

SOME POPULATION CHARACTERISTICS
OF DALL SHEEP IN SIX
ALASKAN NATIONAL PARKS AND PRESERVES

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ABSTRACT

Dall sheep were surveyed 1981-83 in six National Parks and Preserves in Alaska, which were newly created in 1980. About 46% of the sheep were observed in Preserve which are open to sport hunting and 54% in Park or protected areas. Preserves contained 2-4x more legal rams per unit of land than Park lands. Sheep numbers averaged 76% higher than in the same portions of the new areas counted in the 1970's. Mature rams associated more with nursery groups than is commonly reported during summer and only minor segregation of ram groups was observed.

INTRODUCTION

In December 2, 1980, the Alaska National Interest Lands Conservation Act (ANILCA) was passed establishing 10 new National Parks, Monuments, and Preserves and adding lands to 3 existing areas in Alaska. Six of these areas have populations of Dall sheep. Sport hunting in allowed is the Preserve portions and subsistence hunting by local, traditional users is permitted in the Preserves and some of the new Park areas. Only Dall sheep in established portions of Denali (formerly Mt. McKinley) National Park (about 2,200 animals) are totally protected from all forms of human harvest.

The new Parks emphasized scenic mountainous terrain and interior areas and as a result, Dall sheep populations more than other Alaska big game species (Wright 1984). The impact of ANILCA's passage on sport hunting of Dall sheep generated a considerable amount of debate during the passage of the Act and was the topic of 3 papers presented at the Northern Wild Sheep and Goat Council Symposia (Heimer 1978; 1980; 1982). From 1981-83, the U.S. National Park Service (NPS) surveyed sheep populations in the newly-created areas. This paper presents new information on the numbers and some population features of Dall sheep in the Denali National Park and Preserve, Lake Clark National Park and Preserve, Wrangell-St. Elias National Park and Preserve, Gates of the Arctic National Park and Preserve, Noatak National Preserve and Yukon-Charley Rivers National Preserve.

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METHODS

Count units or arbitrary sample blocks were delineated on the basis of major drainages and terrain; 29 count units were established in Gates of the Arctic, 24 in Denali, 28 in Wrangell-St. Elias, 18 in the Noatak, and 6 in Lake Clark. Efforts were made to reduce counting errors from sheep movements by selecting unit boundaries on the basis of the best natural obstacles to sheep movements, such as broad flat areas, rivers, etc., by counting entire count units in a day and by consecutively surveying adjacent units. Nevertheless, sheep movements undoubtedly occurred during the counting process but hopefully ingress approximated egress.

The NPS chartered helicopter (Bell Jet Ranger II) typically flew each count unit counter-clockwise thereby placing 2 observers on the left side of the helicopter against the mountain side, while the 3rd (right side) observer was responsible for lower slopes and across canyons. A single contour was flown usually at mid-slope except in Lake Clark and Wrangell-St. Elias, where sheep occurred at many elevations and 2 flight contours were necessary. The following classification categories were employed: lamb, yearling, ewe, $\frac{1}{2}$ curl ram, $\frac{1}{2}$ curl ram, $\frac{3}{4}$ curl ram, $\frac{7}{8}$ curl ram, $\frac{4}{4+}$ curl ram. For the helicopter portion of the survey, this level of classification was obtained for 75% of the sheep seen in Denali, 95% in Wrangell-St. Elias, 98% in Lake Clark, 94% in Gates of the Arctic, and 82% in the Noatak. Some $\frac{1}{2}$ curl rams in nursery groups were undoubtedly classes as ewes but this error source was minimized by the spotting scope work discussed below and maneuverability of the helicopter. Small groups were classified during 1 to 2 low passes but for larger groups of 20+, the helicopter landed nearby (200-400 m) and 15-45x spotting scopes were used. The landings greatly aided counting and classification detail, and also helped to avoid undue harassment of the larger groups by avoiding the repeated circling required in counting larger groups. While initially laborious, we eventually reduced our landing times to 4-7 minutes. Sheep were typically calm and stationary during landings through a combination of landing down wind, landing out of view, and descending or ascending away from the sheep.

The Super Cub surveys were similar except that more complex maneuvers were flown in order to inspect narrow canyons, ravines and drainage heads. Also, typically yearlings were not distinguished and all rams were pooled as either <7/8 or >7/8 curl.

RESULTS AND DISCUSSION

SURVEY EFFORT

Approximately 505 hours of aircraft time were devoted to the counting of sheep in 1981, 1982, and 1983. These times include local travel to and from units, but not major moves or the time to supply base camps. Survey effort was 58% by the helicopter and 42% by the Super Cub. Pilot (B. Roberts) and classifier (F. Singer) were the same for 56% of the survey time. About 98% of the sheep-occupied areas in the six National Parks and Preserves were surveyed 1981-83 with both aircraft types, with 34% of the survey effort in 1981, 15% in 1982, and 51% in 1983.

The largest proportion of the survey effort (36%) was devoted to Wrangell-St. Elias, with 35% devoted to Gates of the Arctic, 12% to Noatak, 6% to Denali, 4% to Lake Clark, and 4% to Yukon-Charley Rivers.

SHEEP NUMBERS

Two large count units (25 and 27)^{1/} were not counted in Gates of the Arctic but sheep numbers were estimated from adjacent surveyed units. Numbers in 4 other units were extrapolated from ADF&G counts made there in 1974. Only 2 mountains south of the Chitina River in Wrangell-St. Elias were uncounted--they contained only 78 sheep in 1973.

A total of 30,455 Dall sheep were counted in the 6 National Parks and Preserves. Wrangell-St. Elias had the most sheep and the highest densities. Approximately 16,523 (54%) of the sheep were in Park category lands and 13,932 (46%) in Preserve lands (Table 1). In all but Denali, the highest densities were in the Preserve sectors. Also, 1 count unit in Gates of the Arctic, and 7 count units in Wrangell-St. Elias are split between Park and Preserve status, suggesting additional sheep might be subjected to sport hunting if they moved through the mountains at hunting season. Location of sheep harvests influenced placement of Preserve boundaries (Wright 1984) and as a result, 79% of the sheep in Wrangell-St. Elias, the most significant State sheep harvest area, were observed in Preserve.

We counted 76% more sheep in 1981-83 than were counted in 1972-78 in previously-counted portions of the Parks and Preserves (Table 2).

The considerable increases in sheep seen in those areas may be due to one or a combination of the following factors:

- 1) Sheep increase. While few sheep population increases are documented in Alaska during this period, Dall sheep increased 89% in the closely monitored Chugach State Park, 1979-83 (18% per year).

^{1/} Maps of count units on file, Natl. Park Serv., Anchorage, AK.

Table 1. Dall sheep numbers in 6 National Parks and Preserves in Alaska, 1981-83.

Administrative Area	Total Sheep	PARK		PRESERVE	
		Sub-total	Sheep/mi ²	Sub-total	Sheep/mi ²
Wrangell-St. Elias	13,095	2,717	1.7	10,378	2.8
Gates of the Arctic	12,343	10,831	1.1	1,512	2.1
Denali	2,476	2,362	2.0	114	---
Lake Clark	805	613	0.8	192	1.0
Noatak	1,556			1,556	0.4
Yukon-Charley Rivers	180			180	---
TOTAL	30,455	16,523		13,932	

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1,000

Table 2. Dall sheep counts in the 1970's compared to 1981-83 counts in 5 National Parks and Preserves in Alaska.

Administrative Area	Count Units Involved	Year of Last Count		Percent Difference
		1972-73	1981-83	
Wrangell-St. Elias	2,6,7,8,9,12,13,14,21	3,054	5,283	+ 73
Gates of the Arctic	5,6,7,8,9b,16b	789	1,589	+101
Denali		1,104	2,362	+114
Noatak	2,3,4,5,6,15,16	834	1,074	+ 29
Lake Clark	1-6	530	805	+ 52
TOTAL		6,311	11,113	+ 76

- 2) Aircraft types. The helicopter, which was used for 58% of the work in the 1980's but not in the 1970's, may be more maneuverable, holds 3 observers, and has a more stable viewing platform than a Super Cub, which holds only 1 observer. However, the 1980's Cub counts were also higher.
- 3) Survey efficiency. A smaller number of more experienced pilots and observers were used in the 1980's counts.
- 4) Lamb crops. Hoefs and Bayer (1983) observed the Kluane Lake sheep herd to be stable 1960-80. Fluctuations of 17% around a mean value were largely due to differences in lamb crops. Lamb percent was higher in Alaska in the 1980's counts over the 1970's counts (Table 3), but the differences were trivial.

Table 3. Proportion of lambs in 1970's and 1980's counts in parts of the National Parks and Preserves in Alaska.

Area	1970's Counts (%)	1980's Counts (%)	Difference
Wrangell-St. Elias	18	19	+1
Gates of the Arctic	18	18	0
Noatak	18	21	+3
Denali	21	23	+2
Lake Clark	28	32	+4

The difficulty of accurately surveying Dall sheep in clearly demonstrated by the survey efforts in Denali National Park. A number of authors have based their conclusions upon counts or estimates in the Park made from ground or Super Cub (Murphy and Whitten 1976; Haber 1977; Heimer 1979). Partial counts have often been reported on, however, many of the sheep cross from the Outside (winter range) to the Alaska Range and back during summer (Murie 1944; Whitten 1975). Highly inconsistent percents of the sheep herd may be found in Park sectors in any survey (Table 4), thereby mandating that the entire Park and both ranges be counted during any trend count. In addition, the helicopter count in 1981 was 114% higher than a Super Cub count in 1978, suggesting great inefficiency in both that and possibly all the earlier Cub counts. During the 1978-81 period, lamb ratios per 100 ewes averaged only 58%, yearling ratios 27%, and lamb to yearling overwinter survival 45%, which does not suggest a large increase in Dall sheep (Simmons et al. 1984). The greatest annual rate of increase for Dall sheep actually documented is 11% (L. Nichols, unpubl. data) and 18% (Ak. Dept. of Fish and Game, 1984 Regulatory Proposals, Juneau).

Wrangell-St. Elias held the most variable population with count unit densities ranging from 0.6 to 8.2 sheep per mi^2 , and Gates of the Arctic was the next most variable with densities ranging from 0.3 to 3.1 sheep per mi^2 . Both are large and diverse land areas. Densities of 0.3 sheep per mi^2 were considered low; 0 of 24 count units in Denali, 0 of 23 count units in the Wrangells (north of the Chitina River) had a density this low, but 2 of 29 count units in Gates of the Arctic, 1 of 6 count units in Lake Clark, but 9 of 18 count units in the Noatak. Four count units in the Noatak had less than 0.10 sheep per mi^2 .

Table 4. Proportions of Dall sheep found in the Outside versus the Alaska Ranges in Denali National Park during complete aerial surveys.

Year	Survey Date	Percent in Outside Range	Percent in Alaska Range
1957	Aug 14-15	54	46
1959	Jul 18	62	38
1961	Jun 29	80	20
1975	Jul 8-11	35	62
1978	Jul 22-24	47	53
1981	Jul 7-11	51	49

RAM STATISTICS

Wrangell-St. Elias possessed the highest Sportsman's Index (number of 7/8+ curl rams per 100 mi²) and the highest ratio of 7/8+ rams to younger rams, but it was followed closely by Denali (Table 5). Lower Sportsman's indices were largely due to lower sheep densities (Table 1), and additionally, both of the Brooks Range areas (Noatak and Gates of the Arctic) have slower horn growth rates (Heimer and Smith 1975) and fewer rams are likely to reach the larger size classes. There were more 7/8+ rams per area on Preserve lands than Park lands and in the cases of Gates of the Arctic and Wrangell-St. Elias, the differences were very substantial, 2.6 and 4 times, respectively. In addition, in 3 of those count units (mountain units) split between Park and Preserve status, where groups were plotted on maps, 2 units had an average of 90% more rams in the Preserve than Park sector. Efforts were made when the Preserve boundaries were drawn to consult hunting guides and harvest figures and to include areas with highest ram concentrations (Wright 1984); this was found to be the situation.

Table 5. Legal ram percentages and relative densities in 5 National Parks and Preserves in Alaska.

Administrative Area		Total Sheep	7/8+ Rams as % of Herd	7/8+ Rams as % of all rams	Sportsman's Index ^{1/}
Wrangell-St. Elias:	Preserve	7,096	10	29	29
	Park/Preserve ^{2/}	3,777	10	42	30
	Park	1,307	7	60	7
Gates of the Arctic:	Preserve	1,512	16	20	18
	Park	10,831	9	22	7
Denali:	Park	2,362	7	49	22
Noatak:	Preserve	1,556	9	36	4
Lake Clark:	Preserve	192	7	39	8
	Park	613	8	45	7

^{1/} Number of legal (7/8+ curl) rams per 100 mi².

^{2/} Count units split between Park and Preserve status.

RAM DISTRIBUTIONS

Ram percent was lower in higher density count units in 2 Parks but not in 3 others. Rams per 100 ewes was negatively correlated to density in Wrangell-St. Elias (Spearman rank correlation, $P < 0.05$, $r_s = -0.86$) and the relationship closely approached significance in Lake Clark ($r_s = -0.70$, $N=5$ units), but there was no correlation in Gates of the Arctic ($r_s = 0.11$, $N=20$ units) or the Noatak ($r_s = 0.008$, $N=13$, units, Figure 1).

A number of observers report no Dall sheep rams older than 3 years in nursery groups during summer (Haber 1977; Hoefs and Cowan 1979; Hoefs and Buyer 1983). This situation was nearly approximated in lower density Parks and Preserves such as the Noatak (Table 6) but in higher density areas such as Denali (Table 6) ram association in nursery groups was 8 x higher than in the Noatak, and full curl rams were found in nursery groups as often as younger rams.

A distinct separation of the sexes is observed in bighorn sheep (Geist 1971; Shank 1982). We observed no obvious differences in habitat selection by rams or nursery groups, and no difference in ram-ram or ram-ewe intergroup distances, i.e. clustering (t-tests for unpaired variates), and we observed approximately 1 ram of all ages in nursery groups in Denali Park. A common observation by local residents and guides in both the Wrangells and Lake Clark is that many rams, in particular large-horned individuals, segregate themselves up-drainage in the steepest habitats adjacent to the glacial sources of a drainage. Average distance of ram groups was 31 and 42% closer than ewe groups to a glacial source of a drainage in 2 count units in the Wrangells, but not in 2 others, and not in any units in Lake Clark. One resident in the Wrangells felt this was a hunting response and that rams were less accessible near the glaciers plus could better watch and avoid any hunters hiking up the drainage. It could have been a coincidence, but many rams near the glaciers were large-horned individuals.

REAL IMPACT OF ANILCA ON DALL SHEEP HUNTING IN ALASKA

Heimer and Smith (1975), and Heimer (1978), estimated there were 40,000 Dall sheep in the State of Alaska, but Heimer (1980) later increased the estimate to 50,000. The repeat survey counts presented here are 70% higher than corresponding 1975 and 1978 estimates, and 45% higher than the 1980 estimate. If this conservatism holds true for areas outside the National Parks and Preserves, then the State of Alaska Dall sheep population might number as high as 73,000.

Previous calculations suggested that from 29% (Parker 1975) to 49% (Heimer 1980) of Alaska's Dall sheep inhabit the new National Parks and Preserves, and their creation would reduce Statewide harvests of Dall sheep by 36% (Heimer 1980) or 25% (Heimer 1982). This has not proven to be the case. Prior to Monument withdrawals, Alaska harvests of 3/4+ curl rams averaged 1,250 in the years 1977 and 1978. Since passage of ANILCA from 1981-83 the statewide harvest has averaged 976 or only 22% less. Sport hunter effort has decreased about 25%. In 1979, a more restrictive 7/8+ curl restriction was passed suggesting the real reduction in ram harvest

due to ANILCA was as little as 10-15%. While the reduced potential to sheep hunters is undeniable, the results of our survey suggest that the impact of the new Parks was exaggerated and that any future analyses should be based on a revised and updated Statewide sheep population estimate.

The new Alaska National Parks and Preserves probably contain 29-41% of Alaska's sheep. However, 46% of the sheep in the Parks and Preserves are still available for sport hunting. Modest increases in the State ram harvest following passage of ANILCA is likely as many 3/4 curl rams grew to 7/8+ status, as many populations apparently increased, and as sportsmen better understand the new boundaries and regulations.

Table 6. Distribution of rams by horn size class in group types in Denali and the Noatak.

Ram Curl Class	Administrative Area	No. of Rams (%) in Various Groups			Total Rams
		Ram	Nursery	Solitary	
1/4	Denali	31(72)	12(28)	0	43
	Noatak	57(86)	5(7)	5(7)	67
1/2	Denali	29(58)	19(38)	2(4)	50
	Noatak	61(94)	3(5)	1(1)	65
3/4	Denali	31(67)	14(31)	1(2)	46
	Noatak	142(96)	3(2)	3(2)	148
4/4	Denali	50(72)	17(25)	2(3)	69
	Noatak	60(98)	0	1(2)	61

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