

BIRDS OF THE UPPER SHEENJEK VALLEY, NORTHEASTERN ALASKA

BRINA KESSEL and GEORGE B. SCHALLER



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by

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BIRDS OF THE UPPER SHEENJEK VALLEY, NORTHEASTERN ALASKA¹

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BRINA KESSEL and GEORGE B. SCHALLER

In the mountains and foothills of the eastern Brooks Range of north-eastern Alaska lies an expanse of over 16,000 square miles of arctic and subarctic wilderness. Because of its remoteness, little scientific information is available about this region. J. B. Mertie, Jr., and his field parties made the first scientific studies during the summers of 1926 and 1927 on the East Fork of the Chandalar River and the Sheenjek River for the U. S. Geological Survey. Their main concern was geology, but they also made notes on the flora and fauna (Mertie, 1929; 1930). Since 1952 other U. S. Geological Survey parties have visited the area, and in 1952 and 1953 George L. Collins and Lowell Sumner of the U. S. National Park Service made a general survey of the region (Collins and Sumner, 1953). No biological surveys, however, had been conducted prior to 1956.

In 1956 Dr. Olaus J. Murie, president of the Wilderness Society, led an expedition financed by the New York Zoological Society and The Conservation Foundation, with the cooperation of the University of Alaska, into this country. Other members of the expedition were Margaret E. Murie, Olaus Murie's wife; H. Robert Krear, U. S. National Park Service; Dr. Brina Kessel, professor of zoology at the University of Alaska; and George B. Schaller, graduate student at the University of Wisconsin. Dr. Donald McLeod, from Jackson, Wyoming, visited the expedition from June 15 to July 3, and Dr. and Mrs. W. O. Douglas of Washington, D. C., joined the party for a week at the end of summer. From May 31 to August 5, 1956, we explored the upper valley of the Sheenjek River (Figure 1) and studied its natural history. Our first base camp was at the edge of a pond, Lobo Lake (Kuirzinjik Lake), at 68° 21' N. Lat., 143° 56' W. Long., just north of the mouth of Old Woman Creek and at the entrance to the high mountains of the Brooks Range. Table Mountain to the east, and a peak, which we named First Mountain, to the west and just south of Brushman Mountain mark the south edge of the upper valley. We remained at Lobo Lake until June 26 when we moved about 18 miles farther north to our second base camp at the edge of the uppermost lake in the Sheenjek Valley (68° 36' N. Lat., 143° 45' W.

¹ Received for publication December, 1959.

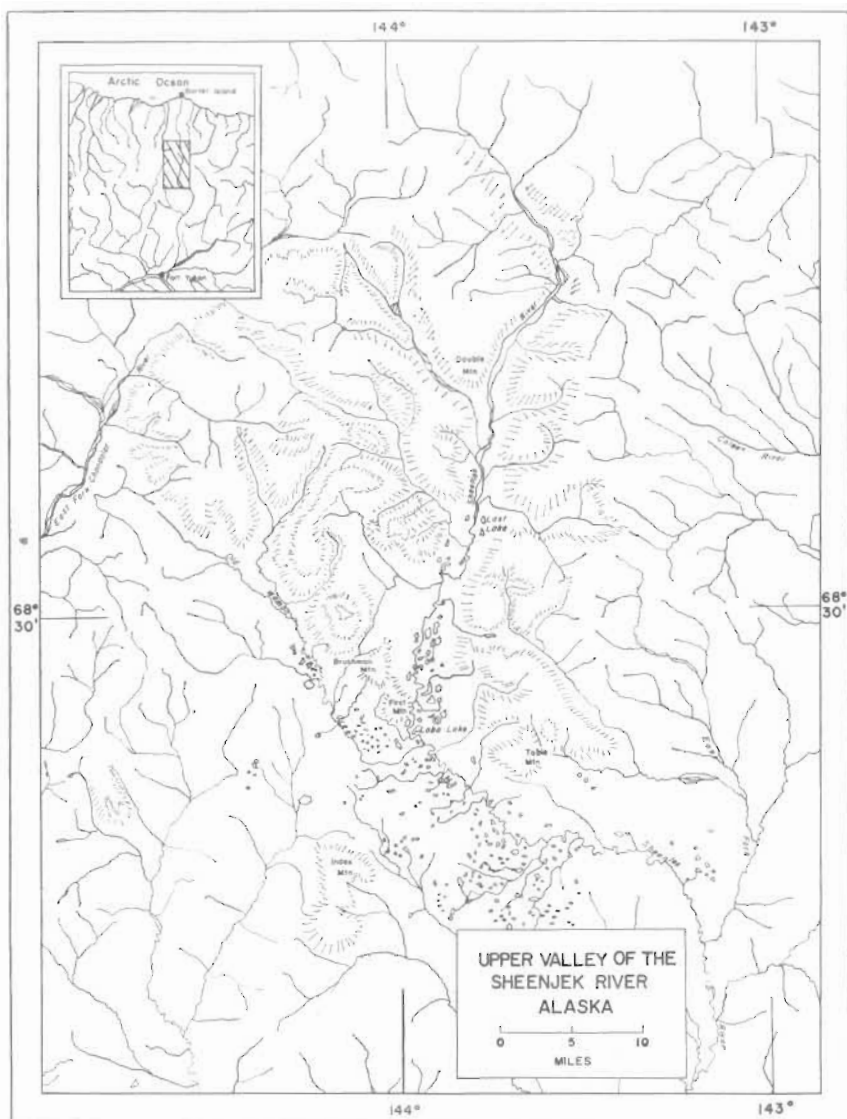


Figure 1. Upper valley of the Sheenjek River, eastern Brooks Range, Alaska.

Long.). At the appropriate suggestion of an Indian hunter, we named this small lake Last Lake (Ambresvajun Lake); we remained here the rest of the summer.

The main efforts of the authors were devoted to studying birds; but we also collected mammals, invertebrates, and plants. The following paper, to which all members of the expedition have contributed data, is primarily a report of our ornithological investigations.

It was a privilege and a pleasure working and camping with all the congenial members of the expedition; they all contributed in many ways to making it a most memorable and enriching summer. Others whose help in ensuring the success of the expedition is gratefully acknowledged are Keith Harrington, Wien Alaska Airlines bush pilot, Dr. Otto W. Geist, University of Alaska, and Dr. John L. Buckley, U. S. Fish and Wildlife Service. Additional thanks are extended to Dr. John T. Emlen, Jr., University of Wisconsin, Dr. Albert W. Johnson and Dr. Frederick C. Dean, University of Alaska, and to many others who have identified specimens and made critical comments on the manuscript.

DESCRIPTION OF THE REGION

PHYSIOGRAPHY

The Sheenjek River is one of the major drainage systems of the southern slopes of the eastern Brooks Range (Figure 1). The Sheenjek, with the Coleen River to the east and the more extensive Chandalar River to the west, carries water from the eastern Brooks Range to the Yukon River.

The Sheenjek River has its source in three cirque glaciers high in the crest of the range, in the vicinity of $69^{\circ} 03' \text{ N. Lat.}$, $143^{\circ} 58' \text{ W. Long.}$ The melt waters from these glaciers combine to form the headwaters of the west fork of the Sheenjek River. The river flows in a southerly direction through the rugged mountains, turns east-southeastward through the foothills, and then is joined by the East Fork of the Sheenjek ($68^{\circ} 10' \text{ N. Lat.}$, $143^{\circ} 11' \text{ W. Long.}$); it then flows in a general southerly direction, crosses the Yukon Flats, and finally joins the Porcupine River ($67^{\circ} 44' \text{ N. Lat.}$, $145^{\circ} 28' \text{ W. Long.}$), which in turn continues another 36 miles to its confluence with the Yukon River just below Fort Yukon. The total length of the Sheenjek River, from its headwaters to its confluence with the Porcupine River, is approximately 250 river-miles.

* The East Fork is the only major tributary of the Sheenjek from the east. From the west, the main tributaries are Old Woman Creek ($68^{\circ} 22' \text{ N. Lat.}$) and the Kones River ($67^{\circ} 45' \text{ N. Lat.}$).

The upper valley of the west fork of the Sheenjek River, from the beginning of the high mountains of the Brooks Range, just north of Old Woman Creek, to the headwaters at the crest of the range, a distance of about 60 miles, is the area covered in the present study. The mountains flanking the upper valley are high and rugged. Their topography indicates extensive glaciation in the past—a U-shaped main valley, truncated spurs, smooth ridge tops, lateral hanging valleys, and benches at the edges of the valley floor. The floor of the main valley lies above 2,200 feet, and the higher mountain peaks reach 5,000 feet in the southern part and over 7,000 feet nearer the headwaters.

The southern half of the floor of the upper valley is 1.5 to 3 miles wide and is characterized by morainal deposits. Here the river is relatively sluggish and meanders through kettle-hole country, with many lakes in undrained depressions. One of the largest of these is Lobo Lake, the site of our first base camp.

Northward, the valley narrows, and as the gradient steepens, the river becomes a swift, braided mountain stream, separated by gravel bars and small willow-covered islands. Ponds are fewer in number; the last one is Last Lake, the site of our second base camp, about 40

miles from the headwaters of the river. Along the upper river, especially near Last Lake, *aufeis*, formed by the freezing of successive stream overflows during the winter, is an apparently regular feature. Substantial remnants of such ice persisted throughout the summer of 1956.

The geology of the Sheenjek Valley is poorly known. The only published accounts are those by Mertie (1929, 1930). Unfortunately, Mertie and his party got no farther upriver than the vicinity of Table Mountain and the mouth of Old Woman Creek, and they were there for only a few days in 1927. According to Mertie the exposed formations flanking the upper valley of the Sheenjek are of two types. A quartzite-conglomerate-slate formation of the Lower Mississippian occurs at Table Mountain and on the west side of the valley at First Mountain and Brushman Mountain; from there it extends westward into the drainage of the East Fork of the Chandalar. The rest of the mountains bordering the upper Sheenjek River are apparently predominately Lisburne Limestone of the Upper Mississippian. This limestone formation is conspicuously stratified with innumerable alternating beds of limestone and dark chert.

The valley floor is composed entirely of unconsolidated Quaternary deposits—silt, sand, gravel, boulders, etc. These materials originated as glacial till and outwash from Pleistocene glaciations. More recently streams have reworked and redeposited much of the surface material, and original deposits have become covered with alluvial deposits of silt, sand, and gravel, and with colluvial deposits which form a covering on the lower slopes of the present valley.

CLIMATE

The weather during our stay in the Sheenjek Valley was sunny and warm during the day and cool at night. The last spring frost was during the night of June 7–8, and the first fall frost was during the night of July 20–21, giving a frost-free season of only 43 days. During the summer we recorded the daily maximum and minimum temperatures on a thermometer hidden among the branches of a spruce to keep it from the sun's rays (Table 1). The average maximum and minimum temperatures, respectively, were 65° F. and 39° F. for June, and 66° F. and 43° F. for July. Daytime temperatures usually ranged from the high 50's to the low 70's, and at night they dropped to the 40's.

We had 21 cloudless days. Many days began clear, but by midmorning clouds drifted in and often covered the entire sky by afternoon. We had a number of light rains and showers and a few short thunderstorms, but only twice prior to July 27 did it rain for extended periods—June 19–21

TABLE 1. DAILY MAXIMUM AND
SUMMER, 1956, FOR UPPER

Day	JUNE					
	SHEENJEK		BETTLES		FT. YUKON	
	Max.	Min.	Max.	Min.	Max.	Min.
1	—	—	53	40	60	33
2	—	29	56	38	60	40
3	68	33	66	41	68	36
4	66	32	67	45	70	40
5	65	34	72	50	70	46
6	63	35	72	45	67	46
7	57	33	68	47	64	42
8	67	28	69	40	63	40
9	58	36	70	44	68	39
10	52	39	68	52	66	45
11	64	36	66	45	69	45
12	66	40	69	44	74	48
13	70	40	69	47	73	40
14	75	43	70	45	76	43
15	76	38	73	47	77	48
16	78	40	74	50	79	49
17	72	44	73	51	77	49
18	76	45	73	50	73	50
19	70	44	63	50	74	50
20	68	48	73	49	68	50
21	50	42	71	47	58	48
22	62	44	47	37	64	50
23	52	41	50	34	58	42
24	54	33	50	37	60	47
25	60	42	53	36	62	42
26	64	36	63	36	70	42
27	64	40	71	44	64	48
28	71	43	75	41	76	45
29	69	54	75	49	77	52
30	71	52	60	45	75	55
31	—	—	—	—	—	—
Average	65.3	39.4	66.0	44.2	68.7	45.0

MINIMUM TEMPERATURES IN DEGREES FAHRENHEIT,
SHEENJEK RIVER, BETTLES, AND FORT YUKON, ALASKA

JULY						AUGUST					
SHEENJEK		BETTLES		FT. YUKON		SHEENJEK		BETTLES		FT. YUKON	
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
62	51	72	45	77	52	51	45	50	42	59	50
70	46	70	47	79	50	50	37	55	39	61	42
71	47	69	47	75	58	54	41	50	38	62	45
66	49	69	46	76	54	—	41	58	39	61	50
58	44	62	45	74	59						
70	43	68	43	76	53						
68	41	65	45	75	54						
63	46	60	50	69	56						
68	48	68	49	70	58						
70	45	75	47	74	50						
76	44	75	53	81	58						
73	49	77	47	80	60						
68	47	73	53	76	60						
68	45	75	51	79	54						
69	42	70	47	75	67						
60	40	70	41	71	56						
64	39	68	41	70	56						
60	40	71	44	72	54						
58	40	58	50	65	57						
58	34	65	46	60	39						
57	24	66	39	60	36						
61	27	68	35	64	37						
70	30	72	39	73	33						
73	38	75	40	76	40						
74	38	73	47	78	53						
73	41	76	42	82	51						
71	42	63	55	79	50						
64	49	64	49	70	54						
61	44	62	41	68	54						
60	33	67	38	70	50						
63	34	53	45	63	38						
66.0	42.7	68.3	45.4	72.8	51.6						

and July 5; afternoon rain showers, however, were rather frequent among the mountains of the upper valley. Between July 27 and August 5, when we left, precipitation increased. It rained July 28-29 and August 1-2 with additional overcast and showers on August 3 and 4.

The prevailing winds blew up the Sheenjek Valley from the south and southwest, though occasionally winds came from the north and northwest. Usually the winds were light, but now and then strong blasts came from the mountains.

Daylight was continuous during our stay on the Sheenjek River. At this latitude darkness never exceeds Civil Twilight from May 3 until August 9, and officially the sun does not set from May 23 to July 20; in this mountainous area, however, the sun disappears for short periods behind the higher peaks, producing, in effect, multiple sunsets.

Unfortunately, no annual weather records are available for the eastern Brooks Range. The nearest U. S. Weather Bureau station is at Fort Yukon about 150 miles to the south-southwest. The geography of Fort Yukon places it in the climate of the Interior, and, being in the middle of the "Flats," its climate is undoubtedly quite different from that of the mountains. Bettles, close to the south base of the Range, is more likely to have a climate similar to that of the upper Sheenjek Valley. It is, however, 230 miles to the southwest, is a full 120 miles farther south, and is not actually in the mountains.

Lacking more satisfactory records for a general climatic summary, however, U. S. Weather Bureau records for Bettles and Fort Yukon are given in Table 2. The average annual temperature of these two places is the same, as is the average number of days the maximum temperature is 32° F. or below. Fort Yukon, however, has a lower average minimum in the winter and a higher average maximum in the summer than does Bettles; and the record maximum and minimum temperatures at Fort Yukon are more extreme (Maximum: Fort Yukon, 100° F., June 27, 1915; Bettles, 92° F., July 25, 1955. Minimum: Fort Yukon, -75° F., January 14, 1934; Bettles, -65° F., January 28, 1947). The annual precipitation at Bettles is about twice that of Fort Yukon; over twice as much rain falls during the growing season, and almost a third more snow falls during the winter.

Extrapolating from these records, and comparing the maximum and minimum daily temperatures during June and July, 1956, (Table 1), we conclude that while the climate of the upper Sheenjek Valley may resemble that of Bettles more than that of Fort Yukon, it probably does not have such extreme temperatures as either of these localities; certainly it has a shorter frost-free season, and the summer temperatures

TABLE 2. SUMMARY OF CLIMATIC CONDITIONS AT BETTLES AND FORT YUKON, ALASKA.
COMPILED FROM RECORDS OF U. S. WEATHER BUREAU

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average
<i>BIRDS OF THE UPPER SHEENJEK VALLEY</i>													
<i>Average Temperatures—°F. (Jan. 1953–Dec. 1957)</i>													
Bettles	-15.1	-16.8	3.2	20.5	43.6	56.0	57.3	51.7	38.8	19.4	-2.9	-19.8	19.7
Ft. Yukon	-24.0	-17.8	2.7	21.8	43.5	58.6	62.3	55.7	41.0	19.3	-6.0	-25.7	19.3
<i>Average Precipitation—Inches (Jan. 1953–Dec. 1957)</i>													
Bettles	.83	.54	.51	.21	.48	1.41	1.12	2.55	2.15	.84	.62	.71	12.0
Ft. Yukon	.42	.37	.32	.16	.29	.72	.55	1.14	.82	.51	.58	.57	6.4
<i>Average Season's Snowfall—Inches (July 1952–June 1958)</i>													
Bettles	11.3	8.9	10.9	2.7	1.1	0	0	0	0	T	11.7	13.9	68
Ft. Yukon	7.3	5.0	6.2	2.3	T	0	0	0	0	1.0	9.3	7.7	47
<i>Maximum Snow on Ground—Inches (Jan. 1953–June 1958)</i>													
Bettles	29	30	39	34	9	0	0	0	0	T	8	25	13
Ft. Yukon	26	29	34	32	7	0	0	0	0	1	6	21	11
<i>Average Number Days Maximum Temperature 32° F. or below (1953–1957)</i>													
Bettles	—	—	—	—	—	—	—	—	—	—	—	—	Total 184
Ft. Yukon	—	—	—	—	—	—	—	—	—	—	—	—	Total 181

in 1956 were somewhat lower. Precipitation and snowfall are probably similar, but are perhaps greater in the mountains.

VEGETATION

The upper valley of the Sheenjek River is an ecotonal area, both latitudinally and altitudinally, between the coniferous forest and the tundra. White spruce (*Picea glauca*), the dominant of the coniferous forest that extends up the Sheenjek Valley, grows in scattered, open stands over much of the drier ground of the valley floor as far north as Double Mountain, about 10 miles north of Last Lake. North of there it grows mainly on the east side of the valley and reaches its northern limit at about 68° 50' N. Lat. It extends up the mountain slopes to an altitude of about 3,000 feet, with small stands fingering up protected slopes and ravines for another 100 feet or so.

Where spruce is absent—at higher altitudes, in exposed or wet situations on the valley floor, or at the northern end of the valley—the vegetation closely resembles that of the tundra that spreads northward across the mountains to the Arctic Ocean. Much of the vegetation of the upper Sheenjek Valley resembles Polunin's (1951) "Low Arctic," being characterized by extensive sedge meadows, lichen-rich heaths, and luxuriant shrub communities.

Growth conditions for plants are rigorous. Soil is poor or absent in many parts of the valley; much of the valley floor consists of glacial till and alluvium, and talus covers the higher slopes. Organic soils develop mostly in flat, poorly drained areas. Permafrost inhibits drainage, and frost action disrupts the ground and vegetation, forming polygons, stone stripes, and other related features.

The characteristics of the major vegetation types found in the upper valley appear to form a gradient, with many of the species of one vegetation type extending into the next. Ground moisture (and exposure) seems to be the major factor in determining the type of vegetation growing on a given site, gradations of moisture resulting in corresponding gradations from one vegetation type to the next. Using criteria similar to those used by Kessel and Cade (1958) in describing avian habitats on the Arctic Slope, we have recognized the following major vegetation types on the upper Sheenjek River: sedge-grass marsh, tussock-heath tundra, spruce woods, dwarf shrub, and dry tundra. In addition to these major, more or less interrelated vegetation types, several less extensive types occur: tall brush, poplar stands, and an alkali flat.

Sedge-grass marsh: Sedge-grass marsh occurs on extremely damp sites, often near the outlets or inlets of ponds. The water may stand 10 to

12 inches deep in these areas, and the vegetation is almost entirely *Carex* spp. with some *Eriophorum* spp. The bluish-green *Carex aquatilis* is typical. Sedge-grass marsh appears to be the major nesting habitat of the northern phalarope, and the common snipe and savannah sparrow are often found in the drier portions, especially where occasional shrubs occur.

Tussock-heath tundra: Tussock-heath tundra (Figures 2 and 3) occurs in areas that are moist, but usually not so damp that there is standing water on the surface of the ground. Tussock-heath tundra usually occurs on the "flats" near ponds and streams, but also occurs at higher altitudes where moisture frequently collects in draws and pockets. It often shows a polygonal pattern of relatively flat, moist areas separated by considerably drier ridges a foot or so high.

In the dampest areas of this habitat, the vegetation is mostly moss, especially *Drepanocladus* sp., covered by *Equisetum scirpoides* and some *Carex* spp.; here it is often so moist that water collects in one's footprints. Mixed with these main species is a scattering of dwarf *Salix crassijulis* (?), *Pedicularis sudetica*, and often some stunted bushes of *Betula glandulosa* and *Salix glauca* or *S. richardsonii*.

On the higher, drier ridges surrounding these low spots the following plants are found in varying amounts: *Salix reticulata*, moss (including some *Drepanocladus* sp.), *Equisetum scirpoides*, a tussock-forming *Eriophorum* sp., *Arctostaphylos alpina*, *Andromeda polifolia*, *Dryas integrifolia*, an occasional plant of *Rhododendron lapponicum*, and more *Salix richardsonii* or *S. glauca*.

On still drier ground, the vegetation begins to resemble closely the ground cover of the open spruce woods habitat. It is this driest type of tussock-heath tundra that is found on the upland areas and in the draws at higher altitudes. Predominately it is an *Eriophorum* tussock vegetation. *Arctostaphylos alpina*, *Salix reticulata*, and *Andromeda polifolia* are common in these drier areas, and patches of *Salix* and *Betula glandulosa* are quite common.

At the lower altitudes, the least sandpiper, Smith's longspur, and savannah sparrow commonly nest in the tussock-heath tundra, and probably also the short-eared owl and marsh hawk. In the drier spots, especially where a few shrubs occur, the willow ptarmigan sometimes nests. At higher altitudes (3,200 to 4,500 feet) the Lapland longspur also is found in tussock-heath tundra.

Spruce woods: The outstanding feature of this habitat is the presence of white spruce (*Picea glauca*). Most commonly, the habitat is an open



Figure 2. Tussock-heath tundra at west edge of Lobo Lake, June 15, 1956.



Figure 3. Tussock-heath tundra in alpine draw at 3,400 feet, on ridge east of Lobo Lake, June 11, 1956. Typical habitat of Lapland longspur.

wood, the scattered spruce trees standing about 15 to 20 feet apart and averaging about 15 feet high; the maximum height of these trees is about 25 feet (Figures 4 and 5). Scattered more or less uniformly among the spruce in these open woods are willow shrubs (*Salix richardsonii* ?); in some areas there may also be shrubs of *Betula glandulosa* or of *Rhododendron lapponicum*.

The ground beneath the open spruce is characteristically hummocky; these hummocks, which are probably the result of frost action, are 3 to 4 feet high and vary in size from 2 x 2 to 5 x 10 feet. Between the hummocks there is often enough moisture to cover the soles of one's boots. In very low areas small pools may form; a few ponds are over 100 feet across and are used by nesting waterfowl.

Areas between the hummocks make up about 30 per cent of the ground cover; here the dominant plants are sedges (including *Carex* spp.), *Equisetum pratense*, and *Equisetum scirpoides*. On the tops of the hummocks, the vegetation is similar to the ground cover of the dwarf shrub habitat on the drier knolls—*Ledum decumbens*, *Cassiope tetragona*, *Empetrum nigrum*, *Arctostaphylos alpina*, *Andromeda polifolia*, some *Vaccinium vitis-idaea*, considerable *Vaccinium uliginosum*, and occasional scattered *Silene acaulis*, *Anemone parviflora*, and *Pedicularis lanata*. In some spots there is considerable coverage by *Dryas integrifolia*, and in other spots there is a little *Potentilla fruticosa*. Many of these hummock-inhabiting species also overlap into the lower areas between the hummocks.

The spruce woods occur mostly at the edges of the valley floor of the Sheenjek River and extend up the sides of the surrounding mountains to timberline (about 3,000 feet). There is little change in the vegetation as the spruce woods extend up the slopes, though the ground becomes drier and ceases to be hummocky. The vegetation is similar to that occurring on the drier hummocks of the valley floor. *Shepherdia canadensis* grows commonly in scattered areas on the slopes.

In order to get some idea of the age of the spruce and their rate of growth, O. Murie counted the growth rings from a number of dead spruce trees around Lobo Lake. One tree, about 25 feet tall, was 6.5 x 4 inches in diameter 10 inches from the base and had 107 rings counted on the long slant; 23 inches from the base, it measured 4.5 inches in diameter and had 90 rings. The oldest spruce was 10.5 x 9.5 inches in diameter 8 inches above the ground and was 298 years old.

Schaller and Krear measured and took increment borings of a number of spruce trees in an open stand around Last Lake. From the data summarized in Table 3 it can be seen that the rate of growth is extremely



Figure 4. Spruce woods on ridge about 200 feet above valley floor east of Lobo Lake, June 14, 1956. Note hummocky ground and standing water.



Figure 5. Spruce woods 2 miles east of Lobo Lake, June 14, 1956. A small patch of tall, densely-grown spruce grew on north (left) side of draw of ridge in background.

slow. Most trees require over 30 years to reach a height of 5 feet and about 100 years to attain 20 feet.

TABLE 3. SIZE AND AGE OF OPEN-GROWN SPRUCE NEAR LAST LAKE, SHEENJEK RIVER, ALASKA, LATE JULY, 1956

Height of tree (feet)	Diam. 1 foot from base (inches)	No. annual rings 1 foot from base	Diam. 4.5 feet from base (inches)	No. annual rings 4.5 feet from base
4.8	1.0	32	—	—
5.3	1.6	43	.6	—
7.6	1.7	34	.6	—
7.7	2.8	42	2.0	26
9.0	2.8	99	1.6	27
10.7	2.8	39	1.5	23
13.4	4.4	94	2.7	75
14.7	4.0	111	2.7	69
16.6	2.6	50	1.8	32
18.7	4.1	76	2.5	59
22.1	5.2	206	3.3	74
22.6	4.4	117	3.5	83
23.9	5.1	—	3.2	95
25.2	4.0	100	2.8	92
27.9	6.4	—	4.8	218
28.0	—	—	4.7	—
30.4	6.3	163	4.6	141

In areas that appear to be more sheltered, and yet not too moist, the spruce trees become taller and the stands more dense. Two such areas were observed during the summer of 1956. One was in a draw on the west-facing side of the mountains bordering the valley about 2 miles east of Lobo Lake (background of Figure 5), and the other bordered the mouth of a mountain stream that enters the Sheenjek River about a mile north of Last Lake. In these areas the spruce grow 45 to 55 feet high and so densely that the ground cover approaches that of a mature white spruce forest. Indeed, a small patch, about 100 to 200 feet in diameter, occurred in each of these spruce woods which was so dense that only *Pyrola grandiflora* and *Moneses uniflora* were able to survive in a thick ground cover of various mosses.

Robins, gray-checked thrushes, myrtle warblers, flickers, and red-polls were typical of the open spruce woods, right up to timberline. Juncos occurred in the spruce of the mountain slopes, and boreal chicka-

dees were more frequent on the slopes than in the valley. In the valley and to some extent on the slopes, the open woods were used commonly by tree sparrows, white-crowned sparrows, and willow ptarmigan, though these species were more typical of the dwarf shrub habitat. In the denser portions of the spruce woods, we found the varied thrush, ruby-crowned kinglet, pine grosbeak, and white-winged crossbill—all birds of the coniferous forest utilizing these northern extensions of their preferred nesting habitat.

Dwarf shrub: The dwarf shrub habitat (Figure 6) is found along the valley floor where the land rises 50 to 100 feet above the "flats" or pond levels. These knolls and ridges apparently are glacial till, and patches of gravel show through the vegetation at various points. The ground is quite dry, except for an occasional depression where small, sedge-bordered puddles may occur.

The dominant plant is dwarf birch (*Betula glandulosa*) which covers rather extensive areas. Scattered among the birch are willows (*Salix glauca*) and occasionally a few alders (*Alnus crispa*) or rhododendron (*Rhododendron lapponicum*). The shrubs average 2 to 3 feet high, and give 50 to 60 per cent ground coverage. Under the shrub growth there is usually a cushion of mosses, including *Aulacomnium acuminatum* and *Hylocomium alaskanum*, and fruticose lichens (especially *Cetraria cucullata*), with varying amounts of *Vaccinium vitis-idaea*, and some *Empetrum nigrum*. In the more open areas an extensive cover may be formed by *Vaccinium vitis-idaea*, *Vaccinium uliginosum*, *Empetrum nigrum*, *Ledum decumbens*, *Cassiope tetragona*, *Arctostaphylos alpina*, *Rhododendron lapponicum*, some *Salix reticulata*, along with sedges, lichens and mosses. By mid-summer a number of showy flowers bloom in the open spots: *Hedysarum* sp., *Pedicularis labradorica*, *Polygonum bistorta*, *Oxytropis maydelliana*, *Papaver macounii*, *Arnica alpina*, etc. In the more moist spots, *Andromeda polifolia* may occur; and throughout the areas of dwarf shrub, an occasional plant of *Lupinus arcticus*, *Pedicularis lanata*, or *Silene acaulis* may grow. Some areas on the knolls are essentially bare, supporting only dry mosses and lichens, with occasional sedges, *Vaccinium vitis-idaea* and *Dryas integrifolia*. Some dry areas are entirely bare.

From the standpoint of utilization by birds, a second, otherwise unrelated vegetation type should be mentioned here. North of Last Lake some of the islands formed in the Sheenjek River by the braided channels support a characteristic and uniform vegetation, which is not widespread. The dominants are willows that grow in a fairly dense stand up to 2 and 3 feet in height, *Salix glauca* and *Salix farrae*. Under the willow is an



Figure 6. Dwarf shrub on knoll just north of Lobo Lake, June 13, 1956.
Table Mountain to the southeast is in the center background.

almost complete ground cover of moss (*Drepanocladus* sp.), and a considerable growth of *Arctostaphylos alpina*.

The tree sparrow is the typical bird of the dwarf shrub, on both the knolls and ridges and the *Salix*-moss islands; both shrub habitats are also used extensively by the white-crowned sparrow and the willow ptarmigan.

Dry tundra: The alpine areas become very dry, with only the draws and larger depressions holding enough moisture to support lush vegetation. In many alpine areas as much as one-third of the ground is bare, showing thin black soil, small gravel, and larger rocks. The vegetation is mostly low and prostrate, the dominant growth being mats of many lichens on the rocks and on the ground itself (See Figures 7 and 8.).

Other plants are scattered: (listed approximately in order of decreasing abundance) *Cassiope tetragona*, *Silene acaulis*, *Salix reticulata*, and *Vaccinium uliginosum*. Of occasional occurrence are *Carex* spp., *Geum glaciale*, *Saxifraga oppositifolia*, *Polygonum viviparum*, *Lycopodium selago*, and *Pedicularis capitata*.

As one moves from the driest areas, other plants become common, and a knoll type of vegetation is soon reached: more *Cassiope tetragona*, *Oxytropis maydelliana*, *Potentilla biflora*, *Rumex* sp., *Pedicularis sudetica*, *Papaver macounii*, and increased *Carex* spp. In depressions, low shrubs of willow and birch grow. Very little *Empetrum nigrum* or *Vaccinium vitis-idaea* occurs in the alpine habitat.

In the draws or along slow-moving streams, where considerable moisture is available, the vegetation immediately approaches that of the tussock-heath tundra in the lowlands, the vegetation type closely following the dendritic pattern of the water supply (Figure 3).

With increasing altitude ground moisture decreases. In protected spots *Dryas octapetala*, *Cassiope tetragona*, a few sedges and mosses, and occasional ferns (*Cystopteris fragilis* and *Dryopteris fragrans*) may grow. Higher up, the vegetation consists mainly of crustose and foliose lichens clinging to limestone talus.

Characteristic birds of the dry tundra are water pipit, rock ptarmigan, horned lark, rosy finch, and wheatear. In the somewhat more moist situations, golden plovers, Baird's sandpipers, and Lapland longspurs may occur. The wandering tattler occurs along the rocky streams at these high altitudes. Bird life becomes sparse above 5,500 feet, but rosy finches, horned larks, and wheatears sometimes range up to the mountain tops. At the lower altitudes, where moisture in the draws makes it possible for some shrubbery to grow, birds more typical of the



Figure 7. Dry tundra at about 4,000 feet on ridge northeast of Lobo Lake, June 11, 1956. Mountains in background border west edge of Sheenjek Valley.



Figure 8. Dry tundra at about 5,500 feet, southeast of Last Lake, June 10, 1956. Note patch of overflow river ice in valley.

spruce woods and knolls may occur, especially tree sparrows, white-crowned sparrows, redpolls, and robins.

Tall brush: Along the edges of the river and its tributaries one finds a growth of tall brush (Figure 9). Composed mostly of *Salix* (*S. alaxensis*, *S. farrae*, and *S. arbusculoides*), this brush averages 10 to 15 feet high and is confined to a 10- to 30-foot strip along each side of the stream.

Fox sparrows are perhaps the most characteristic bird of the riparian tall brush, although yellow warblers and gray-cheeked thrushes also prefer this habitat. Tree sparrows and white-crowned sparrows frequently sing from these willows, too.

Another tall brush habitat is formed largely by alder, *Alnus crispa*. Some alder can usually be found growing among the other plants of the dwarf shrub habitat and in the spruce woods, but on some sites it forms dense, almost impenetrable thickets of tall brush. One dense stand grew on the south slope of First Mountain, and others grew along the boulder-strewn tributaries of the Sheenjek north of Last Lake. The one on First Mountain covered an old rock slide. Part of it was mixed with *Salix* spp., and on one edge it was mixed with *Betula papyrifera*, *B. glandulosa*, and hybrids of these two birches. Another part of the stand, in a gentle draw, was pure alder; there the shrubs grew to 10 feet in height and close together. In the densest part the ground cover under the alders consisted almost exclusively of *Ribes triste* and *Pyrola grandiflora*. Fox sparrows and Wilson's warblers frequent the dense alder patches.

Poplar stands: *Populus balsamifera* is not a common species in the upper Sheenjek Valley. Mostly it occurs sparsely among other brush and tree species bordering the river and its tributaries. In a few places, however, it grows in dense stands, and we were able to visit two such areas near Lobo Lake.

The first stand was an isolated patch of trees about a hundred feet in diameter on the west side of the river south of First Mountain (Figures 10 and 11). It was situated on a slight rise (elev. 2,300 ft.) just north of a somewhat higher knoll covered with dwarf birch. The trees grew up to 50 feet tall, and some had a d.b.h. (diameter at breast height = 4.5 feet above the ground) of 12 inches and a rough, thick bark. The interior of the stand was a tangle of fallen trees, many of which were very large, some with a d.b.h. as much as 14 inches. The ground was rather densely covered by a layer of about 18- to 24-inch high *Ribes triste* and *Rosa acicularis* and some *Epilobium angustifolium*. The floor itself was composed of a 3- to 4-inch layer of dead and rotting leaves. Re-



Figure 9. Tall brush bordering the Sheenjek River, June 15, 1956. The abrupt south face of First Mountain shows in the background.



Figure 10. Poplar stand (*Populus balsamifera*) west of Lobo Lake and just south of First Mountain, June 22, 1956.



Figure 11. Interior of poplar stand shown in Figure 10, showing fallen trees and floor cover of *Ribes triste* and *Rosa acicularis*. June 22, 1956.

production of the poplars was apparent in the stand. This fascinating, isolated area was apparently devoid of bird life, with the exception of one white-crowned sparrow that perched at its edge and scolded us.

The second stand of poplar grew in the old river bed bordering Old Woman Creek near its entrance into the Sheenjek River. This stand was much more extensive than the first one, but it was limited to the vicinity of the creek bed. Most of the trees were not as large as those in the first stand, although some were 10 to 12 inches d.b.h., and the stand was not as dense. There was a considerable number of fallen trees, but the tangle was not as great as in the first stand. The understory of the two stands was quite different. The ground beneath this second one was old, rocky river bottom, covered with a good growth of mosses. The dominant herbaceous cover was *Pyrola grandiflora* and *Lupinus arcticus*. Bald eagles nested in a partially dead poplar at the edge of this stand, and on June 25 Bohemian waxwings were flying about and feeding at the edge of an opening within the stand.

Alkali flat: There was one unique area west of Lobo Lake that looked like a small alkali flat. It was a baked, white sand-clay area, with some drying cracks. It was the only such spot we saw, and it was not more than 100 yards in diameter. On little rises within the area, willow shrubs grew, about one bush to a rise. Most of the willows were *Salix glauca*, but a few were *S. arbusculoides*. At the base of the willows grew *Dryas integrifolia* and some *Arctostaphylos alpina*. The dryas also grew out in scattered patches on the white, sandy clay. The only bird using this strange habitat appeared to be a semipalmated plover that had a nest on the white ground among the dryas.

PHENOLOGY

When we arrived at Lobo Lake on May 31, 1956, the main river and some of the smaller ponds were free of ice. The larger ponds, however, were still largely frozen, though badly honeycombed. Only the ice on Lobo Lake was still hard enough for our ski-equipped plane to land, but there was already an open lead, 5 to 10 feet wide, around most of its edge. Night temperatures dropped to near freezing or freezing until June 9; ice a quarter-inch thick formed at the edge of the lake during the night of June 7-8 when the temperature dropped to 28° F. By June 17 practically all the ponds of the valley were open, except Lobo Lake where the ice was breaking up fast. The last ice in Lobo Lake disappeared on June 22.

The winter's cover of snow on the valley floor had mostly disappeared by May 31; only patches near the spruce woods and in other sheltered

spots and remnants of large drifts remained. It snowed during the night of May 31, bringing the snowline in the mountains down to about 2,800 feet. By June 11 the snow in the mountains had melted up to about 4,000 feet, leaving only patches of old drifts. Such patches still remained at 6,000 feet in early July; though heavy snow fell on the mountains to the north on June 25, by late July it had disappeared from all but the highest peaks. On July 15 a snowstorm caught Schaller at 7,000 feet at the headwaters of the river, and during early August snow fell on the peaks above 6,000 feet whenever it rained in the valley. These early snows, however, were not permanent.

The overall aspect of the valley was brown and gray when we arrived, except for patches of dark green spruce and scattered patches of white snow; the vegetation was still largely dormant. A few early spring flowers, however, were blooming: the colorful, purple *Saxifraga oppositifolia* was at its peak of flowering at the edge of the lake; a number of cream-colored blossoms of *Anemone parviflora* were open; and pink spikes of *Pedicularis lanata* dotted the tundra. A week later a few other species were beginning to flower, and by June 18 the country around Lobo Lake was a blaze of color: knee-high bushes of *Rhododendron lapponicum* were blooming profusely, as were *Lupinus arcticus*, *Cassiope tetragona*, and *Dryas integrifolia*. By this time the valley had changed from brown to green; most of the leaves of *Betula glandulosa* were out, though they were not yet fully expanded, and the leaves of willow shrubs were enlarging.

Several species of *Pedicularis* and legumes bloomed during the last half of June; many composites flowered during the first half of July; and various species of berries ripened during the last half of July. The first frost (24° F.) hit the upper Sheenjek on the night of July 20-21 and killed many of the exposed flowers.

Below is a phenological list of representative floral events as they occurred on the valley floor during the summer of 1956:

- May 31 *Pedicularis lanata* in bloom; *Saxifraga oppositifolia* at height of bloom; *Anemone parviflora* in flower, but many still in bud.
- June 5 *Arctostaphylos alpina* in full flower.
- June 7 *Rhododendron lapponicum*, *Dryas integrifolia*, and *Lupinus arcticus* starting to bloom; leaves of *Betula glandulosa* coming out.
- June 8 *Anemone parviflora* passing height of bloom; *Arctostaphylos uva-ursi* with numerous blossoms.
- June 10 *Cassiope tetragona* coming into bloom.

- June 15 *Pedicularis langsдорffii* just coming into bloom; *Lupinus arcticus* at height of bloom.
- June 17 *Ledum decumbens*, *Vaccinium uliginosum*, and *Hedysarum mackenzii* just coming into flower.
- June 18 *Rhododendron lapponicum* at height of bloom; *Pedicularis sudetica* starting to bloom.
- June 20 *Pyrola grandiflora*, *Pedicularis oederi*, *Pedicularis capitata*, and *Arnica alpina* coming into bloom.
- June 22 *Potentilla fruticosa* beginning to blossom; many *Dryas integrifolia* in fruit; and *Picea glauca* shedding quantities of pollen.
- June 23 First flowers of *Epilobium latifolium* open; *Rhododendron lapponicum* beginning to drop some corollas.
- June 28 *Senecio atropurpureus* in bloom.
- June 30 *Pinguicula vulgaris* just beginning to bloom; *Oxytropis gracilis*, *O. maydelliana*, and *Astragalus umbellatus* in flower.
- July 4 *Senecio hyperborealis* in flower.
- July 7 *Aconitum delphinifolium*, *Polemonium acutiflorum*, and *Anemone richardsonii* blooming at edge of alpine pond at 3,500 feet elevation.
- July 10 Many composites in bloom: *Arnica louiseana*, *Aster sibiricus*, *Erigeron humilis*, *Saussurea angustifolia*, *Senecio lugens*, *Senecio resedifolius*, and *Solidago multiradiata*.
- July 18 First ripe berries of *Vaccinium uliginosum*; a few *Arctostaphylos alpina* getting red leaves.
- July 20 *Epilobium angustifolium* in almost full flower.
- July 21 First frost killed many exposed flowers.
- July 25 *Shepherdia canadensis* with red berries.
- July 29 Patches of horsetail brown; birch and willow leaves turning yellow; lupines and other legumes bearing seed pods.

The birds scarcely await the arrival of spring before they begin their feverish activities of courtship and nesting; the season is all too short. When we arrived, some willow ptarmigan were already incubating full clutches of eggs; the males were extremely active in their courting, although by June 6 they had quieted down considerably and were molting their white body feathers. Tree sparrows and white-crowned sparrows were nest-building, and one early white-crown was already incubating a clutch of four eggs. A least sandpiper was incubating a clutch of four eggs on June 5.

Other species were still migrating when we arrived. The only rough-

legged hawk recorded during the summer was apparently a migrant seen on May 31. A flock of 15 long-tailed jaegers and a few stragglers passed by between May 31 and June 3. Resident Smith's longspurs did not arrive until about June 4. A few transient shorebirds passed through the area until June 9—black-bellied plover, whimbrel, pectoral sandpiper, white-rumped sandpiper, Baird's sandpiper (nests at higher altitudes), semipalmated sandpiper, buff-breasted sandpiper, and sanderling.

Flocks of surf scoters were conspicuous in early June, and oldsquaws were still mostly in small groups, though some were paired; the white-winged scoters appeared paired, even though they remained mostly in small flocks.

Most of the oldsquaws were paired by June 8–10; the scoter flocks had disappeared by June 11; a pintail was incubating six eggs on June 13; and a baldpate began the incubation of eight eggs about June 15. On June 15, too, at about 3,500 to 4,000 feet elevation, the nests of two water pipits were found, each containing six eggs; and a Baird's sandpiper was collected with a soft-shelled egg in its oviduct.

The first willow ptarmigan chicks hatched on June 20, and tree sparrows and white-crowned sparrows were hatching about this same time. Rusty blackbirds and a northern three-toed woodpecker were feeding young in the nest on June 27 at Last Lake, and on July 3 a myrtle warbler was seen carrying food in its bill.

A stubby-tailed fledgling robin was seen with one parent on June 23; rusty blackbird fledglings were being fed by parents on July 4; and by July 8 fledgling sparrows were common.

During the first week of July there was a definite decrease in bird song. The common snipe had essentially stopped "winnowing" by June 30; most gray-cheeked thrushes had stopped singing by July 2, though a few were heard during a 10-mile hike on July 8; and the upland plovers, least sandpipers, yellowlegs, blackbirds, savannah sparrows, tree sparrows, and white-crowned sparrows were much less conspicuous than earlier. By July 19 the area was almost devoid of song, but the chips of young birds could be heard everywhere.

By July 20 Say's phoebes were out of their nests on the cliffs and were moving all over the valley floor near camp, being fed by their parents; and most of the Smith's longspurs and least sandpipers were gone from their nesting grounds in the tussock-heath tundra.

Fall migration was underway by the end of July. On July 29 a flock of eight to ten sandpipers—pectoral, Baird's, and least—fed around the shores of Last Lake, and the mew gulls that had spent the summer on Last Lake seemed to have left by August 1.

Summer on the upper Sheenjek River is brief!

ANNOTATED LIST OF BIRDS

During the summer of 1956, from May 31 to August 5, we identified 86 species of birds in the upper valley of the Sheenjek River. Of these, 23 species were seen only once or twice, or were represented by only a single pair in the valley. In addition, two species of uncertain identity were noted. A large, dark-colored owl flew high over the valley on June 19; Kessel tentatively identified it as a great gray owl (*Strix nebulosa*), though it might have been a great horned owl (*Bubo virginianus*). On June 20 Kessel and M. Murie caught a glimpse of a "V" of 15 dark-colored geese flying north high overhead. They "barked" once—a high-pitched note characteristic of white-fronted geese (*Anser albifrons*).

Our studies of the upper Sheenjek Valley proved unusually interesting, partly because the avifauna of the entire region was essentially unknown and partly because it was an avifauna of an ecotonal region between coniferous forests and tundra, and a region with great altitudinal variations. We found a number of species, especially in the denser portions of the spruce woods, that are characteristic of more nearly climax coniferous forests (boreal chickadee, varied thrush, ruby-crowned kinglet, pine grosbeak, white-winged crossbill, etc.). A large proportion of the passerines are birds typical of the subclimax vegetation of the coniferous forests (gray-cheeked thrush, Wilson's warbler, redpoll, tree sparrow, white-crowned sparrow, fox sparrow, etc.). Other birds are more typical of the tundra, both the northern and the alpine tundras (willow ptarmigan, American golden plover, Baird's sandpiper, and Lapland longspur). Some are strictly montane breeders (rock ptarmigan, golden eagle, gyrfalcon, wandering tattler, horned lark, wheatear, water pipit, and gray-crowned rosy finch). And, for a few like the upland plover (?), least sandpiper, and Smith's longspur, the geographical area of the eastern Brooks Range appears to be a major nesting ground.

To add to the interest of the area, the Sheenjek Valley also appears to be a major migratory route for birds during their spring migration. Were one in this valley earlier in May, undoubtedly many migrant species would be added to our present list of the birds recorded in the area.

Where data were obtained, in each of the following annotated accounts we have indicated something of the species abundance, ecological distribution, and breeding biology. Subspecies names are included only where the collected specimens have been examined for such determinations: Dr. Herbert Friedmann, U. S. National Museum, examined the gray-crowned rosy finches; and Dr. Frank A. Pitelka, University of California, examined the boreal chickadees, savannah sparrows, tree sparrows, white-crowned sparrows, and fox sparrows. In the data

tabulations, in the case of the males, the size of the left testis is listed first; the size of the right, second. All the specimens are deposited at the University of Alaska Museum.

ARCTIC LOON, *Gavia arctica*

The arctic loon was the common loon of the upper Sheenjek Valley. It was apparently resident on the larger ponds and lakes of the valley, where we observed them regularly. Between June 1 and June 19 we recorded at least eight pairs and four singles. A pair frequented Last Lake throughout July, but we never found their nest, nor did we see any young; a third loon visited the lake on occasion. On the evening of June 21, eight of these magnificent birds gathered on the waters of Lobo Lake; six of them, their silvery-velvet necks reflecting the light of the midnight sun, swam, one behind the other, across the quiet waters of the lake.

RED-THROATED LOON, *Gavia stellata*

We saw only a few red-throated loons during the summer, and all were in the vicinity of Lobo Lake. The Muries saw one flying low along the river on June 5, and O. Murie noted a lone bird sitting on the river on June 16. Kessel recorded a pair on Lobo Lake on June 15 and a single bird on June 19.

HORNED GREBE, *Podiceps auritus*

Horned grebes were uncommon, and we saw them only around Lobo Lake. Kessel and the Muries saw separate individuals on June 6, and two days later the Muries saw a pair. On June 13 Schaller found two pairs in a series of small ponds north of Lobo Lake.

MALLARD, *Anas platyrhynchos*

Compared to other waterfowl in the Lobo Lake region, mallards were not abundant. In the early part of June, when pintails, scaup, old-squaws, and scoters congregated on small ponds, a mallard or two could usually be found in their midst. Between June 1 and June 8, we counted a total of four pairs and seven single drakes. Six males and one female had congregated in one of the larger ponds on June 13.

Kessel watched a female along the river on July 14, about 5 miles north of Last Lake. The bird crept along for almost a quarter of a mile, giving the broken-wing act as if a brood were hidden nearby, but no young could be found.

PINTAIL, *Anas acuta*

Pintails were common around Lobo Lake. During a short walk on

June 1, Schaller counted on various ponds a total of 18 pintails, about half of which were females; the next day he counted 30 pintails loafing in one pond. Drakes were apparently already congregating when we arrived. On June 2, O. Murie reported 12 birds, mostly males; on June 4 Kessel saw two pairs and eight drakes, and on another pond Schaller found three pairs and ten drakes; 11 males sat by a small pond on June 13, and a flock of 11 drakes and two hens flew past camp on June 24.

Schaller flushed a hen from a nest in the sedges near a small pond on June 13. Six eggs lay in a cup of sedge sparsely lined with down. When he returned on June 22, the nest was empty and no sign of the eggs or female could be found.

On July 25 a female with a brood of three nearly-fledged young was flushed from the sedges along Last Lake; and a young pintail flew past camp on July 30.

GREEN-WINGED TEAL, *Anas carolinensis*

Teal were infrequent in the Sheenjek Valley, and it was not until late in the summer in the northern reaches of the river that we saw these birds. Kessel observed a female with a brood of six newly-hatched young in a small sedge-bordered slough about 5 miles north of Last Lake on July 13. She watched the birds for some time from a distance of 10 feet. The female croaked continuously, but would not flush. The chicks remained within 2 or 3 feet of the hen, but they dived when startled by a northern phalarope coming over them into the slough.

On this same day, Krear watched a hen with eight small chicks at the marshy mouth of a small creek near Last Lake. This brood was seen again on July 20 and July 22. On July 20 the Muries saw a female teal on a river bar about 10 miles north of Last Lake. She quacked repeatedly, but no young were seen.

AMERICAN WIDGEON, *Mareca americana*

The widgeon occurred regularly, but in small numbers around Lobo Lake. At the time of our arrival they were mostly in pairs, and some hens were apparently laying. What appeared to be a courting party of two males and a female flew past camp on June 2. Krear found a nest on a dwarf shrub knoll near camp on June 9. The nest was at the base of a 3-foot high patch of willow and dwarf birch at the top of the knoll, some 50 to 75 feet above Lobo Lake and about 100 horizontal yards from the water. The hen was just laying, and there were two eggs in an unlined depression in the moss. There were six cool eggs in the nest on June 13, and by this time a few feathers lined the nest. When the

female left the nest she concealed the eggs by covering them with moss. She was incubating eight warm eggs on June 18.

Drakes began to congregate in early June. Kessel saw a flock of 10 males flying downstream on June 6, and she noted 14 males on Lobo Lake on June 17, and 12 on June 20.

No widgeon were observed in the vicinity of Last Lake.

SCAUP, GREATER AND LESSER, *Aythya marila* and *A. affinis*

Both species of scaup occurred in the Lobo Lake area. During early June nearly every pond contained one or more pairs. Between June 1 and June 7 we recorded 24 pairs and a few single drakes. On June 8 Schaller counted eight pairs and three males in one pond; and on June 12 he saw a total of five pairs on four ponds. No nests or young were seen. No scaup were seen around Last Lake.

The observations of the two species are combined here because of the difficulty of identification. Kessel, however, made the following positive identifications: June 1, one pair of greater scaup; June 8, one pair of lesser scaup; June 10, one pair of greater scaup; June 15, two pairs of greater scaup; June 24, two male lesser scaup; and June 25, two pairs of lesser scaup.

BARROW'S GOLDENEYE, *Bucephala islandica*

One pair of Barrow's goldeneye landed briefly near camp in the narrow lead of water around the edge of Lobo Lake on June 7. No others were seen during the summer.

OLDSQUAW, *Clangula hyemalis*

The musical "ah-hah-wi, ah, hah-hah-wi" of the oldsquaw was a common sound around Lobo Lake in early June. During this period migrant flocks were still in the area: O. Murie noted six or seven birds in two groups on June 2, and Kessel counted ten in a flock on June 4. The migrants, however, seem to have left the area by June 11. Many birds were paired when we arrived, and we saw one or more pairs every day during the first half of June. Kessel saw five pairs on one pond on June 8. Oldsquaws undoubtedly breed in the area, though no nests were found. Five males loafed together on Lobo Lake on the evening of June 23, a sight that suggested the possibility of incubating hens.

Several times during the last half of July a female oldsquaw was seen on a small tundra pond near Last Lake at an elevation of 3,500 feet; she would not flush from the pond. Schaller found an unhatched egg on August 2 which had floated up to the shore of this pond; it measured 58 by 40 millimeters and was probably laid by this species.

WHITE-WINGED SCOTER, *Melanitta deglandi*

White-winged scoters were common in the vicinity of Lobo Lake during June, but none was seen during July farther north around Last Lake. Migrant flocks were frequent in the area when we first arrived, though others appeared to be resident pairs. The largest flocks were seen on June 4 when a flock of 20 was on a small pond just north of Lobo Lake and a flock of 25 was on a pond about a mile eastward. The flocks seemed to have dispersed by June 11, and after that only pairs were seen. Three or four pairs frequented Lobo Lake throughout June, and others were found on the larger ponds of the area.

SURF SCOTER, *Melanitta perspicillata*

Surf scoters were much less abundant than the white-winged scoters. A flock of eight whistled low over camp on June 1, and, on June 4, 15 surf scoters swam about on a small, ice-free pond near Lobo Lake with 20 white-winged scoters. O. Murie saw eight surf scoters on June 8; Kessel watched two males courting together in the absence of a female on June 13; and Schaller found three pairs east of Lobo Lake on June 13. Three drakes landed on Lobo Lake on June 20. One drake visited Last Lake on July 2.

RED-BREASTED MERGANSER, *Mergus serrator*

Red-breasted mergansers were not common, but a few were seen throughout the summer. One bird flew over camp on June 1. On June 3 we watched two males and a female fly up and down the river, landing and courting every so often. A pair landed on the water near camp on the evening of June 6; Kessel saw a female on June 14 and a male on June 19; and we saw a male on June 22.

A pair landed on Last Lake on June 27; the Muries and Krear saw a female along the river about 3 miles north of Last Lake on July 14; and Kessel recorded a female on Last Lake on July 18.

GOSHAWK, *Accipiter gentilis*

A pair of goshawks apparently had a territory in the vicinity of Last Lake, and probably all our records are of this one pair. Kessel and M. Murie watched a large, adult goshawk fly along some dense spruce woods about a mile north of Last Lake on June 30. The bird, probably a female, landed in an 8-foot spruce 50 yards from the observers. O. Murie observed an adult northeast of camp on July 10. One flew past camp on July 28 with a mouse-sized prey in its talons; and the Muries and Douglasses heard one calling north of camp on August 4.

ROUGH-LEGGED HAWK, *Buteo lagopus*

Rough-legged hawks seem to be mainly migrants through the Sheenjek Valley. On May 31, while approaching Lobo Lake by plane, Schaller spotted a rough-leg flying immediately below the plane. It was the only buteo seen all summer, although an old abandoned nest on a bluff east of Lobo Lake looked like a typical rough-leg aerie.

GOLDEN EAGLE, *Aquila chrysaetos*

Golden eagles were thinly dispersed over the entire area explored during the summer. An eagle flew low over camp on June 1, flushing a male willow ptarmigan, which flew cackling out onto the ice of Lobo Lake. Two eagles soared high over Table Mountain on June 4 near an old aerie. On June 6 an eagle flushed from a spruce near the river. And a pair was sighted about 20 miles north of Last Lake on July 13. On July 17, while on the East Fork of the Chandalar River, Schaller watched a golden eagle feed on a caribou carcass, and on August 3 he came upon one sitting by a ground squirrel den on an alpine slope near Last Lake.

BALD EAGLE, *Haliaeetus leucocephalus*

Schaller found the nest of a bald eagle on June 24 near the top of a partially dead 25-foot poplar (*P. balsamifera*) at the edge of Old Woman Creek, about half a mile south of Lobo Lake. Both adults were in attendance. One young, covered with gray down, but with the primaries extending $\frac{1}{4}$ inch from their sheaths, squatted in the stick nest. When molested it immediately flopped on its back with talons extended. The nest contained two partially eaten grayling (*Thymallus signifer*), the hind legs of a varying hare (*Lepus americanus*), and the remains of an unidentified diving duck (*Aythya*).

Kessel and the Muries watched an adult bald eagle sitting in the top of a spruce about 1.5 miles north of Last Lake on June 30, and on July 11 we noted one soaring around the shoulder of a mountain about 5 miles north of Last Lake.

MARSH HAWK, *Circus cyaneus*

At least one pair of marsh hawks hunted the region around Lobo Lake. A female was seen on four occasions during the first half of June, and Kessel observed a pair near camp on June 19.

M. Murie heard the loud cry of a male willow ptarmigan near camp on June 22 and turned to watch a marsh hawk swoop past her and practically land on the back of the ptarmigan. Two days later Schaller

and MacLeod watched a female marsh hawk chase, with amazing agility, a male ptarmigan among the branches of tall brush along the river.

Kessel observed a marsh hawk flying over the river about 5 miles north of Last Lake on July 13.

GYRFALCON, *Falco rusticolus*

While climbing about the rocky summit of 4,000-foot First Mountain on June 20, Schaller found the stick nest of a gyrfalcon beneath an overhang of rock at the edge of the precipitous south face of the mountain. The nest was about 2 feet in diameter and contained three young gyrfalcons which were fairly well feathered, except for their heads and backs which were still covered lightly with down. On June 23 the primaries of these young had emerged 3 inches from their sheaths and the tail feathers had emerged 2.5 inches.

On June 20 the remains of at least three ptarmigan, the head and wings of an oldsquaw, and the feathers of an upland plover lay scattered about the nest-ledge. On June 23, one ptarmigan, one oldsquaw, and one ground squirrel had been added to the kills around the nest; and by June 25 two more ground squirrels had been brought in.

PEREGRINE FALCON, *Falco peregrinus*

Peregrines were uncommon in the upper Sheenjek. A lone bird, a female judging by its size, flew swiftly past camp on June 5. On June 8 Schaller found a pair perched near the summit of a 4,000-foot mountain about 3 miles southeast of Lobo Lake, near Table Mountain. They dove at him briefly, emitting their "ki-ki-ki," but they apparently had not yet begun to nest. He found the remains of several ptarmigan on the flat, grassy top of a nearby spire.

PIGEON HAWK, *Falco columbarius*

Kessel saw a small falcon, probably of this species, on June 4 near Lobo Lake. On June 30, Schaller watched two pigeon hawks dive repeatedly over some brush about 12 miles north of Last Lake. The Muries reported seeing two pairs while on a hike between July 20 and July 24: One pair was in a willow-spruce area about 5 miles north of Last Lake, and the other pair was in the same general area where Schaller had watched the pair on June 30.

WILLOW PTARMIGAN, *Lagopus lagopus*

Perhaps more than any other bird, the willow ptarmigan typified the upper valley of the Sheenjek. It was conspicuously present at all times, and was an important prey species of the region. It was a common

bird of the lowland dwarf shrub habitat—preferring the knolls covered with dwarf birch and willow, and the open spruce woods interspersed with dwarf shrubs; at times it also frequented the tall brush of the willow-bordered stream beds.

The peak of the mating season had passed by May 31; some hens were laying, and others were already incubating full clutches of eggs. The males were still in full breeding plumage, with white bodies and contrasting rusty-brown head and necks, and many were still actively courting and would burst forth with their guttural cackle anytime during the 24-hour day, especially when disturbed. They often executed a long, swift glide display which ended in a short upward sweep until the bird "stalled" and, loudly crowing, fluttered to the ground.

Nests were usually in a dry, protected spot, mostly in the dwarf shrub habitat, though we found one nest on the ridge of a polygon in tussock-heath tundra at the base of a 12-inch high willow. The nests were well concealed, usually beneath a patch of low shrub or under the canopy of low spruce boughs. They consisted of only a shallow depression, usually in moss, sometimes with a few dried leaves, grasses, or feathers in the cup which gave the appearance of a lining. We found seven nests during the first three weeks of June; five had completed clutches, averaging 6.8 eggs per clutch (range: 6-7).

Incubating hens exhibit a strong attachment to their nest, especially as the incubation period progresses. Schaller made the following observations:

"A bird which had just completed her full clutch let me approach to within 10 feet; four days later to within 7 feet. Instead of flushing and leaving the vicinity now, the female ran about and hissed in a most menacing fashion. A hen, with eggs about ready to hatch, refused to move from the nest even when touched. Finally, when I pushed the bird, she stepped to the side with beating wings. As soon as I removed the hand she climbed back on her eggs."

With the beginning of incubation, the males became quiet and began molting their white body feathers. After June 5 they seldom called; not until late July did we hear them regularly again. They take no part in incubation, but they "stand guard" in the vicinity of the nest. During the first week of June they sat on slightly elevated prominences, but later, while undergoing heavy molt, many secreted themselves beneath bushes and low spruce boughs, and when disturbed they flushed in a shower of white feathers. When the hens left the nest, which they did about twice a day, the males joined them, and they foraged together near the nest.

The first clutch of eggs under observation hatched on June 20, and on June 24 Kessel came upon a hen that had apparently been brooding a family of eight small chicks. A slight movement on Kessel's part caused the huddled chicks to scatter and brought both parents flying at the intruder. The hen came within 2 feet, hissing and flashing her white wings in a startlingly distractive display.

Ptarmigan were less abundant around Last Lake, where there was less dwarf shrub. We counted, nevertheless, 12 broods between June 28 and July 26. Because of the type of habitat and the behavior of the young it was practically impossible to get an accurate count of the young of each brood flushed. Our counts, however, show an average brood size during July, 1956, of about four chicks. Even assuming that not all the young were seen, the mortality rate seems high, for the average clutch size is about seven eggs.

After the chicks have hatched, many males join the female in the care of the brood. Both adults were with six of the thirteen broods we saw during the summer; with the other broods we saw only the female. It is possible that some males had been killed, but it also seems probable that the males may leave the broods as the chicks develop. A flock of 11 males flushed by Kessel from a *Salix*-moss river island in the upper Sheenjek on July 14 could possibly be explained in this way.

During the second week of June there was a conspicuous tendency for some males to flock. On June 6 as we walked along the edge of the river we found the area literally alive with males. A few days earlier only a few ptarmigan could be found in the tall willows along the river, but on this day, within about half a mile, we flushed groups of five, four, ten, and six males. A 150-foot sandbar held about 25 noisy birds. A few days later the flocks were no longer conspicuous, although O. Murie saw one group of five or six males on June 20. An explanation for this flocking is not available, though similar summer flocks have been reported on the Arctic Slope of Alaska (Kessel and Cade, 1958) and at the mouth of the Anderson River, N.W.T., Canada (Höhn, 1958).

Ecologically, the willow ptarmigan plays an important role in the valley. Every predator capable of killing a ptarmigan undoubtedly pursues it for food. We located a number of remains throughout the summer; on June 2 Schaller counted five remains while walking around Lobo Lake.

A golden eagle swooped low over a male ptarmigan near camp on June 1. On two occasions we watched marsh hawks pursue ptarmigan. Remains were scattered near a peregrine roost and a gyrfalcon aerie. Scat analysis showed that the ptarmigan also formed an important part

of the diet of lynx (*Lynx canadensis*), and that they were eaten by wolf (*Canis lupus*) and fox (*Vulpes fulva*).

Two nests were robbed by predators in June. In both instances no sign of the eggs were left and we suspect the fox as the most probable predator; foxes were abundant around Lobo Lake and some of their scats contained egg shells. One grizzly (*Ursus horribilis*) scat contained the remains of an egg, which may have come from ptarmigan. Ground squirrels have been known to rob the nests of ducks (Sowls, 1955), but an encounter we watched between a ptarmigan and squirrel makes this rodent a doubtful predator. A female ptarmigan was feeding with her mate near their nest when a squirrel approached. The hen took a long jump and landed on the back of the rodent, which retreated to its hole with utmost haste; the ptarmigan continued her feeding.

Ptarmigan feathers are utilized by many species in nest construction. The abundant tree sparrow lines its nest almost exclusively with the soft, white contour feathers. Lapland and Smith's longspurs, redpolls, and Say's phoebes also incorporate ptarmigan feathers in their nests. And Schaller watched a ground squirrel carry a mouthful of feathers into its hole, presumably destined for its nest.

* ROCK PTARMIGAN, *Lagopus mutus*

Rock ptarmigan were seen infrequently in the Sheenjek region during the summer of 1956. While usually a bird of the high alpine valleys, we also found them frequenting the valley floor. Schaller saw a male in white plumage on the tundra east of Lobo Lake on June 4. Kessel and the Muries flushed a total of four males in the spruce forest at about 2,000-3,000 feet between June 6 and June 14. On June 23 Krear observed a flock of five males on a ridge near First Mountain, and Schaller saw two more in the willows of an alpine valley.

On June 27 on an alpine slope near Last Lake, Kessel saw a male with an almost entirely brown back; and during July, seven different birds were counted in the valley bottom near Last Lake. O. Murie saw a flock of nine on the tundra east of Last Lake on August 2.

SEMPALMATED PLOVER, *Charadrius semipalmatus*

We saw semipalmated plovers regularly throughout the valley around the shores of shallow ponds where the vegetation did not reach the water and along the gravel and silt bars and banks of the creeks and rivers. Kessel counted six to eight pairs along the shores of one pond on June 8; the incessant calling and general behavior of the plovers suggested that they had begun to nest. On June 23 Kessel found a nest containing three eggs in a small, unique alkali area (see *Alkali Flats* under *Vegeta-*

tion) west of Lobo Lake. The nest consisted of a depression in the ground lined with dryas leaves.

North of Last Lake we found these plovers especially common along the gravel bars of the river. Schaller counted five pairs within an hour as he walked along the upper river on July 13; he watched one give the broken-wing act. The Muries found a downy young on July 23.

AMERICAN GOLDEN PLOVER, *Pluvialis dominica*

We saw golden plovers on only two occasions. Apparently a few birds are resident at the higher altitudes during the summer. On June 4 a plover stood on a ridge at 4,800 feet near Table Mountain, and another called in the distance. Two more plovers were seen east of camp on June 11 at an elevation of 4,000 feet.

BLACK-BELLIED PLOVER, *Squatarola squatarola*

We heard, and then saw, two black-bellied plovers in tussock-heath tundra near Lobo Lake on June 1. These were the only birds of this species seen all summer, and they probably represented the end of the spring migration through the Sheenjek Valley.

COMMON SNIPE, *Gallinago gallinago*

The snipe occurred regularly in small numbers throughout the lowlands of the valley floor. We heard their "winnowing" daily about Lobo Lake during the first week of June, and during the rest of the month we heard them more or less regularly, though not as frequently. Our records show fewer birds in the vicinity of Last Lake, partly because there is less suitable habitat than farther south, and partly because the birds had ceased courting; with one exception on July 14, we last heard "winnowing" on June 30. One or two pairs frequented the shores of Last Lake; Kessel disturbed a pair about 5 miles north of camp on July 8 that acted as if they had a nest hidden close by; and Schaller heard one over a patch of sedge-grass marsh at the headwaters of the river on July 14.

WHIMBREL, *Numenius phaeopus*

A lone whimbrel flew past Lobo Lake on June 5—the only record for the summer.

UPLAND PLOVER, *Bartramia longicauda*

Among the most memorable sounds of the Sheenjek Valley were the beautiful and striking notes of the upland plover. The sight, too, of these graceful birds landing on the swaying tips of spruce trees and re-

maining there poised with wings extended overhead, will not soon be forgotten.

Although Kessel tentatively identified an upland plover by a fragment of its call on June 8, and Schaller found the remains of one in a gyrfalcon nest on June 20, none was seen around Lobo Lake until June 23, when a lone bird flew by us near First Mountain. This species was scarce around Lobo Lake, and absent from the upper 15 miles of the river; but it was relatively common between Last Lake and the limit of spruce, 15 miles to the north. Here, they seem to prefer fairly well-drained, sloping tussock-heath tundra with a few scattered spruce on which to perch.

Schaller found a nest hidden between two sedge tussocks in tussock-heath tundra about 10 miles north of Last Lake on June 30. The nest cavity was lined with moss and a few fruticose lichens, and contained four eggs. At first one of the adults feigned injury but then flew off to join its mate 50 yards away. One pair with two fully-feathered young flushed from the headwaters of the Chandalar River on July 16.

A female (UA. 857) was collected on June 16 near Last Lake; it weighed 153.0 gm., and her ovary contained varied-sized follicles, the largest being 6 mm. in diameter.

SPOTTED SANDPIPER, *Actitis macularia*

We observed spotted sandpipers a number of times, feeding or flying along the gravel bars of the river north of Last Lake. They were not common, however: e.g., Kessel saw two or three birds during a 5-mile hike on June 30, and Schaller saw a total of four along a 20-mile stretch of river north of Last Lake in mid-July. These birds were absent from the Lobo Lake area, probably because of the lack of suitable habitat.

SOLITARY SANDPIPER, *Tringa solitaria*

Solitary sandpipers were sparsely distributed over the floor of the valley. They were inconspicuous and were seldom seen unless they attracted attention by their loud "killy-killy-killy" cry. We recorded about a dozen separate individuals during the summer and collected one on July 2—a male (UA. 870) from a spruce tree in a wet, marshy area near Last Lake, weighing 53.5 gm; the testes measured 3 x 2 and 2 x 2 mm.

WANDERING TATTLER, *Heteroscelus incanum*

The tattlers are alpine birds, summering beyond the limit of trees along gravelly alpine streams or the rocky shores of tundra pools. Schaller saw one in a creek bed of an alpine valley on June 14; and during

the second week of July, the Muries and Kessel saw two at the edge of a tundra pond near Last Lake, where O. Murie felt that they had probably nested. During a five-day hike in mid-July, through the headwaters of the Sheenjek River and the East Fork of the Chandalar River, Schaller counted a total of 12 tattlers, singly and in pairs. Several of these birds acted extremely excited, but he found neither nests nor young.

LESSER YELLOWLEGS, *Totanus flavipes*

These yellowlegs were relatively common and by far the most vociferous shorebirds around Lobo Lake, where they frequented the marshy lowlands and the open brush and tree areas near most of the shallow ponds. They were less common in the vicinity of Last Lake, but one pair inhabited the marshy, open woods on the north edge of this lake, and a pair was observed in a marshy area about 5 miles farther north.

Kessel and M. Murie flushed a bird from a nest with three warm eggs on June 20. The nest was a slight cavity in a fairly dry lichen-moss rise, about 3 feet from a small puddle, situated at the junction of damp tussock-heath tundra with open spruce woods, not far from a marshy pond outlet. O. Murie caught a young yellowlegs, not quite able to fly, west of Last Lake, on July 27. And on August 2, four fully-feathered young, some with wisps of down still on their heads, sat at the edge of Last Lake.

PECTORAL SANDPIPER, *Erolia melanotos*

We saw only a few pectoral sandpipers and assume that they are only migrants through the Sheenjek Valley. Schaller flushed four of them from tussock-heath tundra near Lobo Lake on June 3, and collected a female (UA. 847) weighing 57.4 gm. whose largest ovarian follicle was 4 mm. in diameter. One more bird was seen in this same area on June 6. On July 24, a sandpiper believed to be this species, was observed by Kessel on the edge of Last Lake in company with four least sandpipers and two yellowlegs.

WHITE-RUMPED SANDPIPER, *Erolia fuscicollis*

The only record of this species for the summer was on June 8 when Kessel saw two individuals, probably migrants, in company with other sandpipers on the mud-flats of a pond about 2 miles southeast of Lobo Lake. A male was collected (UA. 837), weighing 33.9 gm., and having enlarged testes measuring 9.5 x 5 and 7 x 6.5 mm.; the legs were blackish brown to dark olive, and the bill was dark, except for the proximal half of the lower mandible which was yellow.

BAIRD'S SANDPIPER, *Erolia bairdii*

Along the Sheenjek River, the Baird's sandpiper is apparently a sum-

mer resident and breeds in the relatively moist draws of the high alpine valleys, but when we arrived at Lobo Lake a few migrants were still passing along the valley floor. We saw one on the edge of Lobo Lake and one along the river on June 1, and on June 3 we found one dead and partially eaten along the river. Kessel collected a straggler at the edge of a pond on June 14 (UA. 832, weight 39.2 gm., largest follicle 3 mm. dia.). We did not see these sandpipers on the valley floor again until after the breeding season; on July 23 a juvenal Baird's, still with some down on its head, was identified in a flock of about ten shorebirds at Last Lake.

Schaller flushed about five birds, singly and in pairs, from high alpine meadows (about 4,500 feet) on June 14 and 15, in an area where large snow drifts still covered some of the ground; one female had a well-developed egg in her oviduct. A single bird was seen several times during the first half of July in an alpine valley at 3,500 feet near Last Lake; it was reluctant to leave the area, but no nest could be found. During a walk about the summit of the Brooks Range in mid-July, Schaller counted over six Baird's sandpipers, one of which gave the broken-wing act.

LEAST SANDPIPER, *Erolia minutilla*

Least sandpipers were by far the most common shorebird inhabiting the Sheenjek Valley in 1956, and they nested commonly in the tussock-heath tundra of the valley floor. Our observations apparently comprise the first actual nesting records for this species in inland Alaska (see Gabrielson and Lincoln, 1959). During the early part of June small flocks flew over the marshes and fed on the mud bars, and the calls of courting birds were frequently heard. As late as June 14, Kessel saw a flock of over eight sandpipers feeding around the muddy edges of a pond. Egg-laying by some birds, however, apparently was underway by the first of June.

The least sandpiper nested in the damp to medium damp portions of the tussock-heath tundra, but where a footstep squeezed out no excess moisture. It usually chose a low moss hummock (mostly *Drepanocladus* sp.) or *Eriophorum* tussock in which to place the nest cup. We found *Dryas integrifolia*, *Equisetum scirpoides*, *Arctostaphylos alpina*, and various sedges in the immediate vicinity of most of the nests, and two were slightly roofed over by the surrounding sedges. The nests appeared to be lined with small dead leaves—*Salix* spp., *Arctostaphylos alpina*, *Dryas integrifolia*, and *Betula glandulosa*. The consistency with which we found such materials in the nests makes their presence appear more than accidental. We found six nests in the vicinity of Lobo Lake, each containing four eggs—June 5, June 15, June 16, June 16, June 20, and June 23,

respectively. The eggs of the nest found on June 5 had not hatched by June 13, but on June 26 the nest was completely empty and the parents were nearby. The nest of June 15 was apparently deserted, since we found the eggs cold on June 20.

We collected two specimens in the vicinity of Lobo Lake: A male (UA. 848), on June 3, weighing 21.7 gm., with testes 8 x 4.5 and 3 x 3 mm.; and a female (UA. 838), on June 8, weighing 25.2 gm., with the largest ovarian follicle 4 mm. in diameter.

Least sandpipers were also common around Last Lake, where they apparently nested in habitat similar to that at Lobo Lake. These sandpipers had begun to congregate by July 25; on this date ten, many of them juvenals, frequented the shores of Last Lake.

SEMPALMATED SANDPIPER, *Ereunetes pusillus*

The status of the semipalmated sandpiper in the Sheenjek Valley is undetermined. Kessel watched about eight of them feeding with other shorebirds on the mud-flats of a pond on June 8. Two of these, both females, were collected: UA. 834, weighing 28.2 gm. with the three largest follicles 3 mm. in diameter, and UA. 840, weighing 24.5 gm. with the largest follicle 4 mm. in diameter. On July 12 Kessel saw several more of these sandpipers on a river bar just north of Last Lake.

BUFF-BREASTED SANDPIPER, *Tryngites subruficollis*

The only record we have of the buff-breasted sandpiper along the Sheenjek is a dead male found by O. Murie on the north shore of Lobo Lake on June 7 (UA. 830). This bird could not have been dead for more than two days, for the pectoral muscles were still soft and the joints of the wings and legs were still pliable. The enlarged left testis measured 11 x 6 mm.

SANDERLING, *Crocethia alba*

Kessel saw two sanderlings, undoubtedly migrants, feeding with other shorebirds on the mud-flats of a pond about 2 miles southeast of Lobo Lake on June 8. A male was collected (UA. 836) weighing 52.2 gm. with enlarged testes measuring 13 x 7 and 10 x 6.5 mm.

NORTHERN PHALAROPE, *Lobipes lobatus*

These phalaropes were common in the many shallow ponds of the valley floor that were bordered by sedge-grass marsh; because of their habitat preference, they were not as common in the northern parts of the valley as they were in the kettle-hole country around Lobo Lake. We counted a total of 23 birds, mostly in twos and threes in the vicinity

of Lobo Lake during the first week of June. A flock of 18 apparently paired birds was seen on one pond by Kessel on June 8, and that same day she saw another group of six on a different pond. Copulation was observed on June 10. We never located any nests or young, but this species undoubtedly is a common breeder in the Sheenjek Valley.

LONG-TAILED JAEGER, *Stercorarius longicaudus*

Jaegers appeared to be only migrants through the valley. Schaller spotted a flock of 15 from the plane as he approached Lobo Lake on May 31. Two jaegers flew over camp on June 2, and the last three we saw flew past on June 3.

HERRING GULL, *Larus argentatus*

Schaller and O. Murie definitely identified the herring gull for the first time on June 25 at Lobo Lake, although several times previously we had observed gulls that appeared larger than the common mew gull. We saw herring gulls several times during July near Last Lake and as far as 12 miles farther north. A lone herring gull flew past camp on August 2, the day after the mew gulls had left.

On July 18, on the shore of Last Lake, Krear found the shell of a large gull egg (77 x 55 mm.), probably of this species, that had been opened by a predator. A pair of herring gulls apparently had a territory about half a mile south of Last Lake, perhaps a re-nesting attempt from a first nest destroyed on Last Lake.

MEW GULL, *Larus canus*

Mew gulls were relatively common in the Sheenjek Valley. Kessel recorded 13 birds around Lobo Lake, mostly in pairs, during the first half of June. Between June 19 and the time we left on June 26, these gulls began to appear in small flocks; groups of 5 to 16 gulls congregated on the ice or flew screaming overhead. This unexplained behavior occurred at a time when breeding birds should have been incubating eggs; perhaps they were feeding on invertebrates made available by the ice break-up and the seasonal changes within the lake.

Mew gulls were not as conspicuous at the north end of the valley, though Kessel saw a group of seven over Last Lake on July 6. One pair had a nesting territory on Last Lake and relentlessly pursued any large intruders—goshawks, golden eagles, herring gulls, and sometimes even the arctic loons which inhabited the same lake. We located the empty nest of this pair in the sedge-grass marsh at the edge of the lake, and on July 6 we discovered their lone, large, downy chick, with primaries extending half an inch from their sheaths. This young gull

took its first short flight on July 22, and on July 25 it awkwardly chased a pintail. The entire family disappeared suddenly from the lake on August 1.

BONAPARTE'S GULL, *Larus philadelphia*

Bonaparte's gulls were uncommon in the Sheenjek Valley, and we saw them only in the vicinity of Lobo Lake. O. Murie saw two birds on June 2, and two more on June 8; Kessel noted two on June 9. A lone bird sat with a flock of 14 mew gulls on the ice on June 22, and Kessel saw two more on June 25.

ARCTIC TERN, *Sterna paradisaea*

We saw only five terns all summer. Two skimmed over Lobo Lake on June 22, and another flew about on June 25. One bird flew over the river about 4 miles north of Last Lake on June 30, and another flew over Last Lake on July 6.

HAWK-OWL, *Surnia ulula*

One hawk-owl called from a dead spruce tree in a thick spruce-poplar grove about 12 miles north of Lobo Lake on June 16. The owl left its perch and disappeared into the woods as Schaller approached.

SHORT-EARED OWL, *Asio flammeus*

At least one short-eared owl was apparently resident in the vicinity of Lobo Lake during June; several times one was seen hunting silently over the tussock-heath tundra. Kessel watched one swooping over a red fox on the evening of June 12. She flushed one from an open spruce woods east of Lobo Lake on June 14, and another from a sedge-grass marsh at the base of First Mountain on June 22.

A short-eared owl flew past Kessel about 5 miles north of Last Lake on July 8.

YELLOW-SHAFTED FLICKER, *Colaptes auratus*

Flickers occurred sparsely throughout the spruce woods of the valley floor. Kessel heard at least six calls, probably representing three or four birds, between June 8 and June 19 in the Lobo Lake area, and she saw one feeding on a treeless hillside on June 10. Schaller flushed one from a spruce on June 16 about 5 miles north of Last Lake, and he saw two more in the same area on June 30; from July 11 to July 14, Kessel heard one call regularly not far from there. The Muries heard one call from a spruce slope southeast of Last Lake on July 4.

NORTHERN THREE-TOED WOODPECKER, *Picoides tridactylus*

On June 27 MacLeod showed us a nest of this three-toed woodpecker

situated in a thick stand of spruce about a mile north of Last Lake. It was about 7 feet up in a dead spruce that measured about 14 inches d.b.h.; we could hear young chirping within the hole.

SAY'S PHOEBE, *Sayornis saya*

Phoebes were fairly common where nesting sites were available about the bluffs that bordered the valley, but they also extended their activities to the open spruce woods of the valley floor. Between June 1 and June 11, Schaller counted a total of seven phoebes, near Lobo Lake and in the mountains to the east of camp. He collected a male (UA. 852) on June 4, weighing 23.5 gm. and having testes 7 x 5 and 8 x 5 mm.

Schaller found a nest at 3,900 feet on June 4, stuck into the crevasse of a limestone bluff east of Lobo Lake. The nest was formed of mosses, grasses, and lichens, and ptarmigan feathers lined the inside, but there were no eggs. When he returned on June 11, wolf hair and eagle feathers had been added to the lining, and four white eggs lay in the nest-cup.

Kessel discovered a nest at which the parents were feeding young on July 4; it was 20 feet up on a bluff east of Last Lake. Several fledglings and two adults flew about a cliff near the East Fork of the Chandalar River on July 17, and by July 20 many young had left the nest and had moved down to the valley floor near Last Lake where they were being fed by their parents.

TRAILL'S FLYCATCHER, *Empidonax traillii*

The only Traill's flycatcher seen during the summer was identified by Kessel on June 18. For some time she watched it feed in the tall brush along the river, about a mile north of Lobo Lake. It sang several times, and the characteristic eye ring, wing bars, and light lower mandible could be distinguished. The bird was apparently a transient, since it had disappeared from the area by the following day.

HORNED LARK, *Eremophila alpestris*

Inhabiting the high valleys, ridges, and slopes between 3,500 and 6,500 feet, horned larks were nowhere abundant, but we saw a pair or two nearly every day when hiking in the mountains. Between June 4 and July 14, Schaller recorded a total of 25 horned larks in seven observations. He collected a female (UA. 851) on June 4, weighing 36.8 gm. She had a large brood patch, and the largest follicle was 3 mm. in diameter.

VIOLET-GREEN SWALLOW, *Tachycineta thalassina*

The Muries came upon a small colony of violet-green swallows about 15 miles north of Last Lake on July 22, the only swallows of this species

recorded during the summer. About 12 birds flew along the gravel bars and over the willows; several fledged young sat in the brush. The Muries felt that the birds probably had nested in the cliffs nearby.

BANK SWALLOW, *Riparia riparia*

Schaller identified a lone bank swallow as it flew past him along the river near Last Lake on July 25.

CLIFF SWALLOW, *Petrochelidon pyrrhonota*

Several colonies of these swallows occurred in the Lobo Lake area. One colony of 50 or more nests occupied a south-facing bluff at 3,900 feet about 2.5 miles east of camp. On June 4 the nests were in poor repair and were not yet used by the few swallows which flew about the bluff. By June 11, however, the nests were being rebuilt and occupied, though four nests checked contained no eggs.

Two small colonies of six to ten nests clung to the south-facing slope of First Mountain, about a mile to the west of camp. Swallows were occupying these nests on June 22.

These swallows were less common farther north, though Kessel saw several birds feeding along the river 5 miles north of Last Lake on July 8.

GRAY JAY, *Perisoreus canadensis*

Jays were thinly distributed throughout the spruce woods of the valley floor, and we usually saw one or more when hiking along the valley. Schaller also saw jays in willow brush about 20 miles north of Last Lake, beyond the limit of spruce, on July 14.

Young jays were apparently fully-feathered before our arrival. The Muries saw a family of full-grown young on June 11, and Schaller saw a family of five on June 13. On June 30 Kessel and the Muries watched an adult feeding a juvenile as large as itself. As late as July 21 Kessel watched a juvenile jay begging an adult for food.

COMMON RAVEN, *Corvus corax*

Ravens were not abundant in the Sheenjek area. Schaller counted a total of 11 birds between May 31 and July 14, seen singly or in pairs from the Coleen River to the headwaters of the Sheenjek. On July 17 he watched a pair of adults with four fledged young feed on a fresh caribou carcass on the East Fork of the Chandalar River.

BOREAL CHICKADEE, *Parus hudsonicus hudsonicus*

These chickadees occurred in small numbers throughout the spruce woods and apparently nested in the denser portions of this habitat. Schaller saw two chickadees in a dense spruce patch east of Lobo Lake

on June 13, and the Muries noted a group of six birds southeast of Last Lake on July 4. Between July 8 and August 2 we recorded a total of ten more in the spruce in the vicinity of Last Lake. We collected two male specimens: UA. 829 on June 13 near Lobo Lake, weighing 11.7 gm. with testes measuring 1.5 mm. in diameter (in early stages of post-nuptial molt); and UA. 876 on July 20 near Last Lake, a juvenal weighing 12.7 gm. and having testes about 1 x 0.5 mm.

ROBIN, *Turdus migratorius*

Robins were relatively common birds throughout the Sheenjek Valley. We saw them almost every day in the open spruce woods and in the tall brush bordering the streams. They also flew about the slopes near timberline, penetrated the willows of the alpine valleys, and even frequented the limestone bluffs and talus slopes at higher altitudes.

We located six nests, all of typical robin construction. Four were placed in the lower branches of spruce trees, anywhere from 2 to 6 feet above the ground; one was 3 feet up in the center of a willow clump; and the other was on top of a 3-foot slab of limestone standing in a talus slope at 4,000 feet, well above timberline. The contents of the six nests were as follows: June 5, 3 eggs; June 11, 3 eggs; June 11, 4 eggs; June 15, 3 eggs; June 24, 3 eggs; July 13, 3 eggs. The eggs of the last four nests were warm, indicating that incubation had begun.

We saw a number of robins carrying food particles in their beaks between June 19 and June 22, and we saw the first fledged young near First Mountain on June 23. Stubby-tailed juvenals were seen several times in different areas on June 28, and on July 10 Kessel watched a fully-feathered, well-coordinated juvenal fly through the trees.

In view of the above dates, the late nest found with eggs on July 13 strongly suggests a second brood laying, though it could also have been a late re-nesting attempt.

VARIED THRUSH, *Ixoreus naevius*

Varied thrushes were scarce in the Sheenjek Valley, and they occurred only in the tall, dense spruce woods. Schaller collected a female (UA. 841) on June 11 about 2 miles east of Lobo Lake; it weighed 85.9 gm., had follicles up to 2 mm. in diameter, and had a large brood patch. Krear saw a varied thrush on July 8 about one mile north of Last Lake, and we heard one calling three days later about two miles north of camp.

GRAY-CHEEKED THRUSH, *Hylocichla minima*

The gray-cheeked thrush was relatively common along the Sheenjek, though usually inconspicuous. During the evening of June 1, Kessel

heard three singing simultaneously; and while walking along a small creek on June 6, Schaller counted six within 15 minutes. Their preferred habitat appeared to be the tall brush along the river and tributary creeks, though they frequented open spruce interspersed with tall brush.

The frequency of song in the population decreased conspicuously after the first week of June, and after the second week of June the birds seldom sang. Because of the absence of song, this thrush was not recorded often around Last Lake, though we heard several on a 10-mile hike on July 8, and Schaller saw a few in the headwaters of the Sheenjek on July 13.

WHEATEAR, *Oenanthe oenanthe*

The wheatear occurred sparsely throughout the mountain country surrounding the Sheenjek Valley, where we found it only on the high alpine tundra and talus slopes above 4,000 feet. During the hours spent in the mountains on four days in June, Schaller saw only five birds, mostly singles. On July 14 he counted at least five adults and one "bob-tailed" young in the headwaters of the Sheenjek River, and during the next four days he saw three more wheatears. Four fledged young flew about a talus slope in the mountains east of Last Lake on August 3; one male (UA. 878) was collected.

TOWNSEND'S SOLITAIRE, *Myadestes townsendi*

On June 28 Schaller watched two Townsend's solitaires call from a clump of spruce at about 3,000 feet at timberline, about 5 miles northwest of Last Lake. The slope was steep, and rock outcrops and patches of tundra lay interspersed with the patches of spruce. The birds were shy and flew about half a mile down the slope when Schaller approached them. Disturbed again, they returned to timberline, where Schaller collected one: Male (UA. 865), weighing 33.2 gm.; testes 11 x 6, 10 x 6 mm. with grayish pigmentation.

Distribution records for the solitaire in Alaska are sparse. Prior to the above observation, the northernmost records (Gabrielson and Lincoln, 1959) had been a nesting record 20 miles southeast of Circle and a specimen record from Bern Creek, tributary of the Black River (66° 55' N. Lat., 141° W. Long), some 200 and 150 miles, respectively, south of the Sheenjek record. The enlarged testes of the Sheenjek specimen are indicative of a breeding pair.

RUBY-CROWNED KINGLET, *Regulus calendula*

At the edge of a thick stand of tall spruce, about a mile north of Last Lake, Kessel watched a male kinglet feed a fledged, stubby-tailed young on July 21.

WATER PIPIT, *Anthus spinoletta*

Pipits were by far the most abundant alpine birds in the mountains surrounding the Sheenjek Valley. They reached their greatest abundance between 3,500 and 4,000 feet, where they seemed to prefer the steep alpine slopes interspersed with patches of talus. Schaller counted about 100 pipits in the vicinity of Table Mountain between June 4 and June 11. We all saw pipits when climbing above timberline around Last Lake; Kessel counted about 20 birds on July 4, many carrying food in their beaks. And Schaller found them in the headwaters of the Sheenjek, Jago, and Chandalar Rivers in mid-July.

Schaller found a nest at the west edge of the Coleen River drainage at about 3,500 feet on June 15. The grass nest was built into the side of a moss hummock and was shaded by a dwarf birch; it contained six eggs. On this same day, Schaller found another nest at the east edge of the Sheenjek drainage. This second nest was located on a steep slope at 4,000 feet under a moss overhang; it was also made of grass and contained six eggs.

BOHEMIAN WAXWING, *Bombycilla garrula*

- We saw waxwings only twice in the upper Sheenjek. Kessel saw two waxwings feeding in the poplars along Old Woman Creek on June 25, and four executed aerial feeding maneuvers over an extensive, sparsely vegetated, gravel outwash of a mountain tributary about 4 miles north of Last Lake on July 11.

NORTHERN SHRIKE, *Lanius excubitor*

Shrikes were sparsely distributed along the floor of the valley. We counted ten of them during the summer, from Lobo Lake to the headwaters of the river. Schaller saw the first fledgling on June 30, about 7 miles north of Last Lake. On July 13 he saw another juvenal north of Last Lake, and two more hopped through the willows in the headwaters of the Sheenjek on July 14.

YELLOW WARBLER, *Dendroica petechia*

Yellow warblers were infrequent along the upper valley of the Sheenjek, living almost entirely among the tall willows bordering the streams; we recorded them only eight times during the summer. M. Murie saw one in riparian willows near Lobo Lake on June 3. We collected a singing male in this same spot on June 6 (UA. 844, weighing 8.9 gm., with testes 6 x 4 and 5 x 3.5 mm.); and on June 18 another male sang from the same thicket. A third male sang from willows about half a mile farther south on June 18; the Muries noted a pair southeast of Lobo

Lake on June 14; and Kessel watched a male singing in a small poplar stand along the river on June 17. Schaller saw one in some willows north of Last Lake on July 2.

MYRTLE WARBLER, *Dendroica coronata*

The myrtle warbler was the most abundant warbler throughout the Sheenjek Valley; we usually saw a bird or two on each trip through the spruce woods. They were more common in the spruce near timberline, but we also saw them frequently among the spruce of the valley floor.

Kessel noted a female carrying a large mouthful of food on July 3 near Last Lake; and she saw different parents feeding fledged young on July 16, July 20, and July 21, respectively.

BLACKPOLL WARBLER, *Dendroica striata*

The only blackpoll warbler seen during the summer was a male that revealed its presence by singing from a spruce-willow hillside 2 miles north of Last Lake on July 11. Between songs he fed along a rivulet densely bordered by willow, poplar, and buffalo berry (*Shepherdia canadensis*).

WILSON'S WARBLER, *Wilsonia pusilla*

The Wilson's warbler was scarce, but it was probably somewhat more abundant than our sight records indicate. It was a secretive bird, and we found it only in the densest thickets of alder and willow. Kessel saw a singing male in the dense alder brush at the base of First Mountain (see *Vegetation*) on June 22. The next day we heard two separate males singing in a nearby area of birch and alder. On June 30 Schaller watched several of these warblers scold a pair of pigeon hawks which dove over a hillside of alder and willow 12 miles north of Last Lake. Two pairs were also seen in the vicinity of Last Lake during the early part of July.

RUSTY BLACKBIRD, *Euphagus carolinus*

Blackbirds were not common in the valley, but the scolding and calling of a few in the vicinity of our camps made them conspicuous. We counted about a dozen birds in the vicinity of Lobo Lake, where they frequented the edges of the ponds and streams surrounded by brush and a few trees. At least one pair of blackbirds had a nest hidden near camp at Last Lake. O. Murie saw a fledged young near camp on July 4, and an adult fed two juvenals near our tents on July 6. By July 9 the young flew strongly but still made awkward landings. One parent with three young flew over Last Lake on July 26.

PINE GROSBEAK, *Pinicola enucleator*

The Muries saw a male pine grosbeak in the dense spruce woods about a mile north of Last Lake on July 9—the only record for the summer.

GRAY-CROWNED ROSY FINCH, *Leucosticte tephrocotis irvingi*

We found the rosy finch sparsely distributed along the barren ridges and talus slopes of the high alpine country, in areas similar to that inhabited by the horned larks and wheatears. They were one of the few birds found at the tops of the highest mountains along the Sheenjek Valley, though Schaller also saw a pair atypically sitting in some willow brush on a slope at 2,800 feet. We found them at the rocky top of 4,000-foot First Mountain in late June, and in the mountains from Last Lake to the headwaters during July. Schaller watched a bird at 6,000 feet on June 28 feeding on insects which had become entrapped in the soft snow of a melting drift. Some apparently nested on a talus slope just east of Last Lake at about 3,000 feet. Kessel counted over six birds on this slope on July 4; and Schaller, on August 2, counted eight birds, mostly juvenals, in the same area. We collected three adult females during the summer:

UA. 866; June 28; wt., 30.6 gm.; largest follicle, 1 mm. dia.; large brood patch.
UA. 872; July 4; wt., 30.0 gm.; largest follicle, 1 mm. dia.
UA. 873; July 4; wt., 25.4 gm.; largest follicle, 0.5 mm. dia.

COMMON REDPOLL, *Acanthis flammea*

We saw redpolls regularly throughout the upper Sheenjek. They were most common among the willows that bordered the streambeds of the alpine valleys from 2,800 to 4,000 feet, but they also occurred in the open spruce woods interspersed by brush. We counted about 20 redpolls on the valley floor near Lobo Lake during the first half of June. Within 3 to 4 hours on June 14, Schaller counted over 10 redpolls along one alpine valley. A flock of 20 birds flew over a spruce ridge west of Last Lake on June 28. And on July 13, Schaller saw one flock of 20 and another of 15 in the headwaters of the river.

Schaller found a nest on gravel outwash at 4,000 feet in the headwaters of the East Fork of the Chandalar River on July 15. The grass and moss nest was 2.5 feet above the ground in the crotch of a 3-foot willow. Ptarmigan feathers and caribou hair lined the nest, which contained three warm eggs. In view of the nesting dates of the redpoll on the Arctic Slope (see Kessel and Cade, 1958), this late clutch is probably a second brood laying or a re-nest.

We collected two specimens near Lobo Lake, both *Acanthis flammea*: A female (UA. 833) on June 14, weighing 10.9 gm., and possessing minute,

uniform-sized follicles; and a male (UA. 862) on June 26, weighing 11.7 gm., with testes 4.5 x 5 and 5 x 6 mm.

WHITE-WINGED CROSSBILL, *Loxia leucoptera*

The only crossbill we saw during the summer was a juvenal male (UA. 835) collected by Schaller on June 11 in a dense patch of tall spruce on a slope about 2 miles east of Lobo Lake (see background Figure 5). It weighed 26.6 gm., had testes 1 mm. in diameter, and had been eating spruce seeds.

SAVANNAH SPARROW, *Passerculus sandwichensis anthinus*

Savannah sparrows were not numerous, but we found them regularly, both around Lobo Lake and Last Lake, in damp sedge-grass situations where low, scattered brush grew—either in sedge-grass marsh or tussock-heath tundra.

We found two nests in the Lobo Lake area. Kessel flushed a bird from a nest with five eggs in a sedge-grass marsh on June 20. The nest was placed among sedge on a dry rise with a few low willows nearby. It was constructed of small, grass-like leaves and was lined with hair, including some caribou hairs; it was completely roofed over by the surrounding sedges. Another nest found by Krear on June 22 was built into a depression at the side of an *Eriophorum* tussock. It was constructed and lined with grass-like leaves, though the edge away from the tussock was built up with coarser sedges and moss. The nest contained five eggs with embryos about two-thirds developed. On July 9 near Last Lake, an adult was seen carrying food in its bill. We collected four specimens:

- UA. 853; male; June 5, Lobo Lake; wt., 18.0 gm.; testes 10 x 6 and 9 x 6 mm
- UA. 859; male; June 19, Lobo Lake; wt., 19.5 gm.; testes shot.
- UA. 867; male; July 1, Last Lake; wt., 19.8 gm.; left testes, 8 x 7 mm.
- UA. 875; female; July 9, Last Lake; wt., 17.7 gm.; follicles minute.

SLATE-COLORED JUNCO, *Junco hyemalis*

Juncos occurred sparsely throughout the spruce-covered parts of the Sheenjek Valley, showing apparent preference for the higher slopes. We saw only two juncos in the Lobo Lake area, both on a spruce slope above 2,600 feet. Between June 28 and July 4 we counted a total of five around Last Lake, and on July 4 we heard four different birds singing. On July 20 Kessel heard and saw three birds, at least one of which was a fledgling. We collected a male on June 14 east of Lobo Lake: UA. 831; weight, 17.5 gm.; testes 9 x 6 and 9 x 6 mm., cloaca enlarged.

TREE SPARROW, *Spizella arborea ochracea*

The tree sparrow was by far the commonest bird of the upper Sheenjek. It was typically a bird of the dwarf shrub habitat, and its range

extended almost everywhere dwarf shrub existed, including in the open spruce woods, along streams, and even into the alpine valleys where we found them as high as 4,500 feet. They seemed to prefer the valley floor where their density far exceeded that of higher altitudes, and they were more common in the Lobo Lake area than around Last Lake, undoubtedly because of the greater availability of dwarf shrub.

The breeding season was in full swing when we arrived on May 31. Males sang conspicuously throughout the 24-hour day. Some birds were laying eggs, though many were still building nests; a few may already have begun to incubate. We found a total of 27 nests, 22 of them within a few miles of Lobo Lake during June. All were on the ground and were placed in similar situations, and all but a few were essentially similar in construction. They were usually placed on or against a small rise in the ground, usually a moss or sedge hummock. Some dwarf shrubs were always nearby, and in most instances the nests were placed directly under these shrubs, mostly against the bases; a number were built into the bases of the shrubs. Typically the nests were constructed of grass-like leaves and were heavily lined with white ptarmigan feathers. Many were in moss depressions or had an outer layer composed of moss, often combined with grasses. One nest found on July 16 on the East Fork of the Chandalar River was constructed entirely of moss and was lined atypically with caribou hairs with only a few ptarmigan feathers present. One other nest had some caribou hairs incorporated into the lining.

A tabulation of the 27 nests found is given in Table 4. The dates and subsequent visits indicate the progress of the breeding cycle. Of the nests found at Lobo Lake during June, only 12 are assumed to have complete clutches (based on subsequent visits, warm eggs, or behavior of parents); the clutches of these 12 nests averaged 4.7 eggs (4 to 5). In addition, two nests were found with 6 eggs, but it was not possible to revisit them. The late clutches of 2, 3 and 4 eggs, respectively, found near Last Lake, were probably re-nesting attempts.

The first eggs hatched between the 16th and 20th of June (one clutch had an incubation period of 12 days). At Last Lake, Schaller noted the first two fledged young on July 6, and we saw several others on subsequent days.

Two birds were collected near Lobo Lake: a male (UA. 860) on June 19, weighing 20.0 gm.; and a male (?) (UA. 863) on June 26, weighing 15.5 gm.; shot destroyed the gonads of both.

TABLE 4. TREE SPARROW NESTS IN THE UPPER VALLEY OF THE SHEENJEK RIVER, ALASKA, JUNE-JULY, 1956

Date of first observation	First observation	Contents of nest			
		Subsequent observations			
June 1	nest-cup only	June 7 2 eggs	June 8 3 eggs	June 20 3 young; 1 egg	June 26 4 young
June 6	5 eggs				
June 8	5 eggs				
June 8	1 egg				
June 10	4 eggs	June 18 5 eggs	June 24 5 young (just hatched)	June 26 5 young	
June 11	5 eggs (warm)				
June 11	5 eggs (warm)				
June 13	5 eggs				
June 14	5 eggs				
June 14	4 eggs	June 22 3 young (1 day old); 1 egg	June 25 3 young (eyes open); 1 egg (embryo undeveloped)		
June 14	nest-cup only	June 22 4 eggs			
June 14	5 eggs				
June 15	4 eggs	June 22 4 eggs	June 26 4 young (just hatched)		
June 16	5 eggs	June 17 5 eggs	June 26 4 young (just hatched); 1 egg (dead embryo $\frac{1}{3}$ developed)		
June 16	5 eggs				
June 16	6 eggs				
June 19	4 eggs; plus 1 egg cold in front of nest	June 24 4 eggs			

TABLE 4. TREE SPARROW NESTS IN THE UPPER VALLEY OF THE SHEENJEK RIVER, ALASKA, JUNE-JULY, 1956—Con.

Date of first observation	First observation	Contents of nest	
		Subsequent observations	
June 19	5 eggs	June 20 5 eggs	June 26 5 eggs
June 20	6 eggs		
June 22	4 eggs (warm)		
June 22	4 eggs; 1 young (just hatched)		
June 23	5 eggs		
June 24	4 eggs		
June 30	3 eggs (warm)	July 1 3 eggs	
July 6	4 eggs		
July 9	5 young (naked)		
July 16	2 eggs (warm)		

WHITE-CROWNED SPARROW, *Zonotrichia leucophrys gambelii*

White-crowned sparrows were the second most abundant birds of the Sheenjek Valley, but they were only about half as numerous as the tree sparrows. They occupied an ecological niche closely similar to that of the tree sparrow. Their distribution coincided with the presence of dwarf shrubs throughout the valley. They nested on the ground, and all ten nests we found were placed in depressions in moss, usually in a raised hummock. All had some low, woody vegetation sheltering the nest; most were under 12- to 36-inch shrubs. None of the nests was actually wedged into the bases of the shrubs as were some of the tree sparrow nests. All the nests were made of fine, dead, grass-like material, and typically they were lined with fine hairs. Only one nest was lightly lined with ptarmigan feathers. The two nests found at higher altitudes, 3,500-3,600 feet, lacked the lining of hair.

The dates and contents of the ten nests we found are given in Table 5. Only four of the nests found in June about Lobo Lake can definitely be counted as having complete clutches; these clutches averaged 4.7 eggs (4 to 5). The nests found on June 28 and July 13 at Last Lake are probably re-nesting attempts.

TABLE 5. WHITE-CROWNED SPARROW NESTS IN THE UPPER VALLEY OF THE SHEENJEK RIVER, ALASKA, JUNE-JULY, 1956

Date of first observation	Contents of nest			
	First observation	Subsequent observations		
June 1	4 eggs	June 13 4 eggs	June 18 4 young (3-4 days old)	June 26 nest empty
June 6	4 eggs	June 22 nest destroyed		
June 11	5 eggs (warm)			
June 12	5 eggs (warm)	June 18 5 eggs	June 24 4 young; 1 egg	June 26 4 young; 1 egg
June 14	5 eggs			
June 15	5 eggs			
June 18	5 eggs	June 22 5 eggs	June 26 5 young (1 day old)	
June 24	4 young (2-3 days old)	June 26 4 young		
June 28	3 eggs (cold)	July 1 4 eggs (warm)	July 7 4 eggs (warm)	
July 13	3 eggs (warm)			

The phenology of the white-crowned sparrow's season was at least several days ahead of that of the tree sparrow in 1956. A few birds were incubating by the time we arrived on May 31, and the first eggs hatched about June 13-14. The young had left one nest by June 26, but we did not sight any fledged birds until June 30.

The songs of the white-crowned sparrows in the upper Sheenjek were of two distinct types, and individuals were consistent with the type of song they sang. All began their songs with the typical clear, plaintive whistle. Some however, ended with a buzzy note, and others ended with a clearer trill. Specimens of both song types were collected and they all proved to be *Z. l. gambelii*:

- UA. 858; Male; June 19, Lobo Lake; wt., 26.0 gm.; testes, 10 x 8 and 9 x 7 mm.; song ended in buzz.
 UA. 864; Male; June 26, Lobo Lake; wt., 25.8 gm.; right testis, 9 x 7 mm.; song ended in trill.
 UA. 868; Male; July 1, Last Lake; wt., 26.3 gm.; testes, 10 x 6 and 8 x 8 mm.; song ended in trill.
 UA. 869; Male; July 1, Last Lake; wt., 26.5 gm.; testes, 11 x 6 and 10 x 8 mm.; song ended in trill.
 UA. 871; Male; July 3, Last Lake; wt., 24.8 gm.; testes 10 x 7 and 9 x 7 mm.; song ended in buzz.
 UA. 874; Female; July 7, Last Lake; wt., 25.8 gm.; incubating 4 eggs, ovarian follicles, 1 mm. dia.

FOX SPARROW, *Passerella iliaca zaboria*

Fox sparrows occurred regularly in small numbers in the tall brush bordering the river, creeks, and marshy pond edges in the Lobo Lake area. They were secretive in their habits, and so were seldom seen until they mounted their song perches and voiced their loud, cheerful song. We observed these birds only 15 times in the vicinity of Lobo Lake during June, and some of these observations undoubtedly represent the same birds. We saw them less commonly around Last Lake during July. Kessel saw two in tall willows along a brook near the river about 5 miles north of Last Lake on July 13, and on that same day Schaller flushed another individual from willows about a mile farther north.

We collected two males near Lobo Lake: UA. 850 on June 5, weighing 35.5 gm., with testes 8 x 6 and 7 x 6.5 mm.; and UA. 861 on June 19, weighing 33.2 gm., with testes 8 x 6 and 7 x 7 mm.

LAPLAND LONGSPUR, *Calcarius lapponicus*

Lapland longspurs were nowhere abundant along the upper valley of the Sheenjek. They were primarily birds of the alpine slopes and ridges, where we usually flushed a pair or two while traversing tussock-heath tundra (see Figure 3) between 3,200 and 4,500 feet. During early June, while they were still migrating, we found a few frequenting the tussock-heath tundra of the valley floor along with the Smith's longspur; later in June they deserted the valley floor, apparently to nest at the higher altitudes.

On June 11, at about 3,400 feet, we flushed a female, believed to be of this species, from a nest of five eggs. The nest in tussock-heath tundra was made of sedge and was lined with ptarmigan feathers. Schaller found a Lapland longspur nest in tussock-heath tundra at 4,200 feet in the headwaters of the Coleen River on June 14. The nest, made of grass-like materials, was hidden in a moss hummock. A thick lining of ptarmigan feathers surrounded five warm eggs.

One male (UA. 849) was collected on June 6 on the tundra near Lobo Lake. It weighed 24.8 gm. and had testes measuring 10 x 7 and 8 x 7 mm.

SMITH'S LONGSPUR, *Calcarius pictus*

Smith's longspurs were common summer residents of the tussock-heath tundra of the valley floor. They are apparently late migrants, since we first saw them on June 4, and it was not until June 6 that they appeared commonly throughout the tundra. On June 11 we saw two of these longspurs at 3,800 feet, probably transients, but typically they were birds of the valley bottom.

We found three nests in the tussock-heath tundra of the valley floor during the summer. All were hidden in moss hummocks and *Eriophorum* tussocks, and all were built of grasses and sedges. Two nests, found on June 18 and June 30, respectively, were lined with a few ptarmigan feathers and contained four eggs each. The third nest, discovered on July 13, had no lining and only two warm eggs. We noted the first fledged young on July 9, and Kessel saw a fully-feathered juvenal on July 20. We collected three specimens on June 6 near Lobo Lake:

UA. 842; Female; wt., 25.3 gm.; largest follicle 2.5 mm. dia.
UA. 845; Male; wt., 27.5 gm.; testes, 12.5 x 8 and 12 x 10 mm.
UA. 846; Male; wt., 26.3 gm.; testes, 14 x 10 and 14 x 9 mm.

SNOW BUNTING, *Plectrophenax nivalis*

No snow buntings were recorded until Schaller climbed to the headwaters of the river and the crest of the Brooks Range on July 14. On this day he found ten birds at about 5,000 feet near the glaciers at the head of the river. The following day, in the headwaters of the Jago River, he found adult and fledgling buntings the most abundant bird species. On July 18 Schaller saw several more snow buntings at 4,500 feet about 20 miles west of Last Lake on the divide between the Chandalar and Sheenjek drainage systems.

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