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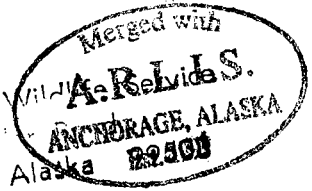
DISTRIBUTION AND PRODUCTIVITY OF FALL STAGING SNOW GEESE ON THE
ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA, AND NORTH SLOPE, YUKON TERRITORY

Results of 1980 surveys

by

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Distribution and productivity of snow geese from the Banks Island Population that stage in fall on the arctic coastal plain between Barter Island, Alaska and Phillips Bay, Yukon were determined by aerial survey on 9 September 1980. Additionally, the staff of the Arctic National Wildlife Refuge (ANWR) was able to monitor the fall migration of birds along the eastern coastal plain of the refuge. From 15 August to 3 September, Biological Technician Jim Levison performed randomly selected (in time) migration watches and opportunistic watches from vantage points at Beaufort Lagoon and Pingokraluk Point.

The aerial survey was conducted on 9 September 1980 in a Helio H-295 aircraft with D.E. Ross as pilot, and M. Spindler and G. Garner as observers. No snow geese were seen on the ANWR coastal plain west of the Kongakut River. A flock of 13 birds was seen and photographed 1 km east of the Kongakut near VABM DAR. We continued the survey into Canada as far east as Phillips Bay. Several large flocks were encountered and photographed for age composition between the Clarence and Firth Rivers. No more flocks were encountered between the Firth River and Phillips Bay, and the survey plane returned to Barter Island. A few more flocks were photographed near Herschel Island on the return flight. No snow geese were seen on a reconnaissance flight W of Barter Island on 10 September.

Comparatively, the 1980 survey was the second out of 7 years of snow goose survey data that indicated the estimated number of snow geese staging in the ANWR was less than 10,000 birds (Table 1). Also, 1980 was a year of early arrival and early departure (Table 2). Complicating the comparisons of total goose population staging in the area, the arrival and departure dates, and age-ratios among the various years of survey data are additional factors, the effects of which are not easily quantified or controlled: (1) differing dates of survey and portions of areas covered on particular dates, largely due to inclement weather and logistical difficulties; (2) effect of varying weather conditions on the birds in each year, and; (3) annual, daily, and spatial variation in age ratio, population, and distribution. Other major factors complicating such comparisons, but which can be controlled, are the different survey methods employed in the various years because the techniques were steadily being refined and improved along with differing environmental conditions under which the surveys were made. In the early years, 1971-1972, emphasis was on description of timing and size of migration movements

Table 1. Total numbers of Banks Island Snow Geese counted during August-September staging surveys, 1973-1980.

Year	Alaska	Yukon North Slope	Mackenzie Delta	Total	Survey Dates
1973 ^a	44,037	126,960	86,520	257,517	Sept. 2,3,5,6,11,12,18,22,23,25
1974 ^a	48,591	37,435	28,913	114,939	Aug. 24,31, Sept. 5,11,16,25
1975 ^a	0	20,972	685,305	706,277	Aug. 25-28, Sept. 8,10,11,13,17-18, 20,23
1976 ^a	228,793	224,401	18,363	471,557	Aug. 16-20,29-31, Sept. 4-6,10-13,18-21
1978 ^b	325,760	N/D	N/D	N/D	Sept. 13-14
1979 ^c	195,000	41,000	N/D	N/D	Sept. 6-7
1980	8,996 ^d	7,500 ^e	N/D	N/D	Sept. 9

- Sources:
- ^a Koski 1977b, extrapolation from transects at several points in time, not all areas covered on each date.
 - ^b Spindler 1978, extrapolation from transects at one point in time.
 - ^c Spindler 1979; note Yukon count incomplete, Demarcation Bay to Phillips Bay, estimates of all flocks seen, and photograph counts, at one point in time.
 - ^d Ground counts by Jim Levison, estimates of all flocks seen continuous count during daylight hours.
 - ^e Estimated total; Actual photograph count was less; Demarcation Bay to Phillips Bay.

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Table 2. Dates of arrival and departure of snow geese on the Mackenzie Delta, Yukon North Slope, and Eastern Alaskan North Slope, August and September 1971-1976 and 1978-1980. The 1978-1980 data are from Arctic National Wildlife Refuge only.

Year	Date first flock sighted	Dates of Major arrival	Major departure	Date last flock sighted	Survey period ^a
1971 ^b	15 Aug.	31 Aug.-2 Sept.	12-16 Sept.	17 Sept	4 June-19 Sept.
1972 ^c	17 Aug	27-29 Aug.	7-10 Sept.	15 Sept.	10 July-17 Sept.
1973 ^d	23 Aug.	1-12 Sept.	22-25 Sept.	4 Oct.	25 Aug.-29 Sept.
1974 ^e	21 Aug.	22-25 Aug.	17-21 Sept.	30 Sept.	24 Aug.-30 Sept.
1975 ^f	18 Aug.	3-5 or 6 Sept.	19-24 Sept.	25 Sept.	20 Aug.-25 Sept.
1976 ^g	13 Aug.	25-28 Aug.	16-26 Sept.	30 Sept.	15 Aug. 2 Oct.
1978 ^h	20 Aug.	25 Aug.-1 Sept.	16-27 Sept.	27 Sept. or before	10 June-5 Oct.
1979 ⁱ	24 Aug.	26-28 Aug.	15 Sept.	N/D	10 June-15 Sept.
1980	15 Aug.	19-21 Aug.	1-2 Sept.	9 Sept.	5 June -12 Sept.

^a Dates inclusive of aerial and ground observation period. Locations of ground observation and aerial survey coverage varied: 1971-1976 data emphasized Mackenzie and Yukon locations, while 1978-1980 data emphasized Alaskan locations. For details see respective sources:

^b Schweinsburg (1974)

^c Gollop and Davis (1974)

^d Koski and Gollop (1974)

^e Koski (1975)

^f Koski (1977a)

^g Koski (1977b)

^h Spindler (1978)

ⁱ Spindler (1979)

largely from ground observations but accompanied by aerial surveys (Schweinsburg 1974 and Gollop and Davis 1974). From 1973-1976 the most extensive systematic aerial surveys were conducted (Koski and Gollop 1974, Koski 1975, 1977a, 1977b): population estimates were derived from extrapolation of transect counts and age ratios were obtained from actual aerial and ground composition counts. The ANWR surveys made in 1978-1980 emphasized systematic transect surveys with population estimates made by extrapolation in 1978, and total flock counts combined with photographic counts in 1979 and 1980 (Spindler 1978, 1979). Age ratios were determined from photographic counts in the latter two years. There is a need for standardization of survey methods and for establishment of minimum environmental conditions under which the surveys are conducted.

The age ratio sample included 1046 birds from 9 different flocks (Table 3). Photographs of total flock size in conjunction with closeup photographs (with telephoto lens) of the same flock allowed calculation of weighted means and standard deviations for age ratios. The 1980 estimate for immature birds (weighted according to flock size) was 3.3% (+ 1.2% SD). This was similar to the 1979 estimate of 3.1 % immatures, but unfortunately the 1980 sample is only a quarter the size of the 1979 sample. The 1980 age ratio is lower than 3 of 6 previous years (1973, 1975 and 1976) but higher than 1974 (Table 4). This comparison, however, must recognize the qualifications made above regarding differences in environmental and survey conditions between years. In addition, temporal and spatial variation in age ratio most likely occurs on the ANWR staging grounds (Spindler 1978, 1979, and Dau, pers. comm.) and must be dealt with through improved sampling techniques.

Snow geese had apparently moved into the Arctic National Wildlife Refuge by 15 August when 100 were seen near Pingokraluk Point. By 18 August several small flocks of about 100-350 birds each were seen flying west past Beaufort Lagoon. From 25 to 27 August more small groups totalling 1205 birds were seen entering the study area from the east. From 24 to 31 August continuous westerly winds (up to 56 mph on 29 August) were observed at Barter Island. These westerlies may have prevented large numbers of snow geese from staging very far to the west in 1980. On 1 and 2 September, 4880 snow geese were observed flying east past Demarcation Bay; these birds may have been the bulk of the birds that staged on the ANWR coastal plain in 1980, and were already migrating back east by early September. Geographic variation in the actual arrival and departure dates is probably not significant, since Koski (1974:12-18) noted that the peak arrival date in 1973 varied by only 3 days for 5 locations (listed east to west: Shingle Point, Blow River, Bloomfield Lake, Komakuk Beach, and Demarcation Bay) which are separated by 100 miles. The movement into the staging ground was quite rapid and direct that year. Koski (1974:13) suggested that weather most likely exerted the major influence upon snow goose movements from the breeding areas to the staging areas.

Table 3. Snow goose fall productivity survey, arctic coastal plain, Alaska and western Yukon, 1980.

Flock number	Flock size	Photo subsample				Total flock							
		Ad.	Imm.	Tot.	%Imm.	Ad.	Imm.	Tot.	%Imm.				
1	13	10	3	13	23.1					10	3	13	23.1
2	1115	410	4	414	2.8					410	4	414	2.8
3	542	60	0	60	0					60	0	60	0
4 ^a	458	76	2	78	2.6	63	7	70	10.0	139	9	148	6.1
4 ^b	158	50	5	55	9.1					50	5	55	9.1
5	25	22	3	25	12.0					22	3	25	12.0
6	188 ^a	71	0	71	0	150	2	152	1.3	221	2	223	0.9
7 ^a	no data ^b	51	8	59	13.6					51	8	59	13.6
7 ^b	no data	46	3	49	6.1					46	3	49	6.1
TOTAL	2499	796	28	824	3.4	213	9	222	4.0	1009	37	1046	3.5
WEIGHTED $\bar{x} \pm SD$	c,d												3.3 \pm 1.2

^a Subsample total exceeds total flock size, indicating photographs of flocks (subsamples) overlapped.

^b Photographic quality unsuitable for counting.

^c In calculation of weighted mean and variance, %Imm. value was weighted according to actual observed flock size.

^d Flock 7 sample not included in weighted mean and variance due to absence of flock size data.

Table 4. Comparison of age ratios for Banks Island snow geese staging on the Alaska and Yukon North Slope, and Mackenzie Delta 1973-1976 (Koski 1977b) and 1979-1980.

Year	Adults	Immature	% Immature	Area of survey	Technique
1973	4533	5399	119.1	MD, YNS, AK ^b	Comp. count
1974	28647	29	1.0	MD, YNS, AK	Comp. count
1975	12223	13638	111.6	MD, YNS, AK	Comp. count
1976	7375	5541	75.1	MD, YNS, AK	Comp. count
1979	4275	133	3.1	YNS, AK	Photo
1980	1046	37	3.5 (3.3 ± 1.2) ^a	YNS, AK	Photo

^a Estimate in parentheses is thought to be a better estimator because it is weighted according to flock size of samples.

^b MD-Mackenzie Delta; YNS-Yukon North Slope; AK-ANWR, Alaska

The apparent faltering productivity of this population should be investigated further through inspection of the Banks Island colony during the breeding season and increased effort in the staging surveys. The ANWR snow goose distribution and productivity surveys should be continued annually. It would be ideal to again have a ground observer to note arrival dates and dates of major influxes so that aerial surveys could be more optimally timed. It would also be desirable to plan enough fuel and time to allow continuation of the survey into the Mackenzie River delta. Because of the difficulties in comparing age ratios between years of differing survey coverage and timing, serious consideration should be given to surveying the entire staging area each year (e.g. from the Hulahula River, Alaska on the west to the Anderson River, N.W.T. on the east). A cooperative survey arrangement between the U.S. Fish and Wildlife Service, The Canadian Wildlife Service, Yukon Game Branch and Northwest Territories Wildlife Service should be initiated to perform coordinated fall surveys of the entire staging ground.

Finally, the ANWR staff will standardize survey methods and minimum conditions under which all future surveys will be made. Recommended standardization criteria include:

- (1) Continue the 6 mile (9km) systematic transect spacing initiated by Koski in 1973.
- (2) Use a combination of photography and visual estimates to determine total flock size. Visual estimates are more efficient with extremely large flocks (less than 10,000 birds) and small flocks (greater than 400 birds).
- (3) Use photography for age ratio estimation.
- (4) Time the survey to occur about 20 days after the first arrival date or 7 to 10 days after the major arrival dates each year, irrespective of calendar date. This timing would increase the likelihood that the survey would coincide with maximum staging population, and would help minimize temporal variation of age ratio due to varying survey dates.
- (5) Conduct the survey only when there is no snow cover, ceilings are greater than 500ft (150m), visibility is greater than 10 miles (16km) and there is minimal turbulence.
- (6) Conduct the survey under good lighting conditions (i.e. allowing shutter speeds of 1/500 or 1/1000 second using ASA 400 film). Avoid heavy overcast days; or early morning/late evening hours.
- (7) The survey crew should be proficient in estimation of flock sizes, having recently practiced with photographs of known flock size or rice grains on a dark table. The crew should also be able to take quality aerial photographs of flocks and be familiar with the area.

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photo subsample					Total flock			
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				60	0	60	0	
63	7	70	10.0	139	9	148	6.1	
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