BIRDS AND MAMMALS OF THE PITMEGEA RIVER REGION, CAPE SABINE, NORTHWESTERN ALASKA

HENRY E. CHILDS, JR.

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Abstract


The results of four summers study from 1957 to 1960 on the interrelationships and distribution of the vertebrate fauna along the Pitmuex River at Cape Sabine in northwestern Alaska are presented. The geologic background, climate, soils, vegetational types and land utilization are discussed. Five major plant communities are described and used to analyze the distribution of birds and mammals. These communities are Barrens, Upland Meadows, Wet Meadows, Marshes and Shrub Types. Ninety species of birds were recorded of which 55 species nested within the Pitmuex drainage. Twenty-three species of mammals were reported. Evidence of reproductive activity, local abundance and distribution and ecological interrelationships are presented. Particular emphasis is placed on microtine rodents and their predators. Evidence for a population irruption in the Tundra Vole (Microtus oeconomus) in 1959 is reported.

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BIRDS AND MAMMALS OF THE PITMEGEA RIVER REGION, CAPE SABINE, NORTHWESTERN ALASKA

by

HENRY E. CHILDS, JR.

INTRODUCTION

The communities in the Arctic, composed of relatively small numbers of species and characterized by low vegetation growing on a terrain that is at the most rolling, offer unparalleled opportunities for the ecologist who seeks to record the changes in an ecosystem. The situation is favorable for observation, and much of the annual activity is compressed into a relatively short period of time. In northern Alaska distributional surveys of terrestrial vertebrates were started more than 70 years ago, and the work of Murdoch (1885), Nelson (1887), Bailey (1948), Irving and Paneak (1954), Bee and Hall (1956) and others has laid a foundation which still continues today. Contemporary ecological research dealing with habitat requirements of arctic animals and their densities has stimulated interest in comparative data from different types of tundra, and one objective of this study was to provide information on an area on the north slope of the Brooks Range in northwestern Alaska. Other than studies near Barrow, the only areas in extreme northwestern Alaska under study recently have been the upper Koolak River (Maher, 1959), and the Cape Thompson region (Wilimovsky and Wolfe, 1966).

For any study of a tundra ecosystem, the terrestrial vertebrate fauna must be examined, not simply from the faunistic standpoint, but with an attempt to analyze influences of physical and biotic environmental factors on seasonal and local distribution. By observations of abundance, local and seasonal distribution, behavior, habitat preferences, and reproduction, the role and relative importance of species in the system may be assessed. In the Pitmegea region the author, using techniques and experience gained in similar studies in 1951 and 1955 at Barrow and other arctic Alaskan localities as a member of a team studying the ecology of terrestrial vertebrates, spent four seasons in the field studying a type of arctic Alaskan tundra previously unexplored.

Particular attention was paid to microtine rodents, represented at Cape Sabine by the brown lemming (*Lemmus trimucronatus*) and the tundra vole (*Microtus oeconomus*). Previous work at Barrow (Pitelka et al., 1955a: 89 and 1955b; Pitelka, 1957b: 83, 84) had raised questions calling
for comparative observations in different sections of the Alaskan arctic. In 1956, the location of the cyclic high in the brown lemming was found to be restricted to areas adjacent to the coast spreading nearly 100 miles to either side of Point Barrow (Pitelka, 1957a: 75). Reasons for this restriction are not immediately evident. A coastal locality, between the Kotzebue area, studied by Grimnell (1900), and Wainwright, studied by Bailey and Hendee (1926) and Bailey (1948), was chosen at Cape Sabine, 40 miles to the east of Cape Lisburne, with the hope that some clues might be obtained regarding the geography of this cycling.

ACKNOWLEDGMENTS

Research reported here represents part of a program of studies on population biology of arctic land vertebrates conducted at the Arctic Research Laboratory, Point Barrow, Alaska, by Frank A. Pitelka, during 1955-1967 under the auspices of the Arctic Institute of North America and the Office of Naval Research. The financial aid of these agencies is gratefully acknowledged. For facilities at the Arctic Research Laboratory and logistic support in the field, I am indebted to the Director, Max C. Brewer. John J. Cantlon aided substantially in identification of plants and in the preparation of a map of plant communities. James V. Drew and J. C. F. Tedrow provided information on soils, the former also providing a soils map. For assistance in various ways, I am also indebted to Mrs. John O'Sullivan, Earl Witscher, John Koranda, Tom Cade, William Gillis, and Eskimo assistants Harry Brower, Merle Solomon, and Pete Sovalik. I am particularly indebted to William J. Maher for assistance in 1959, and to Cade and Maher for permitting me to include here various of their field observations.

To Frank Pitelka, who has guided this study, as well as the author's other graduate studies, with firm, friendly, and understanding counsel, and without whose confidence this study would not have been made, I express hearty deep-felt appreciation and admiration.

GEOGRAPHIC LOCATION

Cape Sabine is a slight promontory into the Chukchi Sea on the northern side of Cape Lisburne in northwestern Alaska, at latitude 68° 56' North and longitude 164° 38' West (Figure 1). It is near the western limit of the arctic slope of Alaska, being located on the north side of the crest of the Brooks Range. This range separates forested central Alaska from the relatively unbroken and flat tundra to the north by extending in an east-west direction from the longitude of Demarcation Point (141° West Longitude) to the western coast between Kotzebue and Cape
Lisburne. At the eastern end, the rugged mountains of the Brooks Range rise to nearly 10,000 ft. above sea level, but in the area of Cape Sabine, there are only rolling hills referred to as the DeLong Mountains, which rarely reach 2,000 ft. in elevation.

The Pitmegea River terminates in the Arctic Ocean at Cape Sabine, after meandering in a northwesterly direction for 40 miles from its headwaters in the foothills of the DeLong Mountains. During most of the year it is a quiet stream. It is then less than 100 ft. wide at its mouth. A day or two of rain during the summer may result, however, in fluctuations of as much as 4 ft. in depth. It is the only stream of significant size north of Cape Lisburne surrounded by foothill country. The Kukpovruk River originates in the same area inland but drains into the Arctic Ocean nearly 50 miles to the northeast, near Point Lay, after running through many miles of flat tundra. Along its course the Pitmegea cuts through bluffs up to 200 ft. high. Cape Beaufort, an area where the foothills rise dramatically and rapidly from a narrow coastal shelf, is 20 miles to the northeast.

**Itinerary**

Base camp was located on a gravel bar on the west side of the Pitme-
gea River approximately 0.5 mile from its entrance into the Arctic Ocean. Research was conducted in the vicinity of base camp from June 15 to August 18, 1957; May 29 to August 24, 1958; June 21 to August 10, 1959; and May 26 to June 2, 1960, except as follows:

In 1957, on July 10, Solomon and I hiked to Thetis Creek, 7 miles to the west. On July 18, we were dropped by plane at the headwaters of the Pitmegea, some 30 miles inland, and the following 6 days were taken to return down the river by boat. Collections were made at various camps along the river. A reconnaissance flight was made along the coast to Cape Lisburne, Point Hope, and Cape Thompson in late August.

In 1958, most of the month of July was spent at inland localities in the valley of the Pitmegea. On July 3, we were flown to the junction of the Pitmegea and the north fork of the Pitmegea, 16 miles from Cape Sabine; and we camped there until July 17. From that date until July 28, we camped 7 miles from Cape Sabine, after which we returned to base camp by boat. At these two camps, collections and observations were made, and two standard traplines for small mammals described below were run. On August 24, 1958, we proceeded from the Pitmegea River to Kotzebue via the Noatak Valley, and continued to Cape Thompson the following day. The return to Barrow on August 26 was via the Noatak. This flight, along with that of 1957, provided general information as to the type of country inland and along the coast in the vicinity of Cape Sabine.

In 1960, the one week early in the season was spent at base camp.

METHODS

For records of occurrence and local distribution of terrestrial vertebrates, all pertinent observations were recorded daily. These records, together with previous experience in the arctic, taken over four summers and including 208 days in the field, provide the author with a basis for the analysis of the fauna. Daily activity at the base camp resulted in frequent coverage of the area for about 3 miles in all directions. Specimens were collected of nearly all species and wherever there was doubt as to the identity of the individual involved. Series of specimens were collected only for those species of questionable status. Most of the specimens are in the collection of the Museum of Vertebrate Zoology, Berkeley, California.

Particular attention was given to classification of tundra plant communities from the standpoint of the needs of investigations in vertebrate ecology. Such a classification was developed with the use of four major
categories. These were Barrens, Upland Meadows, Wet Meadows, and Marshes. Inland, shrub types were found. The importance of each community to individual species was noted. Both the plant communities per se and species distribution within them are described and discussed in later sections of this paper.

For the local avian fauna, breeding densities were obtained on two 33-acre plots in 1958 by use of the spot-map census method (Kendeigh, 1944). Arrival on the study area in mid-June, 1957, was too late for adequate censusing because (1) the breeding cycle was well along, with eggs of some species already hatched, and (2) pressure of other work did not allow census work to begin promptly on our arrival. However, breeding activity of all species was noted, and estimates of breeding densities were made. In August, two plots were staked out in anticipation of the following season. Between June 2 and 26, 1958, five censuses were taken on each plot. Every effort was made to find the nests of all species utilizing the plot. Clutch size, nesting success, and other pertinent information were recorded.

Although, as indicated below, one objective of this study was the study of local microtine rodents, observations on all other mammals were made and assessed as was done for the avifauna. Particular emphasis was placed on common species having the role of predator or herbivore in the tundra ecosystem. At Cape Sabine, in contrast to other arctic Alaskan localities involved in recent studies (Wainwright, Barrow, Meade River, Umiat, etc.), caribou are common and have an important influence on the plant community. The latter circumstance was, in fact, one important reason for the choice of Cape Sabine as a study area.

In the estimation of population levels of microtine rodents, I have followed the procedure developed by Pitelka (1956). This consists of lines of snaptraps placed along a 1,000-foot distance with three Museum Special traps every 20 ft.; these are checked every 12 hr. for 3 days. Subsequent sampling then occurs over the same line at the same stations.

In addition to standardized trap lines, spot trapping was carried out in many areas to provide specimens to document the progression of the breeding season or to check habitat utilization or the occurrence of species in minor habitats. There was no particular pattern to this trapping, traps being placed in the most likely places to catch mice.

In 1957, on the river survey trip, approximately 60 traps were used each night at the four different camp sites in areas where abundant mouse sign was seen. In 1958, transects were established at two inland localities.

For small mammals, specimens were prepared as standard museum
study skins or as flat skins. Skulls, pelvis, and right femur were saved from all specimens except juveniles caught in August, 1958. Standard measurements and data on reproductive condition were taken.

Reproductive data from all mice were taken in the following way: classification into age groups (young, subadult, or adult) was made on the basis of pelage. All were weighed to 0.1 g. In males the total length of the testis was measured and the epididymis was examined; enlarged and milky tubules were assumed to contain mature sperm. Females were examined more closely. Externally, the vagina was noted as either closed, open, or plugged. The pelvic area was palpated with the finger to determine if the symphysis was open, a sign of previous breeding. Internally, the diameter of the uterine horn was measured, just above the vaginal junction. For pregnant individuals, the number and crown-rump length of embryos were recorded, as well as the number of any resorbing young. In post-partum individuals the number and position of placental scars were recorded. Lactation was determined either by teat manipulation or by noting enlargement of mammary tissue internally.

Weather records were taken at the base camp each day after July 2 in 1957, and in August of 1958. These consisted of maximum and minimum temperatures, wet-dry bulb readings for humidity, wind direction, an estimate of velocity, and general comments. Temperatures were taken with a maximum-minimum thermometer mounted on a board approximately 4 ft. from the surface of the ground and in the shade. Humidity was measured with a sling psychrometer. Precipitation was not measured.

Additional details for both methods and results are on record in a doctoral dissertation (Childs, 1959).

**STUDY AREA**

**Geologic Background**

The Cape Sabine area is part of a region of ridges, mesas, and hills. Payne (1951) in a description of the geology of the Alaskan Arctic Slope, placed Cape Sabine in the northern section of the Arctic Foothills Geologic Province. This province lies between the mountainous Brooks Range province and the flat Arctic Coastal Plain. This corresponds in part to what Bee and Hall (1956: 279) call the “Plateau Province.” In this area the Appalachian-type folds characterizing the foothills are principally sandstone and shale strata of the Nanushuk group of Lower Cretaceous origin. These outcrop at the surface and form the structural basis for the lithosol areas. Much of the deformation took place by an orogeny during the Tertiary which was followed by uplift and erosion by streams from glaciers during the Quaternary. A vein of coal 6 inches thick is exposed within a few hundred yards of our base camp, and the veins at Thetis
Creek and at Corwin Mine are of historic importance (Collier, 1905, 1906). Plant fossils of a horsetail and ferns are relatively abundant in the shale outcrops along the Pitmecga River.

Vertebrate fossils are not abundant. Mammoth, mastodon, horse, bison, and muskox have been found in the Cubik formation of the coastal plain (G. Gryc, in Payne, 1951). At the Pitmecga, several teeth, tooth fragments, and pieces of tusk of the mammoth (*Elephas primigenius*) have been found, as well as a tooth and partial skull of the muskox (*Ovibos moschatus*). A well-worn horse tooth (*Equus sp.*) was found in the ocean gravel at Thetis Creek. The only large herbivore remaining in the area today is the caribou.

**CLIMATE**

The climate in northern Alaska is one of short, cool summers lasting from late May to late August and long, cold winters. Precipitation is slight, 12.05 inches falling in 1957 at Cape Lisburne, 40 miles to the west (U.S. Weather Bureau, 1957). Most of this falls as rain during the

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**TABLE 1. WEATHER RECORDED AT THE BASE CAMP**

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<td>SSE</td>
<td>4</td>
<td>Overcast</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
<td>39</td>
<td>—</td>
<td>ESE</td>
<td>7</td>
<td>Rain</td>
</tr>
<tr>
<td>11</td>
<td>57</td>
<td>43</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>Rain</td>
</tr>
<tr>
<td>12</td>
<td>57</td>
<td>48</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>Overcast</td>
</tr>
<tr>
<td>13</td>
<td>55</td>
<td>48</td>
<td>—</td>
<td>—</td>
<td>3</td>
<td>Rain</td>
</tr>
<tr>
<td>14</td>
<td>63</td>
<td>46</td>
<td>—</td>
<td>N</td>
<td>8</td>
<td>Rain</td>
</tr>
<tr>
<td>15</td>
<td>50</td>
<td>45</td>
<td>—</td>
<td>—</td>
<td>13</td>
<td>Overcast</td>
</tr>
<tr>
<td>16</td>
<td>50</td>
<td>45</td>
<td>—</td>
<td>N</td>
<td>6</td>
<td>Overcast</td>
</tr>
<tr>
<td>17</td>
<td>55</td>
<td>45</td>
<td>—</td>
<td>N</td>
<td>7</td>
<td>Overcast</td>
</tr>
<tr>
<td>18</td>
<td>54</td>
<td>40</td>
<td>—</td>
<td>—</td>
<td>5</td>
<td>Overcast</td>
</tr>
<tr>
<td>19</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>6</td>
<td>—</td>
</tr>
</tbody>
</table>

Summer as the total snowfall was only 30.3 inches. The break-up of the ice on the Kakkallik River at Point Lay, 75 miles to the north, occurred on May 30, 1957.

The summer climate in 1957 at Cape Sabine was one of moderate temperature, frequent rain, and high winds. (See table 1.) Winds were
especially characteristic of the area in June and were estimated at velocities up to 40 mph. Many otherwise pleasant days could not be devoted to field work as any field activity was too exhausting in the wind. Winds were predominantly from the south, bringing temperatures in the 50's. Wind storms lasted at high intensity sometimes for 3 days and were associated with storms originating in the Bering Sea or the Aleutians.

The season in 1958 was earlier and drier in contrast to 1957. The snow had melted, except for deep snow areas, by the time of our arrival on May 30, and an inch or more of growth had taken place on some of the grazed cottongrass tussocks. Evaporation and drainage proceeded rapidly, making the tundra much drier from mid-June through late July than it was at any time in 1957. Windstorms were less frequent, less violent, and of shorter duration. Lack of rain reduced the Pitmegea to a stream easily crossed on foot in many places and precluded the use of a boat in traveling down-stream in mid-July. In early August, prolonged rains filled the river from bank to bank within a few days.

These impressions give some picture of the conditions during the summer under which the fauna must exist. During storms, little activity was noted among the birds. Occasionally small species, such as longspurs or sandpipers, would be flushed from protected spots in the lee of a tussock. Rarely did they fly more than a few feet. Jaegers and gulls were seen along the river, resting on sandbars. Flocks of eider and oldsquaws took refuge on leeward sides of sandpits.

The high degree of climatic variation in this area is indicated by the maximum-minimum temperature readings in Table 1. Admittedly limited, these records do give an impression of the summer climate.

Temperatures during July, 1957, were moderate; the lowest recorded was 36 F; and the highest was 83 F., with four days with temperatures over 80 F. That precipitation and run-off was substantial was indicated by fluctuations which took place in the level of the river. Overnight the river might rise 6 inches, and in late July, five consecutive days of rain resulted in a rise of 4 ft. and a transformation of a gentle stream into a raging torrent.

Comparative weather data are available from Cape Lisburne and Point Lay, both coastal localities (U.S. Weather Bureau). Cape Lisburne, located 40 miles to the west, has probably a slightly earlier and warmer season than Cape Sabine. Point Lay, located on a narrow sand spit 75 miles to the northeast, has a later season. In all probability, climate at Cape Sabine is more nearly like that of Cape Lisburne. It is regrettable that data from both stations are taken only irregularly. Data from Point Lay are available only for the winter months as the records are taken by
a non-resident school teacher. At Cape Lisburne, a U.S. Air Force Base, the reason for incomplete records is less apparent. Of the several other weather stations in the arctic drainages (U.S. Weather Bureau, 1943), only the inland locality of Umiat has been summarized for ecological purposes (Kessel and Cade, 1958: 6).

At Cape Lisburne, the first snow was seen on September 17, 1957, and reached 6 inches in depth by September 30. The minimum temperature recorded that month was 19 F on September 28. In October the snow cover was lost, and there were only 2 inches by the end of the month. Temperatures were mild, dropping to 14 F by October 31. November produced below-freezing temperatures with from 4 to 6 inches of protective snow. Snow cover built up to 15 inches in February and dropped to 7 inches in early May. Rapid melting took place on May 19, and snow disappeared by the 24th.

It is interesting to note that the weather records for Cape Lisburne in late October, 1957, indicate a warm spell and complete melting of the snow cover. This warm spell was not followed in this critical period, as it was at Wainwright, by sudden cold without snow, which, in that area, produced a catastrophic die-off of microtines.

Records from Cape Lisburne are not available for the fall of 1956. At Point Lay, snow fell in mid-September to a depth of 3 inches by the end of the month. A continuous cover of 5 inches or more without melting occurred with sub-zero temperatures in October and subsequent winter months.

Complete and continuous weather data are available only from Kotzebue to the south and Barrow to the north.

Soils

Beneath the soils of arctic Alaska, and to a large extent governing the development of soils and vegetation above it, lies a permanently frozen layer (permafrost) beginning at about 1 ft., and continuing to over 1,000 ft. below the surface (Taber, 1943). Above the permafrost, an active layer (one that thaws in summer and freezes in winter), composed of wet tundra and bog soils of varying amounts of mineral and organic matter, is widespread over the arctic slope. Drainage is poor, even in the foothills, as the permafrost is impervious to water, with the result that except for well-drained ridges, the tundra is generally wet during the summer.

Soils on the arctic slope are not well developed zonal soils. Those at Cape Sabine are the same as described for other, more northern areas by Tedrow et al. (1958). The genetic soil-type is termed Arctic Brown,
TABLE 2. NUMBERS OF CARIBOU OBSERVED IN THE CAPE SABINE REGION. (See page 58.)

<table>
<thead>
<tr>
<th>Date</th>
<th>1957 Cape Sabine</th>
<th>1958 Cape Sabine</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>31</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>June</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>20</td>
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<tr>
<td>2</td>
<td></td>
<td>5</td>
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<tr>
<td>3</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>12</td>
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<tr>
<td>5</td>
<td></td>
<td>14</td>
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<tr>
<td>7</td>
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<td>2</td>
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<tr>
<td>8</td>
<td></td>
<td>3</td>
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<tr>
<td>10</td>
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<td>8</td>
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<td>12</td>
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<td>4</td>
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<tr>
<td>19</td>
<td></td>
<td>40</td>
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<tr>
<td>20</td>
<td></td>
<td>40+</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>46</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>100,000</td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>July</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>175</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 mi. SE Cape Sabine</td>
</tr>
<tr>
<td>6</td>
<td>25,000</td>
<td>305</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>30 mi. SE Cape Sabine</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>Aug.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

a partially developed, zonal soil (Tedrow and Hill, 1955). Intrazonal and hydromorphic soils which are more widely distributed are the Upland Tundra, Meadow Tundra, and Bog soils. Along the river is found an azonal river alluvium. The moist soils (Upland Tundra and Meadow Tundra) predominate, the former on the better drained sites. The relationships of vegetation and soils in some arctic areas has been described by Hanson (1950, 1951, 1953).

The following soil description, taken on June 30, 1957, was provided by J. V. Drew. Color designations are based on moist field conditions
using the Munsell color chart. The soil types are listed from the driest to the wettest.

**Arctic Brown (shallow phase):**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth</th>
<th>Morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₀</td>
<td>0-1&quot;</td>
<td>Discontinuous dark brown to black; partially decomposed fibrous dry organic matter.</td>
</tr>
<tr>
<td>A₁</td>
<td>1-4&quot;</td>
<td>Dark reddish brown (5 YR 3/2) sandy loam. Weak crumb to single grain structure. Good distribution of fine plant roots.</td>
</tr>
<tr>
<td>A₂</td>
<td>4-7&quot;</td>
<td>Dark brown (10 YR 4/3) sand. Single grain structure. Many fragments of sandstone.</td>
</tr>
<tr>
<td>C</td>
<td>7-11&quot;</td>
<td>Dark gray (10 YR 4/1) sand and sandstone fragments.</td>
</tr>
<tr>
<td>D</td>
<td>11&quot;+</td>
<td>Sandstone parent material.</td>
</tr>
</tbody>
</table>

The frozen layer was found at 24 inches.

**Upland Tundra (normal profile):**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth</th>
<th>Morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-4&quot;</td>
<td>Very dark brown to black (10 YR 2/2). Partially decayed moist matter.</td>
</tr>
<tr>
<td>2</td>
<td>4-12&quot;</td>
<td>Fine sandy loam, mottled from strong brown (7.5 YR 5/6) to gray (7.5 YR 5/0) with brown (7.5 YR 5/4) the dominating color. Many of the brown mottles follow channels containing partially decayed plant roots. Moist to wet. Weak platy structure.</td>
</tr>
</tbody>
</table>

The frozen layer was found at 12 inches.

**Meadow Tundra (normal profile):**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth</th>
<th>Morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>0-5&quot;</td>
<td>Black (10 YR 2/1) partially decomposed fibrous organic matter. Wet.</td>
</tr>
<tr>
<td>1b</td>
<td>5-7&quot;</td>
<td>Dark reddish brown (5 YR 3/2) fibrous organic matter. Wet.</td>
</tr>
<tr>
<td>2</td>
<td>7-10&quot;</td>
<td>Fine sandy clay loam mottled from dark gray (7.5 YR 4/0) to brown (7.5 YR 4/2). Gray is the dominant color and brown mottles exist only locally toward the upper portion of this layer.</td>
</tr>
</tbody>
</table>

The frozen layer was found at 10 inches.
**Half-Bog (normal profile):**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Depth</th>
<th>Morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>0-4&quot;</td>
<td>Black (10 YR 2/1) fibrous and partially decomposed organic matter. Standing water at surface.</td>
</tr>
<tr>
<td>1b</td>
<td>4-9&quot;</td>
<td>Dark reddish brown (5 YR 3/2) fibrous organic matter. Wet.</td>
</tr>
<tr>
<td>2</td>
<td>9-10&quot;</td>
<td>Gray (7.5 YR 5/0) fine sandy loam. Structureless. Wet.</td>
</tr>
</tbody>
</table>

The frozen layer was found at 10 inches.

**Vegetation**

The climatically controlled community of widespread distribution north of the Arctic Circle is called the Tundra Biome. It is, perhaps, the most homogeneous and best defined of the regional zones of world vegetation (Allee et al., 1949: 583). Its relationships to the Eurasian tundra are thought to have been a result of, and maintained by, Pleistocene connections through Beringia until Recent times (Raup, 1947).

Factors affecting the vegetation and limiting its growth are the climate, the soil, and the biota. Of primary importance is the climate which, as has been noted previously, is severe except in summer. Summer temperatures are rarely above 60 F. Precipitation is low, generally less than 10 inches annually. Another effect of temperature is the permafrost layer which further restricts plant growth (Hopkins and Sigafoos, 1951). In Alaska the distribution of the Tundra Biome is, in general, coincident with the Arctic Drainage and Bering Sea divisions of the Alaskan climatologists (see U.S. Weather Bureau, 1952).

The distribution and taxonomy of Alaskan plants have been considered by Hultén (1941-1950), Porsild (1939), Anderson (1943-1952), and Wiggins and Thomas (1962). The classification of vegetation in the American arctic in general lags behind that of the Old World (Nordhagen, 1943). Problems in the classifying and mapping of vegetation for various uses have been discussed by Küchler (1951) and Griggs (1943). In an ecosystem of such apparent simplicity as the tundra, only a relatively few attempts have been made to detect and describe the subtle differences in plant communities as they affect, or are affected by, varying factors in the Alaskan arctic such as soil (Sigafoos, 1952; Hopkins and Sigafoos, 1951), and reindeer (Palmer and Rouse, 1945; Hanson, 1950, 1951, 1953). Bliss (1956), Bliss and Cantlou (1957) and Churchill (1955) have been primarily concerned with dynamics of plant sociology. The general discussions of Polunin (1948, 1951, 1955) and Porsild (1951) have been most helpful. Hanson, Palmer and Rouse were the only
workers whose activities had been relatively close to the area of this study until Johnson et al. (1966) worked at Cape Thompson. Wiggins (1951) has treated the communities that occur on polygonized ground in the Barrow area. Britton (1957) provides a comprehensive review of certain problems in the vegetational ecology of the Barrow area. The Cape Thompson report (Wilimovsky and Wolfe, 1966) is the most complete description of any arctic study area and is most helpful. Regrettably, it did not appear until some years after this study was completed.

Recently, attempts have been made to apply the concept of succession to vegetation in the American arctic (Shelford and Twomey, 1941; Bliss and Cantlon, 1957; Churchill and Hanson, 1958).

While all the foregoing papers provide background information useful to the studies reported here, the approach to plant communities in this paper was one satisfying needs of the animal ecologist; that is, units were described sufficiently to identify them and to relate their distribution to terrain and soil. The units used were larger and more inclusive than those of plant sociologists; this should be considered with respect to the usage of terms such as type and community in this paper.

Tundra vegetation has been described by some as a relatively simpler habitat; and at first glance, because of the flatness, lowness, and relative monotony of the species complex, it may appear so. There are, however, differences in life-form and species composition associated with subtleties of slope and drainage pattern, and the resident bird and mammal species respond to these differences. Microtines have been described as habitat-specific, and indeed they may be, if the ecologist develops the techniques to detect and describe the differences properly (Jameson, 1955). At this time we can attempt such description only in a gross way and recognize boundaries that may or may not have significance to the resident animals.

The plant communities listed and described here were intended to apply only to the coastal area near Cape Sabine. As one proceeds north to Barrow or inland from the coast, the communities change, not only in species composition, but, perhaps more importantly to vertebrates, in height and cover characteristics.

Mild summer temperatures and frequent precipitation result in an unusually well-developed flora, the flowering continuing over several months. In mid-June, 1957, near Cape Sabine, the variety and beauty of flowers was most impressive for an arctic locality. The greatest variety of flowers was, however, limited to the higher gravel bars and to the lithosol Barrens and dry meadow areas. Species of such genera as Astragalus, Oxytropis, Dryas, Taraxacum, Pedicularis, Potentilla, Papaver and
others were blooming in profusion. These flowering herbs had little to do with the overall economy of the area except, perhaps, as food for the arctic ground squirrel and migrating, seed-eating passerine birds. Of considerably greater importance as a source of food and cover for microtine rodents, insects, and nesting birds were the sedges, grasses, and small shrubs.

Five major plant communities were recognized. These have been arranged in sequence on the basis of amount and duration of available water. Figure 2 is a schematic diagram showing the height and complexity of the main types of vegetation. Barrens and Upland Meadows were found on the highest well-drained sites and differed only slightly from one another. Wet Meadows predominated, with occasional areas of Marsh along drainages. Inland, several shrub types were found. Much
of the following classification and description was developed in discussion with Dr. John J. Cantlon.

**Barrens:** The Barrens plant community occurred on the sandstone outcrops (lithosols) which were found along nearly all the ridges in this area. These ridges tended to parallel one another in a striking way, the highest rising above the adjacent flats less than 100 ft. It is along these lithosols that the Arctic Brown soil developed. These areas were often swept clean of snow in winter and were certainly the earliest exposed when the melt-off began in the spring. Water may be critical in the shallow soils here in summer. Barrens and Upland Meadows may be most directly affected by these conditions and the high-velocity, drying winds of the area. More than 50% of the cover consisted of crustose lichens.

The principal association was the **Dryas Barrens** with *Dryas alaskensis* predominating. Other dwarf shrubs and perennial herbs were *Arenaria macrocarpa*, *Saxifraga eschscholtzii*, *Silene acaulis*, *Bupleurum americanum*, *Festuca brachyphylla*, *Salix phlebophylla*, *Oxytropis nigrescens*, *Potentilla uniflora*. Some mosses plus crustose, foliose, and fruticose lichens were present.

Two minor associations occurring in restricted areas have been listed here for completeness. Alluvial Barrens occurred on the gravel and sand bars with *Artemisia* spp., *Epilobium angustifolium*, and several grasses as characteristic species. Beach Barrens along the coast were characterized by *Elymus arenaria* and *Sagina intermedia*.

**Upland Meadows:** This community was found on slopes and rounded crests in a slightly lower position than the Barrens. Occasionally it was found on gravelly alluvium. The substrate ranged from Arctic Brown soil to Upland Tundra soil and river alluvium. Upland Meadows differed from Barrens principally by a shift in composition of component plants. More than 50% of the cover consisted of dwarf shrubs and herbs. Although these two plant communities (Barrens and Upland Meadows) have been described here, neither was utilized by the microtines or birds for breeding in this area.

**Dryas Upland Meadows** possessed all of the species listed for *Dryas* Barrens plus *Vaccinium vitis-idaea*, *Luzula* spp., and *Carex musandra*. There were more mosses and fewer crustose lichens, a reflection of deeper soil and more moisture.

Deep Snow Upland Meadows were found on protected slopes, generally north-facing, where snow lingered into the summer. The soils were variable. Plant growth and flowering may be dramatic; a few weeks at most are needed for some species to grow and reproduce in mid-July.
Cassiope tetragona was the dominant, with varying amounts of Vaccinium vitis-idaea, Ledum palustre, Luzula spp., Salix reticulata, Dryas integrifolia, lush mosses and lichens.

A sub-type was recognized on south-facing slopes and cliffs where Empetrum nigrum, Betula nana var. exilis, Vaccinium uliginosum, Arctostaphylos alpina, and several grasses were characteristic. Under the deepest snow banks the cover was likely to be mainly mosses and lichens with Salix phylobaphylla and S. reticulata.

Alluvial Upland Meadow was found on gravelly alluvial materials of younger terraces. Plant species were Dryas integrifolia, Salix spp. (shrubs less than 1 ft. tall or dwarf), Androsace chamaejasme, Oxytropis nigrascens, Artemisia spp., Astragalus spp., and several grasses.

Occasionally Upland Meadow vegetation occurred on peat ridges or stringers where dry conditions prevailed. Characteristic species were Rubus chamaemorus and Vaccinium vitis-idaea.

Wet Meadows: In the Wet Meadows community we found the vegetation which was the most widespread of plant communities found at Cape Sabine and along the Pitmeoga. Sedges (Carex spp. and Eriophorum spp.) and various dwarf shrubs (Salix spp. and Betula nana) were the dominant species. The term “wet” merely indicates a general condition for a vegetation also occurring at more temperate latitudes, composed of similar species, and “wet.” Wetness is actually typical of most of the Arctic Slope during the summer.

Moundy Wet Meadow was found on upper slopes where it merged with Upland Meadow. It was found on Upland Tundra soils but may be found on peat (Bog or Half-Bog soils). Dominant plants were Carex bigelowii, Salix phylobaphylla, Dryas integrifolia, Arctagrostis latifolia, Luzula spp., Silene acaulis, Avenaria macracarpa. These species occurred on the tops of mounds; the troughs in between had mosses and herbs more generally found in the wetter Tussock Wet Meadow, or even Sedge-Willow Wet Meadow. This association was found on peat substrates in the study area.

Tussock Wet Meadow was found on Upland Tundra soil, but in a lower drainage position than Moundy Wet Meadow. It received its name from the dominant species, the tussock-forming cottongrass, Eriophorum vaginatum. Other species found were Carex bigelowii, Ledum palustre ssp. decumbens, Vaccinium vitis-idaea, mosses, and foliose and fruticose lichens. This association, like Moundy Wet Meadow, was also found on peat.

Sedge-Willow Wet Meadow is found below Tussock Wet Meadow on Meadow Tundra soils and occasionally on pseudo-tussocks and peat
stringers. Species characteristically found are Carex aquatilis, Salix pulchra, Eriophorum angustifolium, Valeriana capitata, and Polemonium acutiflorum. "Wet mosses" and lichens are also found in varying amounts. In the study area this association was widely distributed and well developed.

Marshes: Sedge-Marsh vegetation developed where water was found standing in varying amounts up to approximately 6 inches during most of the summer season. The type was generally found associated with Half-Bog or Bog soils, but occasionally could be found on Wet Alluvium. Carex aquatilis and Eriophorum angustifolium were the dominants while indicator species were Caltha palustris, Potentilla palustris, and Sphagnum sp. Willows were sometimes present, with Salix richardsonii being generally more abundant than S. pulchra.

Arctophila Marsh with pure stands of Arctophila fulva was found with some aquatic mosses where there was standing water generally deeper than 6 inches and the soils were hydrosols. This association was restricted to pond edges and stream beds.

Estuary Marsh was found restricted to the mud flats near the mouth of the river. The dominant plants were grasses of the genera Puccinellia and Phippsia.

Shrub Types: Vegetation dominated by willows or birches did not occur at the base camp near the mouth of the Pitmegea. However, as one progressed inland, willows became larger, and well-developed stands of several shrub associations were found. Shrubbs were found on the floodplains of the river or its larger tributaries where alluvial materials, mostly gravels, were overlain with silty sands. These comments were based on associations found about 5 miles inland.

The dominant species in the Felt-Leaf Willow type, Salix alaxensis, ranged from 2 to 6 ft. tall, occasionally to 10 ft. Other willows, S. glauca and S. richardsonii, were usually smaller, from 1 to 4 ft. high. An understory of Equisetum sp., Arctagrostis latifolia, or moss was generally present. Toward the coast the height and width of the association diminished; thus at base camp, 0.5 mile from the coast, the largest felt-leaf willow was 2 ft. tall and only occasional individuals occurred.

On the flood plain an association of Salix glauca, S. richardsonii, and S. pulchra occurred with a height generally less than 2.5 ft. The understory varied from that noted above to marsh sedges and/or other alluvium-inhabiting perennials. This was designated Lowland Willow Shrub.

On slopes and banks, Salix glauca was sometimes found in small
amounts as a Slope Willow type. Farther inland this community increased in abundance, and was mixed with *Betula nana* several feet tall.

**LAND UTILIZATION BY HUMANS**

There was considerable evidence that Eskimos have utilized the area near the Pitmegea in the recent past. A well-built wooden cabin was found at the mouth of the river, probably constructed for use by men carrying the mail when it was delivered to Point Barrow via dog team from Point Hope. Sod igloos of fairly recent origin were found on both shores at the mouth of the river. An Eskimo named Kingyak, now residing at Barrow, lived here for many years. On the ridges along the river we found blinds, apparently used in hunting game, as well as deadfall traps constructed of stone. Reindeer antlers were found, indicating that the once-numerous herds roamed this area. Thirty miles inland a hoe-like instrument made of a walrus tusk was found. Smith and Mertie (1930: 47) stated that natives, when hunting, ascend 40 miles along the winding course of the Pitmegea, or about “halfway” to its head.

In mid-June, 1957, a group of Eskimos traveling from Point Lay to Point Hope camped for several days at the mouth of the river. In July, 1958, a party camped at the mouth of the river while we were inland.

Point Lay and Point Hope lie nearly 100 miles in each coastwise direction, respectively, and are the only native villages in the area. The nomadic way of life is disappearing from the Eskimo culture, so that little use of the game and fur-bearing resources in the Cape Sabine area can be expected in the future.

**ANNOTATED LIST OF BIRDS**

In the following species accounts, the order and common names follow the American Ornithologist’s Union Checklist of North American Birds, 5th Edition (1957). Subspecific designations have been made only where a taxonomic problem was considered to exist. In addition to literature already cited, the works of Gabrielson and Lincoln (1959), Irving (1960), Hines (1963), and Williamson et al. (1966) were significant to this study. The specimens, unless otherwise noted, were collected in the vicinity of the base camp at Cape Sabine.

The status of the species is indicated by use of the following symbols placed after the name: N, nesting; R, summer resident but not known to nest in the area considered here; M, migrant; V, vagrant, rare.

Ninety species of birds were recorded within the area of this study.

**YELLOW-BILLED LOON, Gavia adamsi.** R

This species was observed in flight along the coast on June 15 and 26, 1957. In 1958, one was seen over the ice off shore on June 12 and 24.
Five flew over our camp, giving their flight call, on June 20. Since large numbers of these magnificent birds were seen in migration over the ice 10 miles off shore from Wainwright on May 27, most of the summering population probably had passed Cape Sabine by the time of our arrival there in late May. These loons were not recorded in 1959.

**Arctic Loon, *Gavia arctica***. R

This species was noted several times in flight along the coast in mid-June, 1957. It did not appear to breed on the small ponds near the coast, but was seen 12 miles inland on July 24, 1957.

In 1958, arctic loons were seen offshore in small numbers on June 12 and 24. A pair was seen on each of the groups of lakes at 12 miles and at 7 miles inland. A dead individual was found washed up on the beach on July 29, 1958.

Arctic loons were recorded several times along the coast in 1959. On July 12 a nest with two eggs was found on an island of floating peat in a lake at the 7-mile locality. Adults had been seen here in 1958 but the nest, if present, was not found. Cade reported one bird on May 25.

The inland lakes were perhaps close to the lower limits of habitability by arctic loons and were the only lakes in the area suited for this species.

Specimens, I.

**Red-throated Loon, *Gavia stellata***. N

Red-throated loons were the only water bird present and nesting in abundance during our residence on the Pitmegea. Nests were limited to the small ponds, each of which had its pair of red-throats. Their flight songs and eerie wails could be heard at all hours well into August.

On June 15, 1957, a pair was found settled on a small pond on the study area, and 3 days later the nest was found. The following day, June 19, at 2:30 p.m. there was one egg. It was not until 2 days later that the second egg was laid. A week later the eggs had disappeared.

Red-throated loons were present in numbers throughout our stay in 1958. On June 3 and 5, the very interesting courtship display of this species was observed in a group of five on the river. Dryness prevented their nesting on the ponds in Loon Marsh, although they were observed there from time to time. On July 18, a female was collected on a pond 50 ft. by 20 ft., inland at 7 miles. It had a 30-mm ovum in the oviduct, and its nest with one egg was found later. Certainly this must be a late nesting date for this species, and one which has little possibility of successful outcome.

In 1959, 11 nests were found in the immediate vicinity of Cape Sabine
by Maher. The species was first recorded on May 26, and courtship was well underway by June 15. A nest with eggs was found on June 13 and six more in the following week. Chicks, probably a day or two old, were found on July 17. On August 6, two downy chicks had left a tundra pond and moved over 600 ft. to the river. On August 1 an adult in winter plumage was seen on the estuary. Every pond of appropriate size in the area was occupied by a pair of red-throated loons. No pond was large enough to support two pairs.

Ponds suitable for this species did not occur inland along the Pitmegea, and these loons were not recorded until we reached a point 7 miles from the coast where several small ponds were found.

There appears to be an ecological separation of the three loons in the arctic, with the yellow-billed loon requiring the large, deep lakes (with larger fish for prey and/or more space for flight take-off), the arctic loon taking the intermediate-sized ponds, and red-throats the small ponds from which they can fly to rivers or the ocean for feeding.

Specimens, 2.

Red-necked Grebe, Podiceps grisegena. V

An adult in breeding plumage was seen on the lagoon to the east of Cape Sabine from the plane on July 10, 1957. On July 16, 1958, one was flushed from the grass at the edge of a large pond at the 12-mile locality.

Pelagic Cormorant, Phalacrocorax pelagicus. V

This species was recorded near the Corwin Mine on August 18, 1957, in the leads offshore on June 9, 1958, and again drying in typical cormorant fashion on the ice on June 24, 1958. On July 29, 1959, one was seen swimming offshore a few miles west of the Pitmegea.

Whistling Swan, Olor columbianus. V

A pair flew over camp and rested most of the day on the ponds near the mouth of the river on June 7, 1958.

Canada Goose, Branta canadensis. N

Two pairs were seen flying upriver on June 15 and 20, 1957. A pair of small Canada geese, recorded as smaller than emperor geese and thought at first to be brant, landed at the end of our gravel bar on June 22. They were seen again on June 25. On July 8, Solomon shot one adult and three downy young less than a mile upriver. The area around this spot had been visited previously without seeing geese, so that it was suspected they came from some area upstream.

On June 10, 1958, one was collected from a flock of four resting on a
gravel bar near base camp. A pair was seen regularly from June 19 to June 30 near Falcon Rock, a cliff 3 miles inland, but it was not present several weeks later. It appears doubtful that Canada geese nest regularly in this area. At present, specimens from the Pitmegea sector of the arctic coast cannot be assigned racially.

Specimens, 5.

**Black Brant, Branta nigricans.** M

One was seen on June 30, 1957, on the estuary. In 1958, brant were recorded in flight offshore five times in June, most records being before the 12th. Two small flocks were seen on May 21 and 24, 1959, by Cade.

Specimens, 1.

**Emperor Goose, Philacte canagica.** V

The only record of this species was obtained on June 17, 1957, when a flock of five flew in and rested on a bar near camp.

**White-fronted Goose, Anser albirostris.** M

This species was observed daily in small numbers in late May.

**Snow Goose, Chen hyperborea.** M

In late June, 1957, a pair of snow geese was seen twice resting on the mud flats at the river mouth. On July 2, 1957, a flock of nine was feeding in grass outside of our tent when we arose in the morning.

Snow geese were recorded four times in 1958. On June 20, one was seen resting with a pair of Canada geese at Falcon Rock.

During May, 1959, small flocks of up to 30 snow geese were seen between May 20 and 27. Some were seen on the tundra, resting and feeding.

**Mallard, Anas platyrhynchos.** M

Maher reported a pair of Mallards on May 23, 1959, and a group of three the following day.

**Pintail, Anas acuta.** N

Pintails nest regularly in small numbers in this area. During the last weeks in June, 1957, several flocks were seen moving up the river. On June 20, a female was flushed from a pond across the river and acted as though she were nesting, but no nest was found. On July 10, a similar incident occurred near Loon Marsh. On a large pond 12 miles inland, July 24, an almost full-grown juvenile was collected from a flock of seven.

In 1958, nesting was already under way by June 1, when a nest containing seven eggs was found. Pintails were seen regularly throughout
June. On June 24, eight were seen in company with a green-winged teal on the lagoon to the east. A female with seven ducklings was seen on July 12 up the north fork of the Pitmegea. On the 10th, young birds were flying at the 12-mile locality, and a rough-legged hawk had taken one of them. At 7 miles, a flightless female was collected with a nesting red-throated loon on a small pond.

Pintails were again the common duck in 1959 and were present by May 20. Mating behavior was observed by Maher on May 27. A nest with three eggs was found on June 17. A juvenile was caught in a snap-trap on June 28, and an adult female with five young was seen close by. A small migratory movement of pintails occurred in early August.

Specimens, 3.

**Green-winged Teal, Anas carolinensis.** V

A pair was flushed from a small pond on Loon Marsh on June 17, 1957. On June 24, 1958, one teal was seen in company with eight pintails on the lagoon to the east. Two were seen on the ponds near the mouth of the river on June 20, 1959.

**Baikal Teal, Anas formosa.** V

* Maher (1960) has reported on a pair of this Asiatic species he observed at close range on May 28, 1959.

**American Widgeon, Mareca americana.** V

On June 9, 1958, one was seen flying upriver. In 1959, Cade reported a pair and a flock of six on May 23. A female thought to be nesting was seen regularly between June 23 and 26. On May 23 a pomarine jaeger attacked and hit her as she sat in the water of a tundra pond.

**Shoveler, Spatula clypeata.** V

Maher and Cade observed a male on May 29, 1959 on a tundra pond. A pair was seen on June 25, and a flock of 25 on June 29.

**Greater Scaup, Aythya marila.** V

Three were seen resting near the mouth of the river on June 24, 1958.

**Oldsquaw, Clangula hyemalis.** N

This species is an abundant migrant along the coast. A few nest in the area. On July 1, 1957, a downy young came through camp, “peeping,” from somewhere beyond the river bluff. A female with young was seen on one of the ponds across the river the same week. Another family group was noted on a pond 12 miles upriver on July 24, 1957. By late July most oldsquaws had moved out of the area.
In 1958, oldsquaws were seen regularly, but there was no evidence that they nested successfully in the area. Four were seen on the river near the 16-mile locality. They were again seen regularly in 1959. No nests were found.

**Harlequin Duck, Histrionicus histrionicus. N**

This species, previously unrecorded on the Arctic Slope, was noted on June 15, 1957, when three were seen flying upriver and one down. On June 17, a pair was seen on the river above camp. Harry Brower reported seeing two that the Eskimos had shot near the mouth of the river on June 20. On July 22, 1957, a pair preceded us down the river just out of shot-range. Several were seen the following day and a downy juvenile was collected, establishing a northernmost breeding record for the species. On the 24th, a female was surprised in a small cove from which it could not take off. She ran across a sandbar and escaped.

As many as six pairs were seen among the ice floes offshore on June 9, 1958, when a female was collected. Harlequin ducks were recorded five more times in June. Although the species was recorded at both inland camps in 1958, no evidence of breeding was observed.

In 1959, harlequin ducks were first seen on June 12 when a pair flew up the river. Three other records were obtained in June. On August 7 a flock of 7 females was observed on the estuary.

The fact of actual breeding in this tundra area is one of interest. The harlequin breeding grounds in Iceland appear similar to the tundra areas close to the Pitmegea, where only shrub willows exist.

Specimens, 8

**Steller's Eider, Polysticta stelleri. M**

During late June and early July, small flocks of these eiders were seen regularly resting on the sandspit at the mouth of the Pitmegea. On July 10, 1957, a flock of 25 was seen at the lagoon at Thetis Creek. The species was not recorded in 1958. The presence of the ice off shore into July of that year may have influenced their migratory movements. On June 20, 1959, a flock of 20 males was observed resting on an island in the estuary; on the 25th, 25 males and one female, and on August 5, 20 molting birds, mostly males, were seen in the same area.

Specimens, 2.

**Common Eider, Somateria mollissima. M**

In 1957, this species was recorded only at Thetis Creek on July 10, when one male was seen offshore. In 1958, a flock of 15 was observed on
July 1; and they were fairly common after July 29 off shore from the mouth of the river. This species was recorded five times in 1959 from late June to early August.

**King Eider, Somateria spectabilis.** M

A pair was seen on June 24, 1957, and occasional birds or small flocks irregularly throughout the summer on the sandspit at the mouth of the river.

King eiders were recorded in small numbers on June 17 and 24, 1958. Small flocks moved along the coast to the west in early August of that year. On July 4, 1959, twelve were seen at the estuary. A movement of numbers of these birds west along the coast was noted in late July.

**Spectacled Eider, Lampronyctus fisheri.** M

A male in molt was seen resting on the beach near the river mouth on July 10, 1957. On June 2, 1958, a male was taken and on June 12, a female. A few additional records of this species were obtained until June 24. The species was not recorded in 1959.

Specimens, 1.

**White-winged Scoter, Melanitta deglandi.** V

A female was seen on the river on July 24, 1957, 12 miles inland, and it flew to the large ponds at that locality. It was observed closely at both points but could not be collected. It is possible that it was breeding in that area. In 1958, this species was first recorded on May 31, when a pair flew up the river. On June 12, a flock of five was seen off shore. On July 8 and 16, two females were seen resting on the ponds at 12 miles. In 1959, this species was recorded on July 1 (2 females) and July 4 (1 female).

**Surf Scoter, Melanitta perspicillata.** V

A pair of surf scoters was seen in the ice off shore on June 12, 1958, and a flock of 15 was seen in the same area on June 24. A female was seen on July 8 and 16 inland with the two female white-winged scoters at the 12-mile lakes. In 1959 two males were seen on June 25, 30 on July 1, and 10 on July 4.

**Common Scoter, Oidemia nigra.** V

On June 25, 1959, three females were on the estuary; they were still present on July 4 in company with a female white-winged scoter.

**Red-breasted Merganser, Mergus serrator.** R

Mergansers are relatively uncommon on the Arctic Slope (Bailey,
1948), hence the finding of numbers of them from mid-June to mid-
July is of interest. They were first recorded on June 18, 1957, when two
were seen near camp; other records are on June 29, 4; June 24, 10;
June 30, 21; July 3, 20; and July 10, 20. All records were obtained at
the mouth of the Pitmegea. On several other occasions a few were seen flying
upstream. They were not seen inland, although we were on the watch
for them.

In 1958, mergansers were recorded on June 3, 8, 9, 12, 17, 24, July 1, 23,
indicating they are fairly regular in occurrence in this area along the
coast.

In 1958, they were consistently present in small numbers from June
25 to July 24.

**ROUGH-LEGGED HAWK, Buteo lagopus.** N

This species, although relatively abundant in 1958, was not present in
1957. At the base camp it was recorded only once, on June 5, 1958. In-
land, it was found nesting commonly. On July 6, an adult was seen carry-
ing nesting material up the north fork of the Pitmegea. On July 8, a nest
with four young was found a few feet away from a site used by peregrine
falcon in 1957 at the 12-mile locality. Longspur feathers were found in
the nest, and *Microtus* sp. remains were found in the crop of the two
young birds collected. The female was also taken. On July 16, the
remaining two young were well-fed, and an untouched *Microtus oecono-
mus* was found in the nest. The adult male was flushed from the carcass
of an immature pintail.

On July 21, at the 7-mile locality, Sovalik found a nest with three
young, one of which left the nest at his approach. When we both
returned on July 25, all three young were in the nest, and all left upon
our approach. That they were not quite ready for fledging was indicated
by one landing in the center of the shallow stream, where it remained
until we rescued it. No prey remains were found in the nest. The in-
crease in microtine rodents in 1958 was probably responsible for the
nesting success of these hawks.

Cade reported four in late May, 1959.

These hawks were seen occasionally throughout the summer in 1959.
One pair nested in the identical spot at Falcon Rock where a raven nested
in 1957 and a gyrfalcon nested in 1958. Another pair was seen several
times acting territorially near Wolverine Mountain, but no nest was found.
Several resident pairs were seen at the 7-mile locality.
Cade (1955) considered birds from this area of Alaska to be intergrades between *B. l. s. johannis* and *B. l. kamtschakensis.* Specimens, 5.

**Golden Eagle, *Aquila chrysaetos.* R**

Golden eagles were seen occasionally. On June 22, 1957, an eagle was seen high above the base camp to the west. It was trailing from the west. The eagle appeared to be at all concerned, on this and other similar occasions. Upriver, eagles were seen on three separate occasions. No active nests were found, but inland several deserted nests on bluffs along the river may have been occupied by eagles. On July 31, 1957, a first-year bird was chased by two pairs of long-tailed jaegers, one pair relieving the other as the latter came to the edge of its territory. Eagles are not common on the Arctic Slope.

In 1958, eagles were recorded occasionally at the base camp and at both localities inland. One bird was seen patrolling Marmot Ridge while Pete Sovaik was trapping in that area. On August 1, one was seen being chased by a parasitic jaeger and an arctic tern. At each dive by its attackers, the eagle rolled over to ward off the blow with its feet although it did not appear that physical contact was made by the pursuing birds.

**Marsh Hawk, *Circus cyaneus.* V**

Marsh hawks were seen twice in 1958. On August 18, one flew over the bluff to Loon Marsh where it hunted low over the tundra. Another similar incident occurred on August 23. There were 10 sight records of this species made in 1959 between May 23 and mid-August.

**Gyrfalcon, *Falco rusticolus.* N**

A light gray gyrfalcon was seen on July 6, 1957, near the base camp. On July 10 one was seen diving at a sandpiper and in turn being chased by a pair of long-tailed jaegers. On the same day a gyrfalcon was seen three different times along the coast to Thetis Creek; it may or may not have been the same bird.

A nest was discovered on June 20 at Falcon Rock, a cliff 2 miles upstream where a raven was also nesting. This nest was about 40 ft. above the water in an inaccessible place. The adults, unlike peregrines, were neither seen near the nest nor did they scold us when we were in the vicinity. A large, gray juvenile watched us as we passed by boat on July 24, 1957. Poor weather and other work prevented us from returning.
to the nest until August 20, when the young bird, a female, had fledged. It and the adult female were collected. The young bird's stomach and crop were full of meat. Feathers included were those of longspurs. The juvenile weighed 1,750 g., and the adult female 1,107 g.

In 1958, four large, white, downy young were found on June 19 at Falcon Rock. The nest was located on the same cliff but in the nest site utilized by ravens in 1957. By July 22, all the young had fledged; and they and the adult male were collected. The successful fledging of four young birds this year was probably due to a local increase in numbers of ptarmigan, their principal source of food.

A pair of gyrfalcus, one of which was in the white phase, was seen up the north fork of the Pitmegea on July 13, 1958.

In 1959, nesting was attempted in the nest used in 1958. Cade found four eggs there on May 23, all of which proved to be infertile by May 26, and the nest was deserted. Later a pair of rough-legged hawks used the identical nest site. The same nest site was used in 1963, and at least three young were fledged from it in late July.

Specimens, 6.

**Peregrine Falcon, Falco peregrinus. N**

On July 10, 1957, the first peregrine, a male, was seen 3 miles to the west along the coastal bluff. On July 15, one was seen pursued by a pair of long-tailed jaegers, which appeared to be able to outfly and outmaneuver the falcon. On July 23, 1957, a nest was found 16 miles inland, high on a river bluff. The nest was approximately 25 ft. below the top and located on a platform of soil, held by the root system of a willow. Access from above was not difficult, and two young, still in white down but with juvenile feathers appearing, were collected from the total of four. Prey items identified in the nest were three ground squirrels, several long-tailed jaegers, and one golden plover. The male was not seen, and the female could not be collected.

A second nest was found 12 miles inland with only one young in it. The adults scolded us before we were close enough to see the nest and continued to do so throughout our stay as we camped overnight several hundred yards upstream. Attempts to collect the adults were unsuccessful. Both members of the pair remained wary after the first shots. The nest was located nearly at the top of a 100-foot bluff on a very small platform, which may have accounted for the presence of but one young. A dead juvenile was found 30 ft. from the nest on top of the bluff, where it could have climbed and been ignored by the adults. This nest also was formed on a platform of soil held in place by a living willow-root system.
No sticks or other nesting material were used, whereas in the first nest there was a well-developed platform of sticks. No prey items were seen at this nest. The young bird, although as large as the birds in the first nest, was completely covered with down, whereas the former birds were assuming the juvenile plumage. The downy young attacked, as did some of the other juveniles, with a forward jump, talons extended.

In early August, peregrines were seen with regularity along the river and along the coast near the mouth.

On June 13, 1958, a peregrine was seen chasing a longspur over Loon Marsh; it dived repeatedly and unsuccessfully at the small bird.

Neither of the two nest localities used in 1957 was found in use in 1958. On July 9, a nest with four recently-hatched young was found at the edge of a tall bluff at the 16-mile locality. Only longspurs had been fed to the young, judging from the feathers at the nest. An older, unused nest was found 15 ft. away, down the slope.

This species was present near Falcon Rock in June, 1957, and ecological overlap of the two falcons was suspected. However, the nesting sites utilized by peregrines were bluffs cut by the river through low hills and, as a consequence, the nest sites were unstable. They were not used in the succeeding years. Gyrfalcons seen during the nesting season were associated with rocky cliffs, a habitat not occurring frequently in this area. That the nest-site requirements of peregrines and rough-leg hawks are similar was demonstrated by the latter nesting within a few feet of the 1957 peregrine nest site at the 12-mile locality.

Peregrines were not recorded in 1959.

Specimens, 7.

**Willow Ptarmigan, Lagopus lagopus. N**

Several broods of downy young with the female in attendance were found on July 6, 1958, inland at 16 miles, where this species was fairly abundant. At 7 miles, two were collected, but the rock ptarmigan was the more abundant species. On July 27, Sovalik saw a female with young several miles east of the base camp. The willow ptarmigan was not recorded in 1957. Maher reported this species in late May, 1959, but also that willow ptarmigan were not seen after early June that year.

Specimens, 2.

**Rock Ptarmigan, Lagopus mutus. N**

Although their characteristic droppings were seen, it was not until July 12, 1957, that a rock ptarmigan was seen and collected. Evidence of breeding was not found near the coast in 1957. Inland, the species was
recorded regularly but not abundantly. On July 19, 1957, a flock including young of mixed ages was seen.

In 1958, rock ptarmigan were already nesting in abundance on the coast by May 31, when a female with an oviducal egg was collected. Although the females had molted into the brown summer plumage, the males remained white and were very conspicuous as they stood on tussocks, perhaps guarding their territories. There were at least six pairs on Loon and West marshes. A nest with nine eggs was found on June 4. By June 15, the males had disappeared.

This species was not recorded 16 miles inland, where the willow ptarmigan was seen. Both species were taken at the 7-mile locality, and there *L. mutus* was the more abundant. A nest with eight eggs was found on June 18; these hatched between July 5 and July 8, 1959. Cade reported this species daily in late May.

The call of this bird as it flushes is such that the Eskimos have given it a name meaning “the belcher.”

Specimens, 7.

**Sandhill Crane, *Grus canadensis*. V**

On June 20, 1957, a crane was obtained from Eskimos who had shot it on a pond near the river mouth. On July 4, a flock of three flew over the tent, giving a soft, sandpiper-like call. One was wounded and attacked Solomon, but it was finally subdued and collected.

In 1958, cranes were recorded four times: May 30 (1), June 10 (1), June 11 (6), and July 3 (3).

In 1959, several flocks of cranes were seen in late May, and subsequently cranes were recorded on nine additional dates. Maher observed a pair on July 30 that appeared to be hunting mice.

Specimens, 2.

**Semipalmated Plover, *Charadrius semipalmatus*. N**

Adults with downy young were seen on June 20, 1957, on estuary flats at the river mouth. Downy young were seen on June 20 near Falcon Rock. These plovers were the commonest species noted along the river above 12-mile camp, pairs scolding us from gravel bars at nearly every bend in the river. It is an aggressive species, challenging every trespassing bird.

During the first week of June, 1958, these plovers were seen in the vicinity of the base camp but apparently moved inland after that date. They were present at both inland localities. On July 17, at 7 miles, a
newly hatched downy young was found. In 1959, nesting occurred about a mile inland. Cade reported courtship behavior on May 27.

Specimens, 5.

**Kildeer, Charadrius vociferus.** N

On June 6, 1958, two killedeers, both females with large ova (17–18 mm), were taken near the tent. Sovalik later shot a third which could not be found. It is likely that they were intending to nest in this area, which is at the northern limit of their range.

Specimens, 2.

**American Golden Plover, Pluvialis dominica.** N

Golden plovers were an abundant nesting species on the higher, drier ground in the area. A nest with the usual four eggs was found on June 20, 1957. Their call notes were heard regularly through the third week of July, after which the birds moved out of the area. In early August a few were noted in migration.

This bird was common 30 miles inland, where it appeared to be the only shorebird resident on the tundra at that time, July 19, 1957.

Nesting activity was advanced at the time of our arrival in late May, 1958. A female gave a distraction display on May 31, but no nest was found. Two nests were found on June 7 with complete clutches. Newly hatched young were found on June 26. By July 22, small flocks of immatures were seen at 7 miles. Upon return to the base camp on July 29, a few golden plovers remained, and small numbers passed through in August, moving to the west.

In 1959, Cade reported an established pair on May 20. Three nests were found in June, one of which had hatched by June 27. Adults with young able to fly only a few feet were seen on July 22. The population of this species appeared to be rather constant throughout the three summers of the study.

Specimens, 4.

**Ruddy Turnstone, Arenaria interpres.** N

Two groups were seen on July 27, 1957; and one individual was collected on the gravel bar near camp.

In 1958, they were found with regularity on the higher tussock areas, particularly in the vicinity of Wolverine Mountain. Here, at least six pairs were found on June 4, in the same area where knots were taken; an adult female collected on that date had a brood patch and fcellices
up to 4 mm. On July 22, one was seen at 7 miles; and a few days later three were shot from a flock of seven resting in a small creek. In early August, turnstones were heard in flight over the base camp regularly. Turnstones were present in small numbers in 1959 by May 21.

Specimens, 3.

**Common Snipe, Capella gallinago. V**

On August 10, 1958, one was flushed from a puddle on Loon Marsh. In 1959, snipe were heard and seen on May 27, June 14, 22, 23, 25 near the base camp, and on July 11 at the 7-mile locality. There was a definite increase in numbers of this species in 1959 which was recorded by Cade on May 23 and 27 in aerial display.

**Whimbrel, Numenius phaeopus. N**

This species appears to be similar to the bar-tailed godwit in its habitat requirements; and I found it nesting in company with that species on June 27, 1957, along a stream several miles upriver and at ponds located 7 miles inland, on July 24, 1957. Both species announce their presence immediately when one enters their area and fly overhead at low altitude, calling.

In 1958, whimbrels were first recorded on May 31. They were occasionally recorded in June. Although they were observed at both inland localities, no evidence of nesting was obtained. There were only a few records of whimbrels in 1959.

Specimens, 2.

**Spotted Sandpiper, Actitis macularia. N**

Nesting for this species was established when a female was collected on July 22, 1957, while giving a distraction display near a downy young some 20 miles inland along the Pitmegea River. Previously, Townsend (1887) and Grinnell (1900) recorded this species in the Kowak (Kobuk) Valley in the Kotzebue region. Kessel and Cade (1958: 51) found it commonly along the Oolammagavik, a branch of the upper Colville River.

Specimens, 1.

**Lesser Yellowlegs, T. flavipes. N**

This species, unusual on the Arctic Slope, was first recorded at 16 miles inland on July 6, 1958, when one of a pair was taken, an adult male with a brood patch. On July 13 another was collected several miles further up the north fork of the Pitmegea. In both instances the birds
flew directly to me, calling loudly, and acted as though nesting locally.
Specimens, 2.

**Knot, Calidris canutus.** N

In 1957, a flock of four immature knots was seen with a golden plover on July 26, feeding in a depression in the tundra along the river.

During June, 1958, knots were recorded on six different occasions: On June 4, a pair was seen near Wolverine Mountain in a courtship flight-display. Later, one was flushed, from a nest to judge by its actions, and a male with a brood patch was collected. On June 5, Sovalik saw seven. On June 19, I collected three including a female with an egg in the oviduct and saw several more on Marmot Ridge. On June 24, in the same area, one was seen giving a winnowing flight song several hundred feet above the tundra. In all observations in 1958, knots were found associated with high ridges a mile or more away from the flat land along the river. Knots were seen there again in 1959.

Specimens, 6.

**Pectoral Sandpiper, Erolia melanotos.** N

Although the flight song of the male was not heard in 1957, this was a common nesting species. A nest with four eggs was found on June 19. On July 24, 12 miles inland, several were seen.

In 1958, the hooting flight song was heard commonly upon our arrival on May 30 but ceased shortly thereafter as nesting got under way. A nest with a complete clutch was found on June 7. Inland, the pectoral was the only sandpiper found to be numerous. At 7 miles, it was common on the marshes surrounding the lakes. By early August, only a few remained along the coast.

In 1959, pectoral sandpipers were present on May 20. The hooting display song was heard through May 27 and only once after Maher returned June 15. By this time nesting was well under way, and several nests were found. Young were first seen on July 12. Flocks of about 25 were observed in early August.

Specimens, 3.

**Baird’s Sandpiper, Erolia bairdi.** V

Only one specimen of this species was taken, on June 24, 1958, at the foot of the mountains northeast of base camp. A testis measurement of 4 mm suggested this was a non-breeding individual. Cade and Maher reported several seen May 22, 1959.
Specimens, 1.

**Dunlin, Erolia alpina.** N

This species nested in small numbers in 1957, but by mid-July they were gone. On August 8, a few immature birds were seen feeding along the river, apparently migrants. Dunlins were less common in 1958, but some did remain to nest, as an immature bird with a downy head was flushed with an adult on August 3. Although again not common in 1959, dunlins occurred regularly from May 25. Flight displays continued into mid-June, in contrast to the other sandpiper species.

Specimens, 2.

**Long-billed Dowitcher, Limnodromus scolopaceus.** N

During the last two weeks of June, 1957, dowitchers were seen regularly, but in small numbers. The birds were wary, not allowing close approach. As the young hatched in early July, the adults became bolder and would fly up from considerable distances, giving alarm and intermittently coming close to observers, even alighting 20 to 30 ft. away. Juveniles were caught in mouse traps on July 14 and 15.

Dowitchers were recorded inland at 12 miles. On July 10, 1957, dowitchers were seen regularly while we were en route to, and in the vicinity of, Thetis Creek, 7 miles west of the Pitmegea along the coast. Dowitchers were much scarcer in 1958, and only one pair was known to nest. On June 22, a newly hatched young was found in a wet area near camp. At both localities inland a few were recorded in the marshes near the lake. In 1959, dowitchers were again recorded in small numbers.

In habitat, this species showed a decided preference for moist situations, Sedge-Willow Wet Meadow or Sedge Marsh along drainages or near ponds.

Specimens, 4.

**Semipalmated Sandpiper, Ereunetes pusillus.** N

This species was found nesting in Upland Meadow and Moundy Wet Meadow. A nest was found on June 19, 1957, and 3 days later downy young were seen. Inland, no sandpipers of this species were seen beyond the 12-mile camp, but they became common as we approached the coast. Few were seen after late July.

Although this species was fairly abundant in 1958, it seemed restricted to wet areas close to the river. Only one nest was found, and that on June 22. The embryos were well-developed. The nest was located on a
peat stringer in a wet Sedge Marsh. Inland, a few were seen along the river in July.

In 1959, semipalmated sandpipers were seen on May 20, and frequently thereafter.
Specimens, 3.

**Western Sandpiper, *Ereunetes maurei*.** N

This species, the semipalmated, and the pectoral sandpipers comprised the common nesting sandpipers of the area. Western sandpipers are perhaps slightly less abundant than the other two in wet years. Several nests were found in mid-June, 1957. By mid-July most of them had left the breeding areas over the tundra and were found along the river. Small numbers were seen in migration on the estuary in early August.

In 1958, nesting was well under way by June 2, when a nest with a complete clutch was found. By June 29, juveniles were being caught in snap traps set for rodents. This was the most abundant nesting sandpiper in 1958. Inland, they occurred at 7 miles in small numbers. This species arrived at the Pitmegea on May 22, 1959. Two nests were found in mid-June, and a recently hatched chick was observed on June 21. Several flocks were seen moving through the area in early August.
Specimens, 5.

**Buff-breasted Sandpiper, *Tringites subrugicollis*.** V

This species was first recorded when one was shot on Upland Meadow terraces near the lakes at the 12-mile locality, July 17, 1958. One other individual was seen later that day. One was seen at base camp on August 6, 1959.
Specimens, 1.

**Bar-tailed Godwit, *Limosa lapponica*.** N

Godwits were found in several restricted spots where their behavior indicated breeding, although no nest was found. In 1957, on June 27, a pair was seen with a pair of whimbrels about 0.5 mile up a tributary entering the Pitmegea about 3 miles from the coast. Both species were found on a flat area in an otherwise steep stream cut. A pair was seen near Owl Ridge on July 3 and 4, 1957, but they did not remain in the area. At least three pairs were seen on a Sedge Marsh near ponds 7 miles inland, and one was collected. A moderate flight of migrants moving to the west was seen near base camp on August 10 and 11, 1957.

In 1958, a female with brood patch was taken on June 4, and the
presence of godwits throughout June indicated attempted breeding in the area. Inland, at 16 miles, five pairs were seen along the north fork. As they were flocking at this time (July 6), it is doubtful that they were breeding. On July 18, at 7 miles, four were collected; and none showed evidence of breeding. On July 22, a few miles downstream, young of the year were seen with a small flock of adults.

In 1959, on July 12, two adults with a flying juvenile were seen at the 7-mile inland locality. A few scattered occurrences were recorded at the base camp in early June.

Specimens, 9.

SANDERLING, Crocethia alba. M

Maher and Cade reported small flocks of sanderlings along the coast and river near base camp on four occasions between May 24 and 29, 1959.

RED PHALAROPE, Phalaropus fulicarius. N

Red phalaropes were found breeding in this area only in 1957. On July 7, two males scolded us at the ponds near the estuary; and on August 1, a male with a juvenile was seen on a small pond west of the study area. None remained in the study area in 1958; flocks moved northward on June 4 and 17, with only an occasional bird seen at other times in that month. One male was seen on July 18 at the lake at 7 miles in a likely breeding area. Although common in late May, 1959, none remained to breed in the area. Irregular distribution and small amounts of standing water may be responsible for its low numbers here.

Specimens, 1.

NORTHERN PHALAROPE, Lobipes lobatus. N

This is the more common of the two breeding phalaropes in this area, although in 1957 the difference in relative numbers was only slight. It is restricted to areas where there is a small amount of standing water and thus occurs only close to the river and near the coast. It appears to frequent smaller bodies of water than does the red phalarope.

In 1957, during the first week of August there was a definite movement of northern phalaropes through our area. Small flocks and scattered individuals were seen at the estuary and along the river near our tent, where they were feeding on mayflies floating on the surface.

In 1958, only a few individuals were suspected of nesting. A male was seen regularly on the ponds on census plot #1. About 10 were seen on the marsh near the lake at 12 miles and scattered individuals in the same habitat at 7 miles during July. It is believed that the dry condition
of the tundra adversely affected the nesting of the two phalaropes as well as of most shorebirds. In 1959, only six records of this species were obtained, without evidence of breeding.

Specimens, 1.

**Pomarine Jaeger, Stercorarius pomarinus.** M; occasionally N

This species was recorded on June 18 and 22, 1957. These, by the shortness of the central rectrices, were taken to be first-year birds. In 1958, scattered individuals were seen through the middle of June merely passing through the area.

In 1959, several pairs of pomarine jaegers nested at Cape Sabine for the first time during the 3-year period. During that year, except for the Cape Sabine area, this species was not found nesting in any part of arctic Alaska visited by field workers, a fact correlated with the low numbers of the brown lemming. This general nesting failure was indicated by a massive migration of pomarine jaegers to the southwest along the shore and over the coastal tundra during late June and early July. Flocks of 25 to 50 birds were recorded continually. An intensive study of nesting predators near Cape Sabine in 1959 by W. J. Maher will be reported elsewhere. He estimated the nesting density of pomarine jaegers to be 0.25 pair/mile².

Specimens, 4.

**Parasitic Jaeger, Stercorarius parasiticus.** N, R

These jaegers were present near the camp all summer in 1957. However, apparently only one pair nested. On August 5, a juvenile with two light-phase adults in attendance was found to the east of camp. The juvenile acted in much the same manner as those of the long-tailed jaeger described below.

Numbers of this species varied from time to time, apparently with the weather. When it was rainy or foggy, there were good numbers of them present near camp, attracted by our garbage at the river's edge. On clear, sunny days, of which there were few, the jaegers would disappear. Dark phase birds were abundant, comprising perhaps 50% of those seen.

Occasionally, parasitic jaegers were seen as far as 30 miles inland and along the river.

In 1958, the situation remained the same, with scattered individuals present around camp and inland. In August, they became more abundant than the long-tailed jaeger. Two juvenile birds were seen in company with adults, both dark-phase birds, at the 7-mile locality on July 22. On July 18 this same pair of birds was seen hunting on the flat marsh where
*Microtus oeconomus* was abundant. They appeared to use their out-
spread wings to herd the mouse while making short hops and lunges at it. 
During the 0.5 hr. that this behavior was observed, no prey was captured. 
In 1959, several pairs of parasitic jaegers were again settled in the area 
by May 21; and there may have been a slight increase over the earlier 
years. Maher estimated the nesting density at 0.33 pair/mile².

Specimens, 5.

**Long-tailed Jaeger, Stercorarius longicaudus. N**

Jaegers of all species are important as predators on birds and mam-
mals, and their role in the lemming cycle has been discussed by Pitelka 
et al. (1955a, b). The interrelationships of the three congeneric species 
present problems of special interest to students of the arctic vertebrates 
in areas where, as at Cape Sabine, all three may nest; therefore, a full 
account of my observations is given here.

Upon arrival at the Fitmegea on June 15, 1957, long-tailed jaegers were 
noted in flocks of six to eight as well as singly. Some appeared to be 
settling. During the next few days high winds and fog reduced much of 
their activity, and by the time good weather returned on June 19, most 
of the jaegers of this and also of the other two species had left the area. 
Long-tails were seen in pairs on high spots or “owl mounds” on the 
marsh, and active defense of territories was noted, particularly by a 
pair to the north of Loom Marsh and another pair to the east of the river.

The pair to the north of Loom Marsh was observed with some fre-
quency while we were engaged in other activity, and not all incidents 
were recorded. During June there were many records of chasing and 
calling. On June 18, they were seen to chase a flock of seven pomarine 
jaegers and later a small flock of parasitic jaegers. Neither of these 
species appeared to pay much attention to this harrassment and continued 
in their flight across the area without apparent notice of the attackers.

Nesting was, of course, suspected because of this behavior but was not 
confirmed until July 4, when a small, black, downy young was found on a 
dry moundsy patch in that area. The adults were visibly upset by my 
presence but allowed close approach to them on the ground. They did 
not, as one of these birds did at the Meade River in 1955, land on my 
shoulder and peck at my hat, a behavior also recorded by Hanson et al. 
(1956: 75). At least one, and perhaps both, gave a distress call similar 
to that of a pectoral sandpiper in a distraction display. This was given at 
least three different times and would have been overlooked had not the 
bird been 10 ft. away and facing me with its mouth open giving this 
call. The call was continued while the bird was in flight shortly afterward.
This young bird was not seen again until July 30, when it was found in company with its parents in the same area. The young bird had been assumed lost as a result of trampling by a large herd of caribou that passed through the area on July 6. On July 30, the juvenile could fly, but not well, as moderate winds tossed it about. When seen, the young bird begged, and the adults responded by attacking and scolding me. The same behavior was noted on August 6, although the young bird then could fly with considerably greater proficiency. Long-tailed jaegers essentially disappeared from Cape Sabine shortly after that date.

On July 14, one member of this pair was seen to attack and knock down a juvenile pectoral sandpiper in flight. The sandpiper was apparently killed immediately as seconds later I flushed the jaeger, which carried the sandpiper about 200 ft. where it was joined by its mate. The two birds were reluctant to leave as I ran up, and they then dropped the bird. In the minute or less that had elapsed, the skin of the neck and back had been eaten, along with some of the dorsal muscles.

Both parasitic and long-tailed jaegers learned rapidly that lines of mouse traps provided an easy source of meat. A pair of long-tailed jaegers took over a half-dozen longspurs and sandpipers from traps set on July 14. On that date one was flushed that carried the trap (and longspur) over 50 ft. before dropping it.

Other nesting records are as follows: A nest with two eggs was found by J. E. Cantlon on June 24, along a drainage entering the river above Falcon Rock, 3 miles inland. Three days later I investigated the area and suspected the presence of at least one other nest but could not find it. On August 3, an adult with a juvenile was found on the second terrace across the river from base camp.

Interspecific strife was noted between long-tailed and parasitic jaegers on July 30, when a long-tail was seen feeding on some meat scraps we had discarded at the river's edge. Two parasitics flew up-river, causing the long-tail to give a threat display, leaning forward with head and neck extended and giving a loud “chewp.” This did not appear effective, so the long-tail flew directly at the trespassing jaegers. At this the offending birds retreated, but one came back and attempted to land near the meat. The long-tail dived at it and struck it a resounding blow, which was audible where I was standing 100 ft. away. At this the two parasitic jaegers left the area, and the long-tail was joined by its mate.

Long-tailed jaegers seem to be fearless in the defense of their areas against other avian predators. On June 20, a pair was seen attacking a raven; on July 10, a gyrfalcon; on June 22, July 21, and August 1, a golden eagle; and on June 20 and July 15, a peregrine falcon. The re-
mains of three long-tailed jaegers were found in a peregrine nest on July 23 some 16 miles inland.

Inland at 30 miles, on July 19, 1957, long-tails occurred in several flocks with no evidence of attachment to territory. Here a flock of five was seen resting and feeding on a hillside. A pair was seen similarly occupied at the base camp on July 16.

In 1958, territories of several pairs seemed already established by May 30. On June 1, a pair was seen driving another pair across the river, after which they returned to the west side. On June 4, probably this same pair was observed in copulation. When first noted, the male had already mounted the female and had its wings spread and arched downward. The male then treading upon the back of the female and considerable movement of the tails of both individuals followed, the details of which I could not see. Several times the male grasped the neck feathers of the female, apparently to maintain position. During a few seconds after copulation had apparently been completed, the male stood upon the female looking around. It then flew to a mound while the female arched her tail upward. The whole performance lasted perhaps a minute. The female then flew 200 ft. and appeared to hunt insects. The male then flew to her, and they greeted each other with a short call and a posturing with the tail raised at 45°. The nest of this pair, with a complete clutch, was found on June 10. By June 14, the eggs were gone, probably destroyed by the arctic foxes active in the area.

Another completed nest was found on June 7 and by June 12 was also destroyed. No successful nesting was observed along the Pitmegea in 1958 in spite of the increased numbers of microtine rodents. Two factors appear to have brought about this result: (1) earlier and greater amounts of forage growth, providing more cover for the prey; and (2) the presence of numbers of mammalian predators, particularly arctic foxes, but also wolverines and grizzly bears.

Inland the situation was much the same as in 1957. Scattered individuals and small flocks moved through the area. In August, most of them had left the area.

This species was present by May 20, 1959, and was present in greatly increased numbers. Maher estimated the nesting density to be 1.5 pairs/mile². The increase in density of all three jaeger species and of the short-eared owl was directly correlated with the increase in numbers of the tundra vole (Microtus oeconomus) which occurred in August of 1958 and the summer of 1959.
Specimens, 1.

**Glaucous Gull, Larus hyperboreus.** R

Glaucous gulls were present throughout the study, resting on the river-mouth sandspit or patrolling the river. Along with jaegers, they were constant inspectors of our garbage pile. The species is scarce or absent away from the coast along the Pitmegea. It was recorded inland only in 1958, at the 7-mile locality.

A nesting colony of about 100 individuals was found on June 2, 1959, on an island in a small lake near the headwaters of the Ipewik River, a few miles inland from the Corwin Mine, some 20 miles to the southwest of Cape Sabine. With the exception of the colonies at Cape Lisburne and Cape Thompson, this is the only known nesting site in the region we covered. Scattered nestlings occur farther to the northeast on the Arctic Coastal Plain.

**Mew Gull, Larus canus.** R, N?

Two pairs of these gulls were resident on a gravel island in the Pitmegea near the 7-mile locality on June 22, 1958, and July 12, 1959. They resented our moving through the area and dived at us each time we passed. Breeding was suspected, but no nest was found. Occasional birds were seen at the base camp, particularly in late May and early June.

Specimens, 4.

**Ivory Gull, Pagophila eburnea.** V

On July 31, 1959, Maher and I saw a gull in company with several Glaucous Gulls that by its snow white plumage and black feet was clearly of this species. A strong north wind blowing for the previous 5 days may account for the presence of this species, rarely seen along the arctic Alaskan coast in summer.

**Black-legged Kittiwake, Rissa tridactyla.** R

Kittiwakes were seen regularly along the coast each summer. They are known to nest in a rookery at Cape Lisburne, some 50 miles to the west (Bailey, 1948: 249). During a storm on August 7, 1959, a flock of 1,500 rested on a sandspit at the mouth of the river.

Specimens, 1.

**Sabine’s Gull, Xema sabini.** M

Several adults in full breeding plumage were seen along the shore ice on June 9, 1958. Immature individuals were recorded in the same area on July 1. A few were seen along the coast in late May, 1959.
Specimens, 2.

ARCTIC TERN, Sterna paradisaea. N

There was a small resident flock on the sandspit at the mouth of the Pitmegea. Nesting was confirmed on July 16, 1957, when a downy young was found. High winds rolled the bird over and over until it squatted in the lee of a small rock. Apparently only a few of this flock, which consisted at most of only a few pairs, nested; this seems characteristic of this species in northern Alaska (Bent, 1921: 251). On July 23, 1957, one was seen fishing 17 miles inland on the north fork of the Pitmegea.

Nesting was more successful on the sandspit in 1958, for on July 29, several immatures were seen in flight; and a downy chick took to the water upon my approach. The greater nesting success this year was surprising in view of the numbers of arctic foxes and other predators present then.

Six nests of the arctic tern were found on June 29, 1959, all with complete 2-egg clutches. The nests were laid in linear fashion along the sandspit at intervals averaging 68 ft. (range: 43 to 100 ft.). The nests were located just below the crest of the spit on the river side among rocks or flotsam. Although the adults were present in the area through the summer, there was no evidence that the nesting of this small colony was successful. On July 4, a tern caught and brought ashore a 6-inch tomcod. Cade reported them present by May 20.

Specimens, 3.

THICK-BILLED MURRE, Uria lomvia. M

Murres were seen offshore with some regularity in early July, 1957; on July 27, several dead individuals were found washed up on the sandspit. In 1958, the ocean ice remained into early July. Murres were seen in numbers in the open water (leads), where a pair was collected on June 9. Numbers were seen in flight along the coast in July and August, 1959; a large movement to the northeast was recorded on August 7.

Specimens, 2.

PARAKEET AUKLET, Cyclorrhynchus psittacula. V

A specimen was found washed up on the beach in June, 1959, the only record of this species.

SNOWY OWL, Nyctea scandiaca. M

Snowy owls were not present during the summer of 1957, although
their previous occurrence in the area was indicated by pellets found on large mounds and rock outcrops on the lithosols. A few pellets found 30 miles inland contained principally ptarmigan bones and feathers.

In 1958, a few individuals were present in the area during June. None was seen inland. By the first week of August, however, a number of owls had moved into the coastal area. At least one was present on each ridge, and sometimes as many as five. On August 4, Sovalik recorded 20 on Caribou Mountain. Many were seen each day until we left on August 23. This movement is, no doubt, correlated with low lemming numbers and general nesting failure of predators over the entire Arctic Slope (Maher, in litt.) and with the major upswing in the Microtus population at Cape Sabine.

On May 22, 1959, Maher reported at least six snowy owls in the area; and there seemed to be some attachment of pairs to certain areas. By the next day, however, these had left the area; and only scattered individuals were seen during the rest of May. The species was next recorded between July 20 and August 9, in which period a few scattered individuals were recorded. There was no influx of owls comparable to that of 1958 in early August.

**Short-eared Owl, *Asio flammeus*. V, N.**

Presence of this species in 1957 is based on a wing found near the river. In 1958, one individual was seen regularly through June 10, and was suspected of nesting as it was seen carrying prey on one occasion. Inland, at 7 miles, one was seen for several days around July 23 hunting over a marsh in late afternoon.

Short-eared owls were common on May 22, 1959, when Maher and Cade arrived at the Pitmegea. Courtship flights and the wing-clapping display were regularly observed. A substantial number remained to nest, utilizing the tundra vole as food. Maher estimated the nesting density to approach one pair/mile².

**Say's Phoebe, *Sayornis saya*. N.**

This species was first recorded when a nesting pair was collected at a cliff on the north fork of the Pitmegea on July 6, 1958. A second nest was found at Falcon Rock on June 23, 1959, in a crevice about 15 ft. above the river. This appears to be the northernmost breeding record for this species, although Kessel and Cade (1958: 62) suggest its nesting near the mouth of the Kilik. Cade reported one at Falcon Rock on May 26, 1959.
Specimens, 2.

**Horned Lark, Eremophila alpestris.** N

The presence of this species on the Pitmegea was noted for the first time on July 6, 1958, when one immature bird was collected near the cliff on the north fork of the Pitmegea. A return trip to the area on July 13 resulted in the taking of an adult which was observed feeding young birds. One was seen near the base camp on May 21, 1959, and another on June 13 on Caribou Mountain.

Specimens, 2.

**Violet-green Swallow, Tachycineta thalassina.** V

Two were seen on August 10, 1957, catching insects over the river near Falcon Rock.

**Tree Swallow, Iridoprocne bicolor.** V

On August 10, 1958, Sovalik took one of two he flushed from a hole in the bluff near camp during a rain storm.

Specimens, 1.

**Barn Swallow, Hirundo rustica.** V, N

An attempted nesting occurred in the cabin near the mouth of the river in 1959 (Childs and Maher, 1960). The pair was seen regularly through June, and one remained to July 16. Another bird was seen and collected inland at 7 miles on July 15.

Specimens, 1.

**Common Raven, Corvus corax.** N

On June 29, 1957, a nest with young was discovered no more than 25 ft. from a gyrfalcon nest at Falcon Rock. The nest was located 40 ft. above the water under an overhang, which did not allow a view into the nest. The noise made by the young, however, left no doubt as to their presence. The location of a nest near that of the gyrfalcon had only been suspected on June 20, 1957. One adult was seen in the distance. On July 29, an adult was seen flying toward the nest area.

In 1958, ravens were regularly present and more abundant, but none was known to nest. The nest site at Falcon Rock was preempted by the gyrfalcons. Ravens were present at both inland localities.

Only seven records of ravens were obtained in 1959. The reason for their scarcity that year was not evident.
Robin, *Turdus migratorius*. N

Robins were recorded in several places inland along the Pitmeega in 1958. A pair was observed on July 6 on the north fork at the same place that lesser yellowlegs and Wilson's warblers were seen. At 12 miles, one heavily molting robin was seen on July 17. In all cases the birds were very shy and could not be collected. They were associated with well-developed Felt-leaf Willow communities.

**Varied Thrush**, *Ixoreus naevius*. V

Cade reported one seen at Falcon Rock on May 26, 1959.

**Gray-cheeked Thrush**, *Hylocichla minima*. M

Maher reported three seen on June 13, 1959.

**Wheat ear**, *Oenanthe oenanthe*. M

A marked flight of wheat ears was observed on August 15, 1957, when during the day and evening over 20 were seen and seven collected. They were found to be restricted to the lithosols and rock outcrops. An intensive search for them during the next two days produced only one that was seen on the morning of August 16. In 1958, they were present regularly from August 8 to 21. In 1959, two records were made in late May and one on August 11. We departed before the main migration in mid-August.

Specimens, 13.

**Bluethroat**, *Luscinia svecica*. M, N?

An immature individual was collected in low willows near ponds 12 miles inland on July 24, 1957. In 1958, three immature males were collected in felt-leaf willows upstream from the 7-mile camp on July 24; another was seen there the following day but not collected. No adults were detected, but they are notoriously wary and secretive.

Specimens, 4.

**Arctic Warbler**, *Phylloscopus borealis*. M

Maher reported Arctic Warblers on June 12 and 14, 1959.

**Yellow Wagtail**, *Motacilla flava*. N

Wagtails did not breed in the study area but were fairly common a few miles inland. These alert birds were our constant companions and critics whenever we trespassed on their territories. In 1957, one juvenile bird was seen 30 miles inland, but the species did not become common until we were 20 miles from the coast. During the second week in August, there was a small movement of these birds through the area near camp.
In 1958, on June 4, wagtails appeared to be moving inland from the coast where they were quite numerous. Inland they were present in small numbers. On July 15, an immature bird fed on mosquitoes at the netting of our tent. By early August immature birds were moving downstream and to the west. There was no change in 1959.

Specimens, 1.

**Water Pipit, Anthus spinolaetta.** N

Although not present on the Pitmeega in 1957, pipits were found in 1958 nesting commonly on high, exposed ridges near the coast and along the river upland; during July and August they were abundant in a migration movement to the west. In 1959, pipits were recorded on May 22 and 23 at the base camp and on July 5 at a spot inland where they had been recorded in 1958.

Specimens, 4.

**Northern Shrike, Lanius excubitor.** N

A juvenile was collected on July 20, 1957, at a location 30 miles southeast of Cape Sabine on the Pitmeega River. At least four other juveniles were seen in the area as well as the adults. The nest was found in an 8-ft. willow about 4 ft. from the ground. The nest cavity was lined with caribou fur. At several other points along the river above the 12-mile camp, we saw and heard fledgling shrikes begging for food.

On July 6, 1958, a nest containing three young, one of which left the nest, was found in an isolated felt-leaf willow on the north fork of the Pitmeega. The next day all the young had left the nest, and as I photographed one of them, the adult female dived and hit my head three times. Another family group of four fledged young was found near the 7-mile camp. All stomachs contained unidentified meat, and no evidence of prey items was found at the nest. Shrikes were not recorded in 1959.

Specimens, 5.

**Wilson’s Warbler, Wilsonia pusilla.** N

A female with food in its bill was taken on July 6, 1958, on the north fork of the Pitmeega. The following day a male was taken in the same area. This locality is along the northern limit of breeding distribution for this species in Alaska.

Specimens, 2.

**Redpoll, Acanthis (A. hornemanni, A. flammea).** N

The taxonomic status of northern Alaskan redpolls is in doubt. A good sample of specimens along with information on breeding ecology obtained
at Umiat in 1953 by Paul H. Baldwin (1955) suggests that only one species is present. Kessel and Cade (1958: 69) follow this new evidence, using the name *hornermanni*. Williamson et al. (1966) use *A. flammea*. The entire redpoll complex in North America is in need of intensive study.

Breeding activity was well advanced by June 15, 1957, in the willow shrubs along the river. The following day, a nest containing five young was found 1 ft. off the ground in a streamside bush. Three of the young fledged on June 22, and all were gone by June 24. Redpolls were particularly abundant in the Felt-leaf Willow association several miles inland along the river, where an adult male was taken on June 29. Bailey (1948: 293) noted this species at Cape Beaufort as early as March 17, 1922.

In 1958, nests were found from June 2, at the base camp, to July 25 at 7 miles. On the latter day, two nests were found, one with five young and the other with six eggs. Redpolls were abundant wherever there were willows that year.

Redpolls were present and nesting was well under way by May 28, 1959, when a nest with three eggs was found. The first nesting was completed by June 25 when fledglings were recorded. Considering the span of time when eggs were recorded, May 28 to July 25, two broods per season are possible.

Specimens, 9.

**Savannah Sparrow, Passerculus sandwichensis.** N

These shy sparrows nested in the area, being the second most abundant passerine species. They were found in wet areas where there were some erect willows, particularly on terraces along the river. None was seen inland beyond 12 miles in 1957, where a bob-tailed juvenile in company with adults was seen on July 24. On August 6, at the coast, a bob-tailed juvenile was flushed after the adults scolded and indicated its presence. It is possible that this individual came from a second brood.

In 1958, numbers of savannah sparrows were singing on June 1, although they had not been seen or heard previously. A nest was found on June 9 containing six eggs, another on June 20 with three eggs, and a third on June 21 with five young.

In 1959, savannah sparrows were first recorded on May 27, and were regular in occurrence throughout the summer.

Specimens, 4.

**Slate-colored Junco, Junco hyemalis.** V

A mummified specimen of this species was found on July 22, 1958, at Falcon Rock.
TREE SPARROW, *Spizella arborea*. N

This species was found breeding in the Felt-leaf Willow Shrubs 3 miles inland and along the river to its headwaters. It was not abundant anywhere, but a few were seen wherever we stopped on our trip down-stream in late July, 1957. In 1958 and 1959, tree sparrows seemed more common than in 1957 at both localities inland, being regularly present whenever willows were found.

Specimens, 2.

WHITE-CROWNED SPARROW, *Zonotrichia leucophrys*. N

This species was found with tree sparrows and redpolls inhabiting the Felt-leaf Willow Shrubs three miles inland, near Falcon Rock. It was first recorded there on June 20, 1957.

On July 19, 1957, 30 miles inland, a few were noted, and fledged young were seen. It occurred regularly along the river in slightly smaller numbers than the tree sparrows.

Present in numbers in suitable habitat inland, white-crowned sparrows apparently were resident near the lagoon directly on the coast in 1958. They were found near the base camp in May and June, 1959.

Specimens, 2.

FOX SPARROW, *Passerella iliaca*. N?

Three were collected inland near 7-mile camp on July 25, 1958, in a group of willows where bluetothrtes were collected.

Specimens, 3.

LAFLAND LONGSPUR, *Calcarius lapponicus*. N

Longspurs are the most abundant breeding avian species in this area. Nesting was well along on June 25, 1957, with adults seen feeding their young. Many fledglings were seen on June 20. By July 20, more westward movements were noted which continued with increasing intensity into late August. Inland, in mid-July, the species was not common, the few seen were apparently moving down the river to the coast. From 10 to 20 miles inland yellow wagtails become more common along the river than longspurs.

In 1958, nesting was already advanced at the time of our arrival on May 30. During the next few days, several nests with complete clutches were found. In 1959, longspurs were present on May 22, and courtship and pairing were well under way. Copulation was observed. A female
trapped on May 25 had a very enlarged ovum, and on the same day another female was seen carrying nesting material. The last young to fledge from 14 nests observed was July 17. This would appear to be a more prolonged breeding season than that at Barrow to the north. Further information about nesting will be found in a later section on population studies.

Sporadic flocking was noted by July 13 inland and increased to a definite migratory movement by early August. On August 5 a large migration to the northeast took place instead of the normal filtering movement to the west. There was no apparent climatic reason for this strange behavior. During the following days the movement along the coast to the west reasserted itself.

In 1959, Cade reported them to be common and in aerial display May 20.

Specimens, 13.

**Snow Bunting, *Plectrophenax nivalis.***

Buntings were present along the bluffs June 17, 1957, when four were seen. They did not remain in the area, and the species was not recorded again until August 10, 1957, when a molting adult was seen near Falcon Rock.

In 1958, snow buntings were found on some of the high ridges several miles from camp. Adults were feeding fledged young on August 1 on Marmot Ridge.

In 1959, more buntings were recorded than in previous years, and two nestings were recorded. One pair was present near camp throughout June, and its nest was found on July 4. It was in a crevice along the river downstream from camp and contained four eggs, two chicks, and one stone. A second nest was found on Owl Ridge with five young on June 23.

Specimens, 1.

**ANNOTATED LIST OF MAMMALS**

Bee and Hall (1956) have summarized the available ecological and distributional information on mammals of the Arctic Slope. It should be noted, however, that the Cape Lisburne–Cape Sabine area was one of the most poorly known sectors of the Alaskan Arctic prior to the present study. Bee and Hall (1956), and Hall et al. (1957) are the authorities for nomenclature.
CINEREOUS SHREW, *Sorex cinereus*.

Six cinereous shrews were taken in 1957, one of which was caught by hand on August 7, after it was seen to run through a puddle and hide under a tussock.

In 1958, 19 cinereous shrews were taken. The milder and drier weather in June may have been one factor in the increased catch. On June 22, two shrews of this species and two of *S. arcticus* were taken in 100 traps in an area where trapping for several days had produced no shrews. Rain had caused the water level to rise slightly on the tundra, and a warm day perhaps had resulted in their increased activity. On June 30, three cinereous shrews were caught by hand when one was seen to run under a tussock where a rudimentary nest of lichens and mosses was found.

Shrew remains were found in one owl pellet picked up near base camp in 1958.

Probably insects and other small invertebrates make up the main diet of this species during the summer. On one occasion a longspur caught in a trap had its brain eaten, a phenomenon experienced in other areas where shrews occur in numbers. In June, 1958, a collared lemming in winter pelage was found in a winter nest with its brain eaten, possibly by a shrew. No shrews of this species were taken in 1959 or 1960.

The habitat type appearing optimum for both species of shrews is Sedge-Willow Wet Meadow, although there is a tendency for *S. arcticus* to use Sedge Marsh secondarily and *S. cinereus* to use Tussock Wet Meadow secondarily.

Identification of shrew specimens was made by Seth B. Benson.

ARCTIC SHREW, *Sorex arcticus*.

Only one arctic shrew was taken in 1957, on August 8. They were more abundant in 1958, when 31 were taken (see the account of *S. cinereus* for general remarks). Only one arctic shrew was taken in 1959 and that in the traplines at the 7-mile locality. Reasons for the year to year variation in shrew numbers are not known.

HOARY MARMOT, *Marmota caligata*.

In spite of sustained searching for this species in 1958, it was found only on one ridge overlooking the lagoon some 2 miles east of the base camp where several scat piles were located. On June 10, a year-old male was collected. Considerable effort was expended unsuccessfully, throughout the summer, to obtain a large, gray adult in the same den. Although rock outcrops were present along most of the ridges, this was the only one with deep cracks suitable for marmot burrows.
Arctic Ground Squirrel, Spermophilus undulatus.

This herbivore is present in small numbers along edges of bluffs and on alluvial terraces wherever drainage is good and deep burrows may be dug. There are more burrows and burrow systems than the present numbers would seem to require, and it is suspected that Eskimos have preyed on them within the last few years. Squirrel skins are sought by them for parkas.

Squirrels were not obviously active during June, 1957, and only an occasional individual was seen. By mid-July the young were out of the burrows, one being taken on July 19 along the coast. After this date squirrels were seen with increasing frequency. During the last week in July they moved onto our gravel bar and were seen regularly there. Burrow systems were then all reworked.

In 1958, squirrels were present and active in small numbers. On June 4, Sovalik snared two from under the cabin at the mouth of the river. Squirrels were seen on the island in the estuary, where they were resident in 1957. By June 30, two had moved from higher ground and were resident on the gravel bar near camp. Inland, from July 18 to 20, Sovalik and I snared two families of squirrels in a few hours. Each family consisted of an adult female and eight young. During August, dispersal movements were detected, and the dispersing individuals were adults. We were providing animals for experimental purposes to the Arctic Research Laboratory, snaring all squirrels seen along the bluffs in back of the camp. Of several adults taken, all were males. In the mud across the river squirrel tracks were abundant, although it was at least 0.25 mile to suitable habitat and protective burrows.

On several occasions we surprised them at a distance from a burrow. They would then flatten themselves and remain motionless, “freezing,” and becoming almost invisible even at a distance of a few feet.

Ground squirrels were seen inhabiting the bluffs above the nests of the peregrine falcon, gryfalcon, and rough-legged hawk. In a peregrine nest 20 miles inland, the remains of three squirrels were found. Golden eagles also occur in the area and undoubtedly prey on squirrels. Many of the burrows on the gravel bar at the base camp had been dug out by one of the large mammalian predators. In the stomach of the grizzly bear shot on July 29, 1958, were the remains of three squirrels. Many burrows showed the enlarging effects of bears.

An abortive attempt by three parasitic jaegers to prey on a squirrel was observed on August 12, 1957, at the upper end of our gravel bar. For over 5 min. the jaegers were watched diving at the squirrel but never actually making contact. It is possible that they may be successful in
a concerted effort of this kind, particularly if the victim is a young animal.

Restricted as they are to well-drained areas along the coast or river, their role in the ecology of lowland arctic must be a minor one except for the local support of large avian and mammalian predators. Although the latter occur only in small numbers, their home ranges are large, and for them the ground squirrel may be an important food item in spite of its local distribution.

The presence of squirrels in burrows could almost always be determined by blowing down the hole. The squirrel (or marmot) would call out in a scolding reply. One ground squirrel made its home under a cabin at the mouth of the river and gave its chattering notes whenever we entered the structure.

**Collared Lemming, Dicrostonyx groenlandicus.**

Collared lemmings were present in small number in both 1957 and 1958. What appeared to be the beginning of an upswing in their numbers in June, 1958, was not followed by further increase; and in fact, none was obtained in the second run of the transects in August. In 1959, one collared lemming was taken in trapline on May 22. No others were taken.

Collared lemmings appear restricted to Tussock Wet Meadow and the drier, more exposed habitats of Moundy Wet Meadow. No significant ecological overlap with *Lemmus* or *Microtus* was noted. None was taken at any of the inland localities. Pellet analysis indicates that this species provides a small but fairly constant source of food for snowy owls. Much of the information concerning this and other microtine species occurring at Cape Sabine is to be presented elsewhere.

**Brown Lemming, Lemmus trimucronatus.**

*Lemmus* was not an abundant species during 1957, as only nine animals were obtained. In 1958, a substantial increase took place with 32 specimens obtained, mainly in August. Only one was taken at an inland locality in either year. Thus, it appears that *Lemmus* is restricted to the coast in this area. The analysis of owl pellets revealed *Lemmus* to be much more abundant in years just prior to this study. This indicates that the numbers of this species fluctuate and are not synchronous with the fluctuations in *Microtus oeconomus*. Whether *Lemmus* can be considered cyclic in this area is yet to be determined.

In 1959, 14 lemmings were taken, primarily in the early portions of the trapping periods. One was taken in trapline #1 on May 24. In that trapline, *Dicrostonyx*, *Microtus miurus* and *M. oeconomus* were taken, the most varied catch of microtines during the study. As this was the time of
maximum snow melt, this variation may have been due to shifts resulting from flooding.

The habitats preferred by this species are Sedge-Willow Wet Meadow and Sedge Marsh, habitats also utilized by *M. oeconomus*.

**Red-backed Vole, Clethrionomys rutilus.**

Only a few red-backed voles were taken in 1958, at the 16-mile and 7-mile localities. None was found at the coast. All were taken in well-developed Tussock Wet Meadow in which willows and dwarf birch were present.

**Tundra Vole, Microtus oeconomus.**

The tundra vole was the most common small mammal at the coast and along the drainage of the Pitmegea. Because of its abundance and significance to the tundra ecosystem in this area, considerable effort was expended to obtain information pertinent to the general problem of its population regulation. The detailed findings concerning this species will be reported elsewhere (Childs, MS), but a brief summary will be presented here. Pruitt (1966) has reported in detail on this and other small mammals at Cape Thompson.

During the four seasons of the study, a population irruption was observed. Number of tundra voles taken in essentially the same trapping effort were in 1957, 34; in 1958, 510; and in 1959, 1,156. In 1960, a short visit in May produced no indication of mouse activity of any kind. There were few predators present also.

The tundra vole is an inhabitant of Wet Meadows and Marshes. There appears to be a significant overlap in habitat preference and possible competition for space between *M. oeconomus* and *Lemmus*.

Breeding generally occurs from June through August. However, in the high year of 1959, breeding commenced in May and had essentially stopped by early August. Two to three litters are produced each year with an average of seven to eight young per litter, the largest litters being produced in June. Some precocial breeding occurs.

Although the snowy owl did not nest in the Cape Sabine area during this study, owl pellets were numerous and were gathered each year. Analysis of prey items reflected the increase in vole abundance. For the years 1957–1959 the minimum percentage occurrence of voles, based on palates and mandibles, increased as follows: 15%, 57%, 81%. *Lemmus* declined from 79%, 32%, 14% during the same period. *Dicrostonyx* was consistently 10% or less. Other species occurred in insignificant numbers.

**Singing Vole, Microtus miurus.**

The singing vole was common along wet drainage areas along the
Pitmegea from 30 miles inland to 7 miles from the coast in 1957. The runways were well developed, and on the drier adjacent slopes burrows were frequent. The squeaking noise from which their name is derived was heard commonly in shrubby areas near marshes where cutting of sedges was quite evident. Both *M. miurus* and *M. oecononus* were taken on the same trap lines and on occasion at the same spot, indicating overlap in habitat utilization between these two congeners.

In 1958, very few were taken inland. Several of the identical localities were visited in 1958 that showed abundant sign in 1957, but these were inactive. There had been a significant die-off over the winter, the reason for which is not apparent.

*M. miurus* was not found in the area of the base camp at Cape Sabine until August 18, 1958, when a small, very localized colony was discovered on the bluff. It was not associated with shrubs or marshy areas as the inland individuals had been. In 1959, two were taken in transect #1 in late May.

**White Whale, Delphinapterus leucas.**

A school of 50 or more white whales was seen circling lazily in groups of two or more in the mouth of the river on June 24, 1958. Later we learned that two white whales were killed by natives at Point Lay at about the same time of the summer.

**Pacific Killer Whale, *Grampus rectipinna.***

The presence of this species in this area is based on the finding of a skull and lower jaw on the sandspit in June, 1958. A whale of this species was seen washed up on the beach south of Point Lay in June, 1959.

**Gray Wolf, Canis lupus.**

Wolf tracks were seen on June 20, 1957, on the mudflats near the estuary and regularly along the river inland during July.

In 1958, tracks were frequently seen at all localities. On June 5, fresh tracks, made during the night, were seen on one gravel bar. Many tracks made during our absence from the base camp during July were seen near camp on July 29. Wolves were actually seen only twice: one on July 3, near the 7-mile camp, a large, black individual. Sovalik saw a brown wolf near the 7-mile camp on July 20. Tracks downstream from the 7-mile locality indicated that perhaps a den was nearby, but it was not located. Two fresh caribou carcasses were found in this area.

On August 20, a large, black female was collected as it proceeded downstream across the river from base camp. It was undoubtedly the same individual seen on July 3. In its stomach were found three *Micro-
tus oeconomus and some carion bear meat. The uterus was not enlarged nor did the teats indicate recent lactation.

In 1959, only occasional tracks were seen, indicating fewer wolves in the area than in the previous years.

Arctic Fox, Alopex lagopus.

Although not recorded in 1957, foxes were abundant in June of 1958, and scattered records were obtained in July and August. Active during the late afternoon and evening in June, they were made conspicuous (like the male rock ptarmigan) by their white pelage against the dark tundra and by the constant calling between members of pairs hunting together.

On May 31, two were found asleep on low, wet tundra and were approached within 10 ft. before they fled. One, the smaller and thinner of the two, ran directly away for over a mile; the other, larger, fatter, and possibly pregnant, ran more slowly, stopping often to look at us. On June 3, six were seen from one vantage point, two pairs and two widely scattered individuals making, thus, as many as four pairs in the area near camp.

On June 5, upon returning to camp, a fox was found on our gravel bar. Without hesitating, it plunged into and swam across the river, hardly pausing on the other side to shake off the water.

By June 19, fewer foxes were seen and only occasionally were they heard. As Sovalik indicates that the young are born around this time, less activity by pairs would be reasonable. The molt was well under way so that foxes were becoming less obvious, also.

On June 27, 1958, a molting fox was seen to pass through the large herd of caribou from Owl Ridge to Second Ridge. It was ignored by the caribou but not by another fox on Second Ridge that attacked and chased it out of sight a mile or more away.

On August 3, a den with four openings was found southeast of Second Ridge with two adult foxes close by. They did not seem very shy and stayed near the area and yet refused to be chased down the holes. On the following day another den with two openings was found, not far from the first. Here, on August 7, an adult male was trapped. A second fox was trapped on August 13. No young foxes were seen. No arctic foxes were recorded in 1959 or 1960.

When hunting, the fox, like the wolverine, proceeds at a loping run which it apparently can maintain for long periods without rest. Yet the tongue is nearly always out and the animal seems to pant. Finding prey in this manner must be largely a random procedure.
Red Fox, *Vulpes fulva*.

Several skulls found in 1957 in refuse at the cabin at the mouth of the river constituted the only record for this species until June 21, 1959, when one was observed from the air watching some caribou on Marmot Ridge. In the early morning of August 7, 1959, a pair visited our camp and woke us with their barking.

**Grizzly Bear, *Ursus horribilis***.

Grizzly bears appear to be relatively abundant in this section of the arctic. Two individuals were seen from a plane on June 10, 1957, one on the lagoon near the Pitmegea and the other along a stream near Cape Beaufort. Fresh tracks were seen on numerous occasions along the Pitmegea. On June 20, tracks were seen on the mud flats at the estuary; on June 20 at Falcon Rock tracks less than three days old were seen. A bear came to our water hole less than 200 ft. from our tent during the night of July 12. Wherever we looked along the river bank during our trip downstream in late July, 1957, tracks could be found. Tracks were seen opposite our tent across the river on August 10, 1957.

During 1957, we came across grizzlies in the field only twice. One bear was seen on July 10, when we came over a rise 2 miles to the southwest of the study area; as we were upwind from the bear, it was already in full flight when we saw it, and it kept running until out of sight several miles away. The second bear was seen near camp coming over the bluff near the tent on August 4 as we were setting traps on trapline #1. Upon seeing us, this bear ran and continued upstream for at least 2 miles, or as far as we could see it. Less than 0.5 hr. earlier we had watched some caribou run off over a mile away and were puzzled as to the reason. Apparently they had seen or smelled this bear.

In 1958, grizzly bear tracks were seen commonly, although the bears themselves were seen only at the coast. On May 31, a very light yellow-colored male was collected as it approached camp from the coast. Its muzzle was smeared with some kind of grease, and its stomach contained one *Microtus oeconomus*, the gill filament of a fish, and about two fistfuls of caribou hair. It had almost no subcutaneous fat.

Two days later, after I watched a small herd of caribou stampede for no apparent reason, a grizzly came over Owl Ridge, slowly hunting among the tussocks. It stopped, walked along trapline #2, which I had just finished running, got my scent, and ran off.

On July 29, a large dark bear was seen across the river. By the time we crossed the river it had moved to the top of a ridge upstream and lay down to sleep. Our tent and our approach were in direct view of the
bear at this point. We got behind the ridge and approached the bear to within 16 paces when it heard us and started. Sovalik collected it and maintained that it was a black bear, it being the darkest bear he had ever seen. Perhaps similarly colored grizzlies were referred to as black bears reported by Bee and Hall (1956: 199) on the word of Eskimos. The stomach of this bear contained three ground squirrels, one singing vole, hooves of a caribou fawn, skin and winter fur of caribou, some *Arctostaphylos* berries, and 3 quarts of grass. Most of the fur of the caribou and rodents was found in a wad in the cardiac part of the stomach, while the grass and meat were found in the fundus and pylorus.

Maher reported seven sight records in 1959, all but two in June. On July 29, he reported two along the creek inland from the base camp.

**Polar Bear, Thalarctos maritimus.**

Skulls found in the refuse near the cabin at the mouth of the Pitmegea provide the only evidence for the presence of this species in this area.

**Ermine, Mustela erminea.**

The only evidence for the occurrence of the ermine in this area is a skull found at Falcon Rock in 1957 and another in an owl pellet.

**Least Weasel, Mustela rixosa.**

The skull of a least weasel was found in an owl pellet in 1957, the only record of this species that year. Two specimens were taken in traplines in 1959, one in trapline #4 on August 1 and the other, by Solomon, in trapline #3 on September 19. It appears that both species of arctic weasels are uncommon in this area.

**Wolverine, Gulo luscus.**

Wolverines were seen twice during 1957. On June 20, Harry Brower saw one at some distance beyond the river to the east. Another large one was seen July 12 in the same place. It was accompanied by another (cub?) that remained on the first bluff upstream. No tracks were observed at any time.

In 1958, evidence of the presence of wolverines was seen at all localities along the Pitmegea. One wolverine was observed hunting along the edge of the large pond at 12 miles on July 16. It ran through several large puddles, apparently not minding the water.

On June 4, near the base camp, two wolverines were observed from the top of Wolverine Mountain. The first seen was downwind and got my scent. It ran upriver until out of sight a mile away. Almost immediately a second larger, and lighter-colored wolverine was seen upwind,
hunting in the tussocks. The hunting technique appears similar to that of the arctic fox, that is a slow, loping run, back and forth, pausing now and then to smell and to sit up and look around. Although a clumsy-looking animal, it can cover a great deal of tundra rapidly.

On June 11, one was seen at the lagoon to the east. Upon our return to the base camp, tracks made during our absence were seen at the end of the gravel bar in the mud. On August 5, Sovalik saw one on Owl Ridge, which, when frightened, ran to the west upwind from eleven caribou. The scent of the wolverine caused the herd to stampede over Caribou Mountain and out of sight.

It is evident from their hunting activity that wolverines prey upon nesting birds and *Microtus*. However, the lack of a systematic searching method for prey together with their small numbers and large home ranges make their effect on prey populations a minor one. No wolverines were observed in 1959.

**Walrus, Odobenus rosmarus.**

That walrus occur in the area at times was testified to by the presence of a skull and miscellaneous bones at the cabin at the mouth of the river. On July 31, 1959, a young female was found washed up on the beach.

**Harbor Seal, Phoca vitulina.**

A seal, presumed to be this species by the size of its head, was seen floating out of the estuary on July 29, 1958.

**Ringed Seal, Phoca hispida.**

Ringed seals were abundant on the offshore ice through the middle of June, 1958. A single individual was seen on June 24. On August 5, 1959, one was found washed up on the beach.

**Bearded Seal, Erignathus barbatus.**

Bearded seals were less common than ringed seals. Individuals were seen among the latter on June 4, 9, and 12, 1958. A large, adult female was found on the beach on August 5, 1959.

**Barren-ground Caribou, Rangifer arcticus.**

This large herbivore was outstanding in its abundance. Dates of occurrence and the estimated number seen are listed in Table 2 (page 11).

The occurrence of caribou on July 6, 1957, is noteworthy. I was awakened by Solomon, who said he thought there were caribou outside the tent. Upon looking out we found more caribou than one could count or indeed estimate with any accuracy. On the gravel bar around our tent there were over 500, and others could be seen in all directions to the
horizon. There appeared to be sub-groups within the main herd, from a few to several hundreds. Animals were fairly evenly spaced over an area of approximately 15 miles². As our subsequent observations showed, the caribou appeared from the southwest with a north wind, and they disappeared to the east in less than 24 hr. The evidence of their presence did not, however, disappear quite so easily; tracks and trails were everywhere.

That the herd in 1957 spread evenly over the study area was indicated by the number of snapped mouse traps, 220 of 306 in traplines #5 and #6. There was no significant difference in either line (111 vs. 109 out of a total of 153 traps per line).

On July 19, 30 miles inland, two herds of about 75 each were seen fairly close to one another. Here, as elsewhere along the river downstream, caribou tracks were seen everywhere.

On one occasion, August 4, caribou appeared to be stampeded by the scent of a grizzly. No wolves or other large predators were seen following the large herd of July 6, although some time was spent looking for them. To a large extent, caribou rely on sense of smell (Harper, 1955: 86; Banfield, 1954, II: 15), as we observed in hunting them. Fairly close approach could be made if we remained motionless when they looked up, provided that we were downwind. When frightened behind the ridge, they ran and often stood up on their hind legs and appeared to smell the upper air currents. This may have been the "excitation jump" described by Pruitt (1960: 15).

Caribou hair was abundant over the tundra and was utilized by longspurs, redpolls, and northern shrikes in their nests.

On June 8, Sovalik collected three caribou. All were males and had 35, 59, and 119 warble fly larvae (Oedemagena tarandi?), respectively, under the skin of the back. Scars indicating the former presence of many other larvae were present. Most of the larvae were in the meat and connective tissue and only a few adhered to the skin, appearing large enough to leave the host soon. The majority of larvae were distributed along the rump and to each side of the midline. The large male with 119 warbles was also infested with 31 nasal fly larvae (Cephenemyia sp.). They were present in a mass half the size of my fist in a pocket in the nasopharynx. These larvae lived for over 4 hr. in a mixture of 70% alcohol and Bouin's fluid. The first adult warble flies were seen on August 5 on the skin of a caribou. The same day one landed in my hair. On August 9, the skin of a caribou was thickly covered with eggs along the chest and upper legs. This animal had bruises on its chest and cracked hooves, probably
the result of a fall. Six Eskimo-killed caribou on June 27 had few warble fly larvae remaining and no nostril flies. Sobnikov (1935) believes these two species of flies are of no greater importance to reindeer than are black flies or mosquitoes. Harper (1955: 45, 69) discusses the importance of these flies to caribou studied in Keewatin.

On June 27, 1958, a herd of 100,000, similar to that seen on July 6, 1957, passed Cape Sabine. The vanguard of the herd was sighted near the cabin at 1130. Solomon, my Eskimo assistant, killed six. Our activity apparently turned the left flank of the advancing herd so that instead of crossing the Pitmegea near our camp as they had the previous year, they quartered the wind and moved generally coastward along the river. I went on to Second Ridge and lay in the lee of an outcrop and soon had caribou all around me. Downwind the animals were panicked by my scent, but this did not scare the other hundreds nearby. I watched the herd for 2 hr., then returned to camp for more film, food and rain gear. At 1530 I built a stone blind in the same area and again the caribou soon surrounded me. Up to this time no fawns had been seen, but they became increasingly abundant. The vanguard of the herd, then, was composed of bulls. The molt was well under way. Muzzles were black and hair was falling in blotches from many areas. As the animals came down the slope, there was much belching and flatulence. Fawns became abundant, with every small group having several trailing along. The fawns gave a bleating call which was answered with a grunt from the mother; in this manner contact is maintained between the two. One fawn was seen to run hysterically from adult to adult looking for its mother. Another fawn came to the blind and licked lichens from the rocks 18 inches from my face. Nursing was attempted by fawns whenever the mother paused, the fawn butting the udder much in the manner of domestic calves.

Caribou possess very acute hearing. The click of the camera would frighten them at 30 ft. and the rustle of paper would cause them to look up. Movement sent them running, although they were not frightened when looking directly at me at 10 ft. A female came over the hill and almost stepped on me before realizing something unusual was in the way.

When the rain stopped at approximately 1630, the movement of the caribou slowed down; and they began to feed more intensively. They appeared to feed on the sedges and willows primarily, but some were seen to eat Cassiote. Feeding was directed to the plants between the tussocks; the cottongrass was ignored.

Several instances of males scratching the tips of their antlers with their hind feet were seen. In these instances it appeared that the metatarsal gland was involved. A number of individuals were heard with
heavy persistent coughs, suggesting respiratory illness or irritation from nostril flies.

The size of the herd in 1958 was determined by the following method. The number of caribou passing a line between my blind and a knoll on Owl Ridge in 2 min. were counted. The length of this line was 0.4 miles as determined from air photos. The width of the herd was at least 1.6 miles and the density appeared the same all along the front. The average of three counts was 75 or 9,000 per hour. This figure multiplied by 12 hours is 108,000. From these figures and observations the estimate of 100,000 individuals for this herd is not considered excessive.

By midnight most of the herd had passed through the area, although scattered bands of many hundreds could still be seen. The next morning the herd had vanished.

Again, as in 1957, no large mammalian predators were seen in attendance, although considerable time was spent looking for them. No avian predators were seen with the exception of long-tailed jaegers which might have been resident in the area. An arctic fox passed through the herd, observed but ignored by the caribou. Godwits and golden plovers scolded caribou that apparently approached nests or young too closely.

In 1958, caribou were present in sight of the base camp nearly every day. Mostly scattered individuals or small herds of 40 or less were seen. During early June they remained on the upper slopes of the large mountain to the west of camp. There, the tussocks of cottongrass were larger and more growth had taken place. In contrast to the vegetation on Loon Marsh, which was dry and brown, growth was well along, and large, green, succulent lichens were abundant. There was evidence of considerable trampling by caribou between the tussocks, and bare soil could be seen. On these upper slopes where the snow melts earlier, damage to the vegetation was considerable, and the reduction in cover appeared to be enough to reduce the microtine populations significantly.

Along the coast at Cape Sabine, mosquitoes were never numerous, even in July. The rather constant winds appeared to prevent their flying. Yet, caribou were observed to be almost constantly on the move and to move generally into the wind. This behavior, in addition to providing information about predators, would tend to reduce attacks by mosquitoes and other flies.

Continued grazing by caribou could be a major influence on the vegetation, and the animals dependent upon it. The major damage to the vegetation, however, appeared not to be from grazing, which was mainly evident in the willows (S. pulchra and S. richardsonii), but from trampling by their large, spatulate hooves. Indeed, the general flat, in-
regular nature of the meadow areas at Cape Sabine may be caused by,
or at least maintained by, trampling. This, of course, is conjecture on my
part. The constant movement by the migrating and resident herds ap-
pears to prevent the widespread overgrazing noted by Palmer and Rouse
(1945) for reindeer.

In 1959, no caribou were seen by Cade or Maher at the Pitmegea in late
May. The first seen was a group of 16 on June 18. Scattered small groups
up to 40 in number were seen regularly until June 25, when over 1,000
were seen. The following day about 700 were still present. After that
date only a few were recorded. The large movement seen in the previous
years did not materialize, although many thousands were reported with
calves in the Lisburne Hills around June 26 by Leo Fay, geologist for
Richfield Oil Corporation.

Since the completion of this study, Lent (1966) has made a detailed
study of the movements of caribou in arctic Alaska.

BREEDING BIRD CENSUSING, 1958

Although it proved feasible to carry out censuses of breeding birds
only in 1958, the data are reported here because of the poverty of this
type of information from the arctic and particularly because of the com-
parative value it may have for more extensive censuses conducted re-
cently at Barrow by F. A. Pitelka and at Cape Thompson by Williamson
et al. (1966).

My late arrival at the Pitmegea, in mid-June of 1957 when nests of
longspurs already contained young, precluded censusing of breeding
birds during that year. In August, two plots of 20 acres each were
marked in preparation for the 1958 season. Although the marked plots
were 418 ft. \times 2,090 ft. in size, a band 100 ft. wide around each plot was
included in the censusing, thereby increasing the plot size from 20 acres
to 32.7 acres. Accuracy will not be sacrificed if 33 acres is considered to
be the effective size of each plot.

Censusing of the plots commenced on June 2, 1958. Most of the birds
present were longspurs. Nests were located by slowly walking back and
forth across the plot; the displaying males were noted and their terri-
tories outlined by each individual's singing activity. When females were
seen, a careful watch generally resulted in prompt location of the nest
when she finished feeding. In some cases females were flushed from the
nest. The condition of the nest was noted, and a stake was placed one
pace to the north to assist in finding it in the future. Later, when young
were present in the nest, the action of the female in collecting food was
an obvious clue and resulted in the location of nests not found earlier. The plots were checked approximately twice a week during June.

*Laptland Longspur.*—The breeding cycle was well under way by June 2, when seven nests of longspurs with completed clutches of six eggs each were found. The resident males were occupied by almost continual song-flights and in chasing the numerous migrant males passing through slowly to the northeast. The northward migration continued through the middle of the month, with groups of six or more, principally males, in loosely associated flocks moving through the area. Some non-breeding males remained in the area throughout the month. Hatching began on June 10, and most of the young had fledged by June 26. Fledging was completed by June 30. By mid-July, the return movement was under way, with individuals slowly moving through our area; and it continued throughout our stay in August. An accelerated movement was noted during August 5 to 9.

An attempt to correlate the location of each nest and territorial boundaries with vegetation types was made, but no significant relationship was detected. Sedge-Willow Wet Meadow was favored for 8 of 16 nests. However, it appears that the presence of a suitable nest site determines the location and configuration of the territory and that tussocks are the main type of nest-site. Observations on the distribution of breeding longspurs yield the impression that although tussocks are principal locations for nest sites, for feeding more open vegetation is preferred. Solid, well-developed stands of Tussock Wet Meadow inland had few resident birds.

On Plot 1, 13 nests were found and on Plot 2, 10. This is equivalent to 35 pairs/100 acres.

 Territory size could not be determined with accuracy, as few territories were located completely within the boundaries of the plots. However, the data indicate that most territories are between 1 and 2 acres; and the figure of 1.5 acres is probably a reasonable estimate of the average size.

*Pectoral Sandpiper.*—One pair of pectoral sandpipers was found on each plot. Nests of this species are difficult to find as the female leaves the nest and walks for some distance before flying. The nest is located in grass and is well-hidden. Complete clutches were found by June 7, and by that time most of the hooting flights of the males had ceased. Both clutches hatched after a minimum of 12 days following discovery of nests.

*Western Sandpiper.*—One pair of western sandpipers was found breeding on each plot.

*Golden Plover.*—One nest of the golden plover was found on Plot 2. The territory was considerably larger than the plot.
Other Species.—Species whose nests were not found but which were utilizing the census plots as parts of their breeding areas or territories were the dunlin, semi-palmated sandpiper, dowitcher, long-tailed jaeger, redpoll, and savannah sparrow. It is doubtful that any but the last-named species may have actually nested on the plots. Savannah sparrow nests were found only twice in the two summers of field work in this area.

DISCUSSION

Fifty-five species of birds were either found nesting or were suspected of nesting at Cape Sabine and along the Pitmegea River to 50 miles inland in the summer seasons 1957 through 1960. These are listed in Table 3, along with an estimate of abundance. From this table it can be seen that 13 species comprise the principal breeding population on the tundra near the coast.

The avian breeding cycle in the arctic proceeds at a considerably accelerated pace in comparison to that in more southern latitudes. Migrants arrive on the breeding grounds in late May and immediately proceed into the nesting cycle. Shorebirds and passerines have eggs in the nest by the first week of June. A month later the young are fledged and generally independent. Soon thereafter, a slow drifting movement to the south may be detected which develops into a strong migration in early August. Thus, the span of occupancy of the tundra is approximately 3 months with the principal utilization being a breeding period of 6 weeks.

The larger species, loons, hawks, and jaegers, take a longer period for breeding and in some cases may be barely able to complete the cycle before winter sets in.

Table 4 outlines the breeding activities of the avifauna at Cape Sabine. Note that by early August only 11 of 23 breeding species are still involved with reproduction or are still present. Similar evidence from other parts of the Alaskan Arctic Coast points up a significant fact that the bulk of a breeding population of birds leaves shortly after the middle of summer. In other words, even with a "short" summer, only a half or fewer of the breeding species remain into or through August. This strongly suggests an effect of waning food supply.

Birds.—At Cape Sabine and inland along the Pitmegea River, 55 species of birds were recorded as nesting. Of these, the harlequin duck, killdeer, lesser yellowlegs, spotted sandpiper, Say's phoebe, Wilson's warbler, robin, and horned lark reach, or essentially reach, their northernmost distribution. Some are boreal species existing inland in protected south-facing pockets of tall shrubs, as, for example, robin, Wilson's
<table>
<thead>
<tr>
<th>Species</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gavia arctica</td>
<td>Nested uncommonly inland.</td>
</tr>
<tr>
<td>Gavia stellata</td>
<td>Common. One pair/mile.</td>
</tr>
<tr>
<td>Branta canadensis</td>
<td>Rare. Only one pair known to nest.</td>
</tr>
<tr>
<td>Anas acuta</td>
<td>Nested regularly in small numbers.</td>
</tr>
<tr>
<td>Markea americana</td>
<td>Suspected of nesting in 1958.</td>
</tr>
<tr>
<td>Clangula hyemalis</td>
<td>Nested irregularly in small numbers.</td>
</tr>
<tr>
<td>Histrionicus histrionicus</td>
<td>Probably nests regularly inland.</td>
</tr>
<tr>
<td>Melanitta deglandi</td>
<td>Suspected of nesting inland.</td>
</tr>
<tr>
<td>Mergus serrator</td>
<td>Suspected of nesting inland.</td>
</tr>
<tr>
<td>Buteo lagopus</td>
<td>Common on bluffs inland along river.</td>
</tr>
<tr>
<td>Aquila chrysaetos</td>
<td>Suspected of nesting inland.</td>
</tr>
<tr>
<td>Falco rusticolus</td>
<td>Two pairs along entire Pitmecea.</td>
</tr>
<tr>
<td>Falco peregrinus</td>
<td>Regular on bluffs along river.</td>
</tr>
<tr>
<td>Lagopus lagopus</td>
<td>Nested inland.</td>
</tr>
<tr>
<td>Charadrius semipalmatus</td>
<td>Common along river.</td>
</tr>
<tr>
<td>Charadrius vociferus</td>
<td>Rare. Two pairs at coast in 1958.</td>
</tr>
<tr>
<td>Pluvialis dominica</td>
<td>Common. Possibly five pairs/mile.</td>
</tr>
<tr>
<td>Arenaria interpres</td>
<td>Uncommon. Restricted to high ridges.</td>
</tr>
<tr>
<td>Capella galinago</td>
<td>Uncommon. Suspected of nesting.</td>
</tr>
<tr>
<td>Numenius phaeopus</td>
<td>Uncommon. Suspected of nesting inland.</td>
</tr>
<tr>
<td>Actitis macularia</td>
<td>Rare. One nesting record in 1957.</td>
</tr>
<tr>
<td>Calidris canus</td>
<td>Uncommon. Restricted to high ridges.</td>
</tr>
<tr>
<td>Erolia melanotos</td>
<td>Common. Five to 10 pairs/mile.</td>
</tr>
<tr>
<td>Erolia alpina</td>
<td>Common. Five to 10 pairs/mile.</td>
</tr>
<tr>
<td>Limnodromus scolopaceus</td>
<td>Common. Two to three pairs/mile.</td>
</tr>
<tr>
<td>Erenetes pusillus</td>
<td>Common. Ten to 20 pairs/mile.</td>
</tr>
<tr>
<td>Erenetes manri</td>
<td>Common. Ten to 20 pairs/mile.</td>
</tr>
<tr>
<td>Limosa lapponica</td>
<td>Uncommon. Nested inland.</td>
</tr>
<tr>
<td>Phalaropus fulicarius</td>
<td>Uncommon. Few pairs at coast.</td>
</tr>
<tr>
<td>Lobipes lobatus</td>
<td>Uncommon. Few pairs at coast and on inland lakes.</td>
</tr>
<tr>
<td>Stercorarius pomarinus</td>
<td>Bred sparingly and only in 1959.</td>
</tr>
<tr>
<td>Stercorarius parasiticus</td>
<td>Uncommon as nester. Regular resident.</td>
</tr>
<tr>
<td>Stercorarius longicaudus</td>
<td>Common. One pair/mile.</td>
</tr>
<tr>
<td>Larus hyperborens</td>
<td>Regular. One nesting colony 20 miles SW Cape Sabine.</td>
</tr>
<tr>
<td>Larus canus</td>
<td>Rare. May have nested at 7 miles.</td>
</tr>
<tr>
<td>Sterna paradisaea</td>
<td>Common. Small nesting colony at coast.</td>
</tr>
<tr>
<td>Aythya flammea</td>
<td>Nested only in 1959, in moderate numbers.</td>
</tr>
<tr>
<td>Sajornis saya</td>
<td>Rare. Nested inland in 1958; at coast in 1959.</td>
</tr>
<tr>
<td>Eremophila alpestris</td>
<td>Rare. In high areas inland.</td>
</tr>
<tr>
<td>Himantopus rufica</td>
<td>Attempted nesting in 1959.</td>
</tr>
<tr>
<td>Corylus corax</td>
<td>Regular. Nested only in 1957.</td>
</tr>
<tr>
<td>Turdus migratorius</td>
<td>Rare. Possible nesting inland.</td>
</tr>
<tr>
<td>Lucambia scibia</td>
<td>Uncommon inland, probably nesting.</td>
</tr>
<tr>
<td>Motacilla flava</td>
<td>Common along river. Two pairs per mile.</td>
</tr>
<tr>
<td>Anthus spinolleta</td>
<td>Uncommon.</td>
</tr>
<tr>
<td>Lanius excubitor</td>
<td>Uncommon inland.</td>
</tr>
<tr>
<td>Wilsonia pusilla</td>
<td>Rare. One pair 16 miles inland.</td>
</tr>
</tbody>
</table>

* Important member of the tundra avifauna near the coast (total, 13).
TABLE 3. Continued

<table>
<thead>
<tr>
<th>Species</th>
<th>Habitat/Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acantits sp.²*</td>
<td>Common, Several pairs/mile².</td>
</tr>
<tr>
<td>Passerculus sandwichensis*</td>
<td>Common, Five to 10 pairs/mile².</td>
</tr>
<tr>
<td>Spizella arborea</td>
<td>Common in shrubs along river.</td>
</tr>
<tr>
<td>Zonotrichia leucophrys</td>
<td>Common in shrubs along river.</td>
</tr>
<tr>
<td>Passerella iliaca</td>
<td>Uncommon, Probably nesting.</td>
</tr>
<tr>
<td>Calcanius lapponicus*</td>
<td>Common, Thirty-five pairs/190 acres.</td>
</tr>
<tr>
<td>Plectrophenax nigricollis</td>
<td>Rare, Nested in 1958 and 1959.</td>
</tr>
</tbody>
</table>

warbler, northern shrike, fox sparrow, tree sparrow, and white-crowned sparrow. The location of knots breeding on ridgetops along the Pitmegea is one of the few documented nesting records for this species on the Alaskan Arctic Slope. Birds of Asiatic affinities are the nesting yellow wagtail and migrant bluethroat, wheatear, and yellowbilled loon.

Sympatry was demonstrated in the gyrfalcon and peregrine falcon, willow and rock ptarmigan, killdeer and semipalmated plover, pectoral sandpiper and dunlin, semipalmated and western sandpipers, and parasitic pomarine, and long-tailed jaegers. The amount of sympatry among close relatives should be considered at a number of localities from the standpoint of the generally held view that tundra communities typically have low numbers of species. It is evident from this and other studies of tundra avifaunas that some diversification results when two species, each originally arctic in the broad sense, become sympatric or when the pair consists of one arctic species and a second penetrating northward from a more southern distribution. A review of different arctic avifaunas compared with more southern ones with regard to some “coefficient of sympatry” might show that faunal evolution occurring in arctic groups has occurred in part as a result of northward spread of species from the south, but not so much as might be expected. Such analysis would provide evidence on the question whether arctic faunas are simple because of relative recency, on a geologic scale, or because of environmental rigors that discourage effective colonization from the south.

Spring migration was almost over by the time we arrived at Cape Sabine on May 29, 1958. Most of the residents were already actively engaged in nesting activities. Longspurs appeared to be still moving through the area until mid-June. By late July they were headed west along the coast in large flocks. Some reverse movement was seen on August 5.

The migration of waterfowl had either ceased by late May in this area or was too far off shore to be observed. It is likely that a route directly across the Arctic Ocean to Point Lay from Cape Lisburne is utilized.
<table>
<thead>
<tr>
<th>Species</th>
<th>June 1</th>
<th>June 15</th>
<th>July 1</th>
<th>July 15</th>
<th>Aug. 1</th>
<th>Aug. 15</th>
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<tbody>
<tr>
<td>Gavia stellata</td>
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<tr>
<td>Branta canadensis</td>
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<tr>
<td>Anas acuta</td>
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<tr>
<td>Clangula hyemalis</td>
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<tr>
<td>Falco rusticolus</td>
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<tr>
<td>Lagopus mutus</td>
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<tr>
<td>Erolia melanota</td>
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<td>Erolia alpina</td>
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<tr>
<td>Limnodromus scolopaceus</td>
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<tr>
<td>Eremetix semipalmatus</td>
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<tr>
<td>Eremetix mauri</td>
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<tr>
<td>Hmospa lappella</td>
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<tr>
<td>Platoropus fulicarius</td>
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<tr>
<td>Leioptes lobatus</td>
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<tr>
<td>Stercorarius pomarinus</td>
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<tr>
<td>Stercorarius parasiticus</td>
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<tr>
<td>Stercorarius longicaudus</td>
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<tr>
<td>Stevna paradisea</td>
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<tr>
<td>Astro flammeus</td>
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<tr>
<td>Motacilla flava</td>
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<tr>
<td>Acanthis sp.</td>
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<tr>
<td>P renderer sandwichensis</td>
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<tr>
<td>Zonotrichia leucophrys</td>
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</tr>
<tr>
<td>Calcarius lapponicus</td>
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<tr>
<td>Plectrophenax minoris</td>
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</tbody>
</table>

Table 4. Legend: Solid Line—Species present
Dashed Line—Species present in reduced or scattered numbers, or merely transient
Blocked Area—Main period of breeding activity.
The presence of ice off shore in late June may influence the waterfowl movements also. Flocks of eiders were seen in early August following the shoreline to the west. Godwits moved to the west in early August in small numbers. Wheatears were abundant moving west on August 15, 1957, but were present regularly from August 8 to 25, 1958. Bailey (1948: 280) notes the sporadic appearance of this species.

Most species showed no spectacular migratory movements in this area. After completing the nesting cycle in early July, they moved off to the south slowly and imperceptibly, so that by late July the tundra was almost deserted.

Mammals.—The mammalian fauna of Cape Sabine does not differ greatly from other studied areas of the North American tundra. Thirteen species were considered regular resident species. Umiat has a richer fauna of 17 species, as does Cape Thompson with 21. Barrow, with seven, has the smallest number. As Pitelka (1957a, b) points out, there is a tendency in both the bird and mammal faunas to decrease the number of species with increased latitude on the Arctic Slope. This decrease in the complexity of the fauna, and also the flora, is thought to be basic to the strong cycle in lemmings in the Barrow area.

Until further study has taken place and several complete cycles of Microtus oeconomus and other microtines are observed, possible factors in the natural control of these species cannot be assessed. Nevertheless, the limited evidence from Cape Sabine falls in line with the general trend of information now available, that the simpler the faunal composition within the limits of the tundra zone, the stronger the fluctuation in microtine members. This study has shown magnitudes of fluctuation falling in between those known at Barrow and Wainwright, on the one hand, and Meade River and Umiat, on the other, over study periods of four years.

SUMMARY

The summers of 1957, 1958, and 1959, as well as a short stay in late May, 1960, were spent studying the interrelationships and distribution of the vertebrate fauna along the Pimegea River at Cape Sabine in northwestern Alaska. This is an area of coastal tundra located where the rolling foothills of the Brooks Range reach the coast, some 500 miles southwest of the flat Arctic Coastal Plain. By comparison with other parts of Alaska, the climate is mild in summer, although at times extremely windy. The major land habitats were described. The soils and vegetation types present and their relationships were discussed. A classification of the tundra vegetation was devised in order to describe the subtle differences in plant communities and to provide a basis for descrip-
tion of responses of terrestrial vertebrates to them. Four major types were recognized: Barrens, Upland Meadows, Wet Meadows, and Marshes. Sub-types within these major categories were also recognized and described.

Ninety species of birds were recorded. Of these, 55 species nested within the Pitmegea River drainage. Northern breeding records for the harlequin duck and killdeer were established. At Cape Sabine, in 1958, the breeding population on two 33-acre plots was studied. The Lapland longspur was the common nesting species, occurring at the density of 35 pairs/100 acres. Other important breeding species were pectoral and western sandpipers, which were present in densities no higher than 4 or 5 pairs/100 acres, and golden plovers, which were more sparsely but regularly present.

Twenty-three species of mammals were recorded. Of these, the microtine rodents—the brown lemming (Lemmus trimucronatus), the collared lemming (Dicrostonyx groenlandicus), and the tundra vole (Microtus oeconomus)—were studied intensively. Standardized transects were used to determine population levels. In 1957, populations were low but increased significantly in 1958. An increase of 1,500% in the tundra vole (Microtus oeconomus) and 300% in the brown lemming (Lemmus trimucronatus) took place between June, 1957, and August, 1958. Analysis of owl pellets collected indicates that the brown lemming was much more abundant in years immediately prior to the study. Regional synchrony in the fluctuation of species did not occur even within the Pitmegea River drainage, as inland populations were considerably lower in 1958 than in 1957.

Small herds of caribou were regular in occurrence throughout the study. In addition, large migrating herds of approximately 100,000 individuals passed through the area each summer. Their role as a competing herbivore in the ecosystem was discussed. Their effect at Cape Sabine, though easily observed, was sufficiently dispersed that it did not appear to deflect trends in microtine populations. The possibility of significant effect by caribou on microtines seems more likely in interior upland and drier habitats.

Predators were not abundant in either year. Small numbers of long-tailed jaegers, parasitic jaegers, and arctic foxes were present but were reproductively unsuccessful in 1958 and virtually so in 1957. The range of possible predator-prey relationships in this area was examined. Of 19 species occurring and potentially effective, only five had an important role locally as predators.

Marked fluctuations which may be cyclic occur in two microtine
species, *Lemmus trimucronatus* and *Microtus oeconomus*. Their magnitude was, however, only a fraction of that known in the simpler communities near Barrow.

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