0.219 to 0.255 (avg=0.239, n=8) (Table 2); none were significantly different among themselves. The coefficients of variation (standard error/mean) for the annual proportion of young were 3.7-5.9% in all except the first year. Beginning in 1986 the sample has included at least 255 photographs with 5,700 birds (Table 2).

The estimated age ratio was used to partition the total fall population into the number of adults and number of young (Table 3). This allowed calculation of the number of geese not returning in the subsequent year. The number of young in the fall population averaged 17,513 with estimates varying from 9,840 to 26,257 (Table 3).

In 1995, Ugashik had a notably lower proportion of young present, and the other 6 lagoons were similar in their age composition (Table 4, Fig. 2). This was the second highest production year on record, with 23,207 young produced, exceeded only by 1990, when 26,257 young were in the staging flocks. In 1990, however, the population count was abruptly higher and the mortality to the subsequent year was unrealistic, suggesting that unusual conditions or some bias occurred in the 1990 aerial survey count.

Data from 1986 to 1995 showed that an average of 15,158 adult-plumaged birds were missing from the total geese (young plus adults) of the previous fall population (Table 3). Average annual production (17,513) exceeded average annual mortality (14,699) by 2,355 birds. The unweighted average from 1986-1995 of the annual proportion of geese not returning from the previous year was 0.179. Expressed as an October-to-October, combined-age, annual survival rate, the average survival was 0.820 (Table 3). When considering the sum of the number of birds surviving from year to year divided by the sum of the total count, the average survival rate for the past 10 years was 0.802. From 1985-1995, population numbers increased at an average annual rate of 1.0651.

Literature Cited

Butler, W.I., R.A. Stehn, R.J. King, M.R. Petersen, and C.P. Dau. 1995. Monitoring emperor goose populations by aerial survey counts and fall age ratio. U.S. Fish and Wildl. Serv., Anchorage, Alas. Unpubl. Rep. 28pp.

Table 1. Number of Emperor geese counted on aerial surveys in early October 1985-1994 on aerial surveys along the Alaska Peninsula.

Year	Dates in Oct.	Observers	North Bay	Egegik Bay	Ugashik Bay	Cinder Lagoon	Port Heiden	Seal Isl.	Nelson Lagoon	Izembek Lagoon	South side	Total
1979	1-4	BC, REG, MRP	0	60	84	3255	28603	6719	13067	7326	6636 ^c	65750
1980	1-9	RJK, REG	8	588	322	5284	9695	4064	35481	7649	6636 ^c	69727
1981	3-8	RJK, DVD, REG	131	2288	2405	1626	7299	5552	30585	7580	5690	63156
1982	6-10	RJK, KSB	0	1056	2063	5000	14097	9980	30684	9580	8148	80608
1983	10-16	RJK, DVD	19	369	723	5029	11642	4510	29002	13642	7615	72551 ^d
1984	3-8	RJK, DVD	0	1641	2223	9351	17923	10378	29689	6546	5091	82842
1985	10-14	RJK, WDE	0	2058	1474	7700	9260	5081	25155	3895	5161	59784
1986	5-11	RJK, WDE	0	65	693	12112	12263	13960	22282	4770	1288	67433
1987	2-5	RJK, WDE	24	1920	1289	14610	10362	8310	22056	3716	3349	65636
1988	7-12	RJK, WDE	12	816	1188	12844	20116	7440	24400	5438	3911	76153
1989	7-12	RJK, BG	15	1195	1841	10456	7769	11173	26558	5133	6589	70729
1990	16-20	RJK, AWB	3	89	1833	11910	21677	19990	39420	9439	5133	109491
1991	16-20	RJK, AWB	3	1644	1790	11525	12711	15242	22552	4324	5493	75284
1992	?	RJK, AWB	0	636	701	16059	9108	14034	26663	8070	6383	81654
1993	?	RJK, DD	?	664	660	12725	9740	8548	27076	5049	6589?	71051
1994	8-14	RJK, KL	?	1002	730	19046	10421	10465	32376	5908	7138?	87086
1995	14	RJK, KSB	?	907	1195	23745	10467	9938	32803	2033	9921 ^e	91009

^a Observers - Bruce Conant, Margaret R. Petersen, Robert E. Gill, Jr., Rod J. King, Dirk V. Derksen, W.D. Eldridge, Karen S. Bollinger, Barbara Gradin, Allen W. Brackney, Donna Dewhurst, Karen Laing.

^b Named survey sections include shoreline segments as follows: north of AK peninsula (segments 1-7), Egegik Bay (8-10), Ugashik River (11), Cinder River & Hook Lagoon (12-14), Port Heiden (15), Seal Islands (16-18), Port Moller, Herendeen Bay, Mud Bay, & Nelson Lagoon (19-21), Izembek Lagoon, Moffet Bay, Big Lagoon, Middle Lagoon, St. Catherines's Cove (22-30), south side of AK peninsula (31-56).

^c South side was not surveyed, therefore the avg. count of 6636 from the next 4 years was substituted for the missing data

^d Survey repeated on 22 Oct 1983 by B. Conant and J.G. King counted 82,610 emperors

^e Total for south side calculated as the difference between North side lagoon totals and survey grand total.

Table 2. The number of photographs, number of young and total emperor geese photographed from aircraft in late September and October, 1985 to 1994. The mean and standard error (SE) of the proportion of young in flocks on the north side of the Alaska Peninsula was calculated based on population count weighted and self-weighted strata.

Year	Dates	Young	Total	Number birds/ photos photo		Count- weighted		Self- weighted	
						Mean	SE	Mean	SE
1985	24 Sep-10 Oct	536	3193	155	20.6	0.165	0.026	0.168	0.018
1986	30 Sep-15 Oct	1659	6380	311	20.5	0.254	0.015	0.260	0.017
1987	16 Sep-10 Oct	2417	10177	703	14.5	0.228	0.008	0.238	0.008
1988	25 Sep-3 Oct	2747	11180	483	23.1	0.244	0.009	0.246	0.009
1989	23 Sep-3 Oct	2684	12718	390	32.6	0.219	0.011	0.211	0.011
1990	28 Sep-4 Oct	3418	13541	474	28.6	0.240	0.009	0.252	0.009
1991	26 Sep-4 Oct	3433	14569	412	35.4	0.232	0.009	0.236	0.009
1992	26 Sep-4 Oct	2154	14832	403	36.8	0.155	0.008	0.145	0.008
1993	1-3 Oct	1372	5735	255	22.5	0.242	0.013	0.239	0.013
1994	26-29 Sep	3974	16881	479	35.2	0.228	0.010	0.235	0.009
1995	26-29 Sep	2947	11664	361	32.3	0.255	0.013	0.253	0.012

Table 3. Total population size, proportion young, annual production of young, and adult population size of emperor geese based on fall survey counts and age ratio of flocks on the Alaska Peninsula. Age ratio data prior to 1985 were based on observations at Izembek Lagoon.

Year	Total count	Age ratio	Adults	Young	Mortality number	Survival rate	
1979	64319	0.1184	56703	7615			
1980	68296	0.2480	51359	16937	12960	0.798	
1981	63156	0.3169	43142	20014	25154	0.632	
1982	80608	0.0781	74313	6295	-11157	1.177	
1983	72551	0.2708	52904	19647	27704	0.656	
1984	82842	0.2241	64277	18565	8274	0.886	
1985	59784	0.1646	49944	9840	32898	0.603	1979-1985 avg=0.792
1986	67433	0.2538	50319	17114	9465	0.842	
1987	65636	0.2278	50684	14952	16749	0.752	
1988	76165	0.2443	57558	18607	8078	0.877	
1989	70729	0.2194	55211	15518	20954	0.725	
1990	109494	0.2398	83237	26257	-12508	1.177	
1991	75284	0.2315	57856	17428	51638	0.528	
1992	81654	0.1550	68998	12656	6286	0.916	
1993	71051	0.2417	53878	17173	27776	0.660	
1994	87086	0.2284	67196	19890	3855	0.946	
1995	91009	0.255	67801	23207	19285	0.779	1986-1995 avg.=0.820

Table 4. Proportion of young observed in photograph samples during fall staging of Emperor geese in lagoons on the Alaska Peninsula.

	Egegik	Ugashik	Cinder	Heiden	Seal Isl	Nelson	Izembek
1985	-	-	0.0868	0.2179	0.2354	0.1528	0.1747
1986	0.1740	0.2684	0.2772	0.1563	0.1642	0.3371	0.3175
1987	0.0000	0.0459	0.2506	0.1952	0.2204	0.2607	0.2303
1988	0.2530	0.1667	0.2734	0.2387	0.1982	0.2538	0.2319
1989	0.2424	0.0925	0.1959	0.1909	0.1295	0.2822	0.2215
1990	0.1556	0.1708	0.3393	0.2237	0.2322	0.2468	0.1659
1991	0.1988	0.1056	0.3018	0.2373	0.2070	0.2246	0.2135
1992	0.0761	0.0885	0.1805	0.1222	0.0686	0.1765	0.2331
1993	0.0940	0.2109	0.2306	0.1709	0.1481	0.2958	0.2977
1994	0.2364	0.1923	0.2351	0.2480	0.2614	0.2195	0.1661
1995	0.2556	0.1278	0.2847	0.2348	0.2165	0.2562	0.2693

Fall Staging Emperor Goose Population Distribution

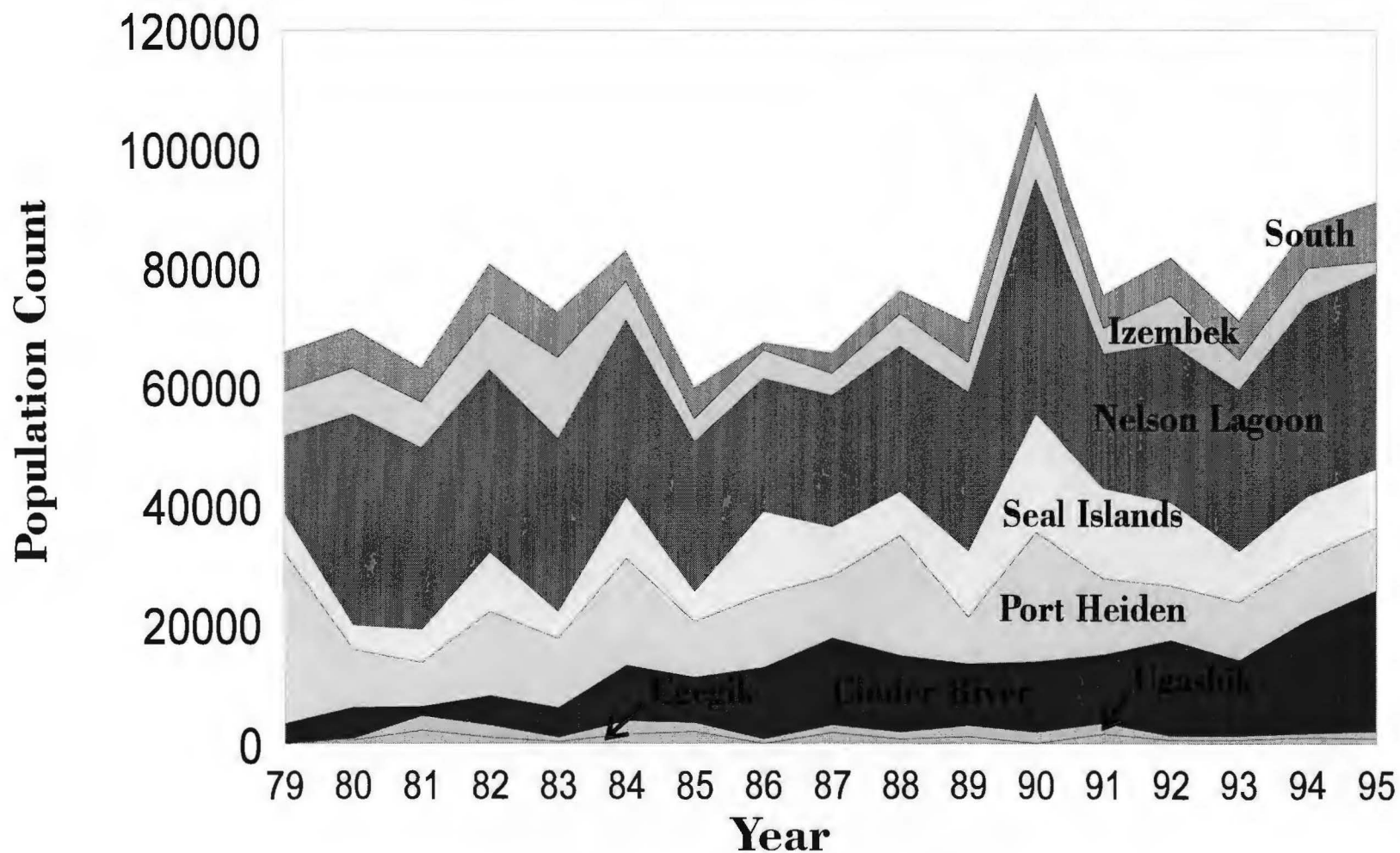


Fig. 1. Relative importance of lagoons along the Alaska Peninsula as measured by the number of emperor geese counted in the early October aerial survey.

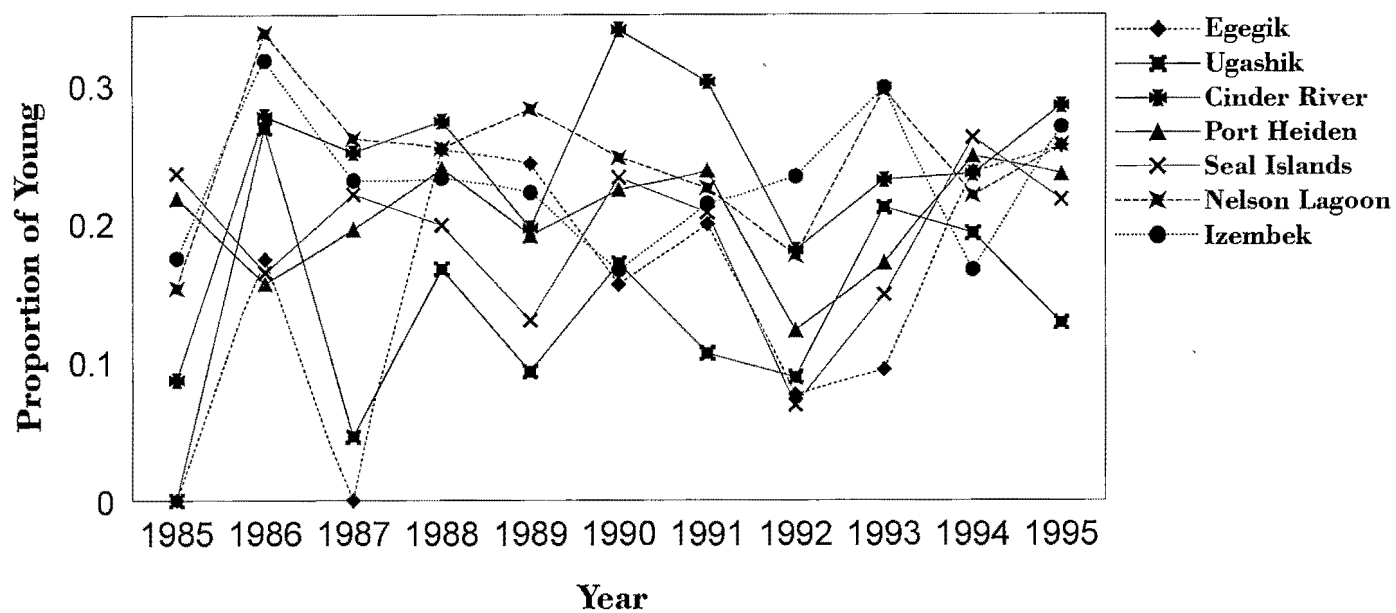


Fig. 2. Proportion of young emperor geese per lagoon as measured by photograph cluster samples during fall staging on the Alaska Peninsula.