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PROJECT CHARIOT - PHASE III PROGRESS REPORT

MASTER

TERRESTRIAL MAMMAL INVESTIGATIONS,
OGOTORUK CREEK - CAPE THOMPSON AND VICINITY

William O. Pruitt, Jr., Peter C. Lent,
Ernest A. Carl and Barbara Murray
Department of Biological Sciences
University of Alaska

June, 1961

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INTRODUCTION

The mammal investigations since the December 1960 Mammal Report fall into four main categories: (1) General studies and small mammal biology, (2) Winter field work in the Ogotoruk Creek-Cape Thompson region, (3) Investigation of the Arctic Ground Squirrel and (4) Caribou investigations. The report of the caribou investigations is submitted separately from this section on the rest of the mammal investigations.

In addition to the above listed areas of investigation, Mrs. Barbara Murray has continued her search of the literature for references which may have a bearing on all aspects of the mammal investigations, including the caribou study.

Personnel and Itineraries

William O. Pruitt, Jr., Senior Investigator. At College until 18 March. Then in the field in northwestern Alaska until 6 April. At College from 6 April to date.

Peter C. Lent, Senior Research Assistant. In the field in northwestern Alaska, based in Kotzebue until 7 April. At College 7 April to 11 May. In the field 11 May to date.

Ernest A. Carl, Senior Research Assistant. At College until 18 April. In the field in the Ogotoruk Creek-Cape Thompson region after that date.

Barbara Murray. Part-time Research Assistant. At College.

GENERAL STUDIES AND SMALL MAMMAL BIOLOGY

William O. Pruitt, Jr.

Species Accounts

Since the final identification of Sorex cinereus, the known land mammal fauna of the Ogotoruk Creek-Cape Thompson region now stands at 20 species. The capture at this late date of a species new for the region points up the coarseness of our techniques. Recall that some 7,000 trap-nights in the same exact sites during 1959 did not produce Sorex cinereus.

The following species accounts consist of observations and analyses made since the December 1960 Mammal Report. Initials following miscellaneous observations in the accounts indicate source: DCF=Don Charles Foote, PCL=Peter C. Lent, HK=Howard Kantner, WOP=William O. Pruitt, Jr.

Sorex arcticus Arctic Shrew

Mr. Carl has determined statistically that the lumped occurrence data for both species of Sorex show that the 1960 population was significantly higher (5 per cent level) than that of 1959. There was also a non-significant trend from plots OTK-4, 7, and 19 to OTK-12, 36, 42, and 45. In other words, there was a non-significant trend from Eriophorum tussock with polygons, Eriophorum-Carex solifluction slope and tall willow grove to ridged wet meadow, Eriophorum tussocks with frost scars and Eriophorum tussocks with polygons. Thus the tendency was for Sorex arcticus to occupy more extreme environments in 1960 than in 1959.

For the first time in the Ogotoruk region, Sorex arcticus was found in a raptor pellet. As nearly as can be determined, the pellet was cast by a jaeger.

Sorex cinereus Masked Shrew

Six specimens of the Masked Shrew were taken in 1960. I mentioned the probability of this identification in the December 1960 Mammal Report. Table 1 shows a comparison of the morphometry of Sorex cinereus and Sorex arcticus taken during 1960 in the Ogotoruk Creek-Cape

Table 1. Comparison of the two species of Sorex in the Ogotoruk region. (1960 coll.)

<u>Sorex arcticus</u>												
Cat. no	Plot	L	T	HF	Wgt.	Sex	Post- mand. canal	Condyl.- basal length	Max. breadth	Inter- orbit. breadth	Cranial breadth	Maxillary tooth row
RSS 34	OTK	110	34	12	9.2	♂	+	17.9	18.43	15.96	33.82	25.46
35	-	98	31	12	8.6	♂	+	--	17.48	--	--	25.46
38	-	83	30	11	3.7	♂	+	17.9	17.86	15.96	34.20	25.46
48	4	99	28	12	8.3	♂	+	17.5	17.67	15.39	33.06	25.08
55	9	107	33	12	6.0	♂	+	18.0	17.48	14.25	33.06	25.46
56	12	119	33	12	10.5	♀	+	18.1	17.29	15.96	34.20	26.22
57	12	92	27	11	5.8	♂	+	16.2	16.15	14.44	--	23.94 (distorted skull)
58	12	103	31	12	9.1	♂	+	--	--	--	32.68	
59	12	96	30	11	6.5	♂	+	--	17.86	14.63	--	25.46
68	28	88	29	11	5.8	♂	+	17.9	17.67	15.77	33.44	25.84
82	47	102	32	12	5.6	?	+	--	17.67	14.82	30.40	25.84
84	19	106	31	12	5.7	♂	+	17.8	17.67	13.87	34.20	26.22
85	19	86	27	11	4.5	?	+	16.3	16.53	13.30	33.06	23.56 (distorted skull)
72	42	102	32	12	6.1	♀	+	18.0	17.67	13.68	33.44	25.84
73	42	102	34	12	5.9	♂	+	18.2	17.86	15.96	33.44	25.84
77	48	102	28	13	8.2	♂	+	--	17.86	15.77	34.20	25.08
75	45	100	32	14	6.5	♂	+	--	17.67	15.58	--	26.22
76	45	107	32	14	5.8	♂	+	--	17.86	15.01	--	25.84
WOP 1295	CT-2	99	31	12	6.2	♀	+	17.9	18.24	15.39	33.44	25.84
<u>Sorex cinereus</u>												
RSS 36	-	83	30	11	3.7	♂	-	15.2	14.63	12.73	28.85	21.66
66	36	88	32	11	3.4	♂	-	15.5	15.01	13.11	--	22.80
67	36	85	30	11	3.7	♂	-	15.5	14.82	13.30	--	22.42
70	42	88±	30	10	3.3	♂	-	15.4	15.01	13.30	28.50	22.42
71	42	88	32	10	3.5	♂	-	15.4	15.20	13.68	28.50	22.42
80	46	88	31	11	3.7	?	-	15.5	15.39	13.49	28.88	23.18

Thompson region. It seems that the presence or absence of the post-mandibular canal (Bee and Hall, 1956) is a useful character in distinguishing these two species.

The ecological segregation (Table 2) of these two species of shrews deserves further attention. A review of the trap-site descriptions shows that Sorex arcticus used a rather wide range of habitats, varying from runways in sedges (OTK-9, 12) to frost-crack in Dryas-willow-sedge soluflection terrace (CT-2). They also were taken under cover of Ledum, Betula or Salix.

In contrast, Sorex cinereus was taken only at trap-sites closely associated with overhead cover, such as Ledum, Betula or Salix. On plot OTK-42 both species were found, but at widely separated trap-sites (S. arcticus at B-6 and D-10; S. cinereus at I-10 and J-10.)

A considerable literature has developed around the concept that a species with the wider ecological amplitude governs the micro-distribution of a species with narrower amplitude. It follows, then, that Sorex arcticus may be said to govern the micro-distribution of S. cinereus in this instance.

Ursus horribilis Grizzly Bear

- 1 September 1960 - Don Foote observed fresh bear tracks at Kukpuk. (DCF)
- 11 October - Fresh tracks at Ogsagahaek. (DCF)
- 14 October - Point Hope hunters shot grizzly on middle Ipewik River. Reported many bear tracks in the region. (DCF)
- 15 October - Bear tracks seen at Suklolik. (DCF)

Thalarctos maritimus Polar Bear

- In mid-October Antonio Weber reported Polar Bear at Point Lay. (DCF)
- 26 November 1960 - Polar Bear tracks seen at Pingu near Point Hope. (DCF)
- 1 December - Charlie Tuckfield killed Polar Bear at Sinyuk. It was small but very fat. (DCF)
- 21 January 1961 - Amos Lane and Rev. Lawton saw Polar Bear at Pingucheak, across an open lead. (DCF)

Table 2. Ecological Segregation of Sorex arcticus and S. cinereus.Sorex arcticus

<u>Cat. No.</u>	<u>Plot no.</u>	<u>Trap-site description</u>
RSS		
34	non-plot	Sedges and 15 cm. willows
35	non-plot	Edge of tussock
38	non-plot	runway under 20 cm. willows
48	OTK-4	runway under tussock
55	9	runway in sedges
56	12	" " "
57	12	" " "
58	12	" " "
59	12	" " "
68	28	near hole in moss and lichens
82	47	on moss under 2 dcm. willow
84	19	among grass under 1 m. willow
85	19	on moss under 75 cm. willow
72	42	near tussock under <u>Ledum</u>
73	42	edge of frost boil near sedges and <u>Betula</u>
77	48	depression in moss under <u>Eriophorum</u>
75	45	on moss among sedges under <u>Betula</u>
76	45	near tussock under <u>Betula</u>
WOP 1295	CT-2	frost-crack in <u>Dryas</u> -willow-sedge solif. terrace

Sorex cinereus

RSS 36	non-plot	edge of tussock
66	36	between tussocks on moss under <u>Ledum</u>
67	36	between tussocks under 3 dcm willows and <u>Betula</u>
70	42	between tussocks on moss under 2 dcm. willow
71	42	between tussocks near 15 cm. willow
80	46	between tussocks near <u>Ledum</u>

- 23 January - Seymour Tezroylik and Amos Lane killed a Polar Bear at Sinyuk near a cache of seals. (DCF)
- 10 February - Patrick Atungana saw tracks of 2 Polar Bears on the south side of Point Hope. (DCF)
- 19 February - Nick Timothy wounded a Polar Bear at Nuwuk, it had apparently recently killed a seal at Nuwuk. (DCF)
- 2 April - Lawrence Sage observed fresh tracks of adult and very small Polar Bear at mouth of first valley northwest of Kuropuk. (WOP)

Canis lupus Wolf

During the winter 1960-1961 the U. S. Public Health Service diagnosed rabies in several wolves from northwestern Alaska.

In mid-October Antonio Weber shot a wolf on the shore south of Point Lay. (DCF)

- 21 January 1961 - Wolf tracks at Kukpuk. (DCF)
- 3 February - Elijah Atungana shot at a wolf on Sahligvik Ridge. (DCF)
- 25 March - Pruitt and Lawrence Sage observed several wolf tracks between Camp 3 and Kukpuk-Kissimilouk divide (see Winter Trip section).
- 27 March - Pruitt and Lawrence Sage observed wolf tracks on north side of height of land between Kukpuk and Ogotoruk.
- 20 April - One wolf reported along the beach near Kissimilouk Creek. Fresh wolf tracks on the beach between Kissimilouk and Ogotoruk. (HK)
- Last week of April - Wolf seen just north of Sinyuk. (DCF)

Alopex lagopus Arctic Fox (White Fox)

- 5 January 1961 - White Fox reported seen south of Point Hope. (DCF)
- 9 January - White Fox tracks at Nuwuk. (DCF)
- 16 January - White Fox reported seen at Sinyuk. (DCF)
- 4 February - Four White Fox taken by Amos Lane. He took several additional ones later in the season. (DCF)

- 15 March - Nick Hank took one White Fox north of Point Hope Village. (DCF)
- 17 March - Don Wilson observed a White Fox 2 miles north of Chariot camp.
- Lent observed White Fox tracks along Sahligvik Ridge. (PCL)
- 22 March - John Omnik took a White Fox at Kukpuk. (DCF)
- Pruitt and Lawrence Sage observed occasional White Fox tracks between Kivalina and Kitingurok along the Kivalina River.
- 29 March - Edgar Swan, on his way from Kivalina to Point Hope, found a White Fox dead on the beach south of Ogotoruk. From superficial examination of the frozen carcass it seemed to have died from fight wounds; there were bloody gashes on the neck and throat.
- 31 March - Pruitt and Lawrence Sage observed many White Fox tracks while visiting mammal plots in the Ogotoruk valley.
- 3 April - Pruitt and Lawrence Sage observed White Fox tracks at Kissimilouk and Cape Seppings.

- 1961 Vulpes fulva Red Fox
- 26 January - Red Fox tracks at Kipaloq. (DCF)
 - 7 February - Red Fox observed near Jabbertown. (DCF)
 - 22 March - Pruitt and Lawrence Sage observed many Red Fox tracks between Kitingurok and Ahkuttorot Creek.
 - 24 March - Pruitt and Lawrence Sage observed many Red Fox tracks between Camps 2 and 3.
 - 25 March - Pruitt and Lawrence Sage observed many Red Fox tracks between Camp 3 and Ogotoruk. Observed one Red Fox and one Cross Fox 2 miles SW of Camp 3.
 - 27 March - Pruitt and Lawrence Sage observed Red Fox on Flag Hill.
 - 31 March - On the bluffs of Ogotoruk Creek, Pruitt and Lawrence Sage observed Red Fox tracks leading up to a mafsah or over-curved snow cornice. Sage reported that foxes, both Red and White, and even Wolverine use these spots for winter dens.
 - 3 April - Pruitt and Lawrence Sage observed numerous Red Fox

tracks between Ogotoruk and Kivalina. Several sets were of two individuals together, for example, those at Shaaktut.

Mustela erminea Ermine

•No additional notes on Ermine are offered.

Mustela rixosa Least Weasel

No additional notes on Least Weasel are offered.

Gulo luscus Wolverine

- 1960
- 14 August - At Eetaeblaeruk, Foote observed a Wolverine swimming the Kukpuk River with a ground squirrel in its mouth. Wolverine observed at Kukpuk. (DCF)
- 1 September- Wolverine seen at Kukpuk. (DCF)
- Last week of September - Wolverine taken at Kukpuk. (DCF)
- 15 October - Many wolverine tracks at Angmakroq Mtn. (DCF)
- 16 October - Wolverine shot at Ahyougatuk, where it was feeding on a dead seal. (DCF)
- 21 October - Fresh Wolverine tracks at Kukpuk. (DCF)
- 26 November - Amos Lane obtained Wolverine near Angmakroq Mtn. (DCF)
- 9 January¹⁹⁶¹ - Antonio Weber obtained Wolverine at Kukpuk. (DCF)
- 26 January - Wolverine tracks at Kipaloq. (DCF)
- 10 March - Wolverine observed on west side of Nasoarak Creek. (PCL)
- 10 March - Antonio Weber obtained Wolverine on Kukpuk delta. (DCF)
- 22 March - Pruitt and Lawrence Sage observed several fresh Wolverine tracks upstream from Kitingurok on the Kivalina River.
- 24 March - Pruitt and Lawrence Sage observed occasional Wolverine tracks on Kukpuk River between Camps 2 and 3.
- 25 March - Pruitt and Lawrence Sage observed many Wolverine tracks on the Kukpuk River between Camp 3 and the Kukpuk-Kissimilouk divide.
- 30 March - Wolverine tracks below plot CT-2. (WOP)
- 31 March - Wolverine tracks observed on plots OTK-19 and 46.
- 27 April - Wolverines seen, one at Kukpuk and one on uplands 10 to 15 miles south of Kukpuk. (DCF)

Lutra canadensis River Otter

Although no otters have been recorded from the Ogotoruk drainage they occur in the Kivalina drainage. Pruitt and Lawrence Sage observed fresh otter tracks about 8 miles up the Kivalina River on 4 April 1961. This river and the lower Kukpuk River, especially the delta, offer suitable otter habitat. Locally-taken otter fur is a prized trim for clothing at Kivalina. The scarcity of this species in the region can undoubtedly be attributed to its great value as fur.

Marmota caligata Hoary Marmot

In previous reports I have noted the value placed on marmot skins by the local people. The following episode may serve to emphasize the economic importance of this mammal. John and Frank Omnik, Point Hope Eskimos, left Cape Lisburne on 5 August on foot with three pack dogs and light loads. They walked overland eastward nearly to Iglauk Mountain (Igloo Mtn. on maps) and returned to Point Hope on 30 August. The object of this 140-mile hike was marmot skins, of which they secured 17. (DCF)

Citellus parryi Arctic Ground Squirrel

Because this species is treated in detail by Mr. Carl, all comments will be found in his section of this report.

Clethrionomys rutilus Red-backed Vole

Mr. Carl has determined statistically that there was a change, significant at the 2 per cent level, in the population size of the Red-backed Vole from 1959 to 1960. There was a non-significant trend to remain in vegetation types exemplified by plots OTK-4, 32, 36, 46 and 49 (Eriophorum tussocks with polygons, Eriophorum tussocks with frost scars, and Carex bigelowii high-center polygons.)

Jaws and teeth of Clethrionomys were found in an owl pellet collected at Pellet Site #1 during summer 1960. Clethrionomys has been very rare in scats or pellets from the Cape Thompson region.

Microtus oeconomus Tundra Vole

Mr. Carl has determined statistically that the 1960 population was significantly lower (at the 1 per cent level) than the 1959

population. There was also a non-significant trend from vegetation types exemplified by plots OTK-1, 9, 12, 13, 19, 32, 34 and 36 to those exemplified by plots OTK-45 and 49. In other words, there was a tendency to avoid such types as Eriophorum-Carex soluflection slope, Ecotone Communities, high willow grove, Eriophorum tussock with frost scars and low-center polygons in favor of ridged wet meadows and Carex bigelowii high-center polygons. Thus, there was a tendency to avoid the areas of more extreme environmental conditions. This tendency agrees with what I have found elsewhere with other small mammals (Pruitt 1959a).

Microtus miurus Alaska Vole

Although the population of Alaska Voles on ANG-1 was very low in summer 1960, observations on the Wulik River in October 1960 and on the Kivalina River in March 1961 lead me to conclude, from the numbers of trails and individuals seen and heard, that a higher than average population existed in those areas at that time. Just where the population "break" occurred between Kivalina and Angmakroq Mtn. is, of course, not known. Investigation of such a "break" would be of great significance to our understanding of population cycles.

Ondatra zibethicus Muskrat

No additional notes on muskrat are offered.

Lemmus trimucronatus Brown Lemming

Mr. Carl has determined statistically that Brown Lemmings showed a non-significant trend toward a population drop between 1959 and 1960. There was also a non-significant trend from vegetation types exemplified by plots OTK-13, 19, and 25 to types exemplified by plots OTK-1 and 32. This trend was from Ecotone Communities and Tall Willow Grove to Ridged wet meadow and Eriophorum tussock with frost scar types. At present I can draw no conclusions as to the ecological significance of this tendency.

Dicrostonyx groenlandicus Collared Lemming

Mr. Carl has determined statistically that no significant change

in the Collared Lemming population occurred between 1959 and 1960. There was, however, a statistically significant trend to shift from vegetation types exemplified by plots OTK-13, 15, 28, 35 and 49 to types exemplified by plots OTK-7, 32 and 49. This is a trend from Carex bigelowii frost scar (Ecotone Communities), Ericaceous snowbed, rocky-lichen snowbed and Carex bigelowii high-center polygons types to Eriophorum-Carex solifluction slope, Eriophorum tussock with frost scar and Carex bigelowii high-center polygon types. It is seen that snow-bed vegetation types were not utilized in 1960 whereas they were used in 1959. As yet we can draw no conclusions as to the ecological significance of this trend.

Erethizon dorsatum Porcupine

- First week of October 1960 - Charlie Tuckfield observed a porcupine at Makpirak Creek. Amos Lane shot it the next day. (DCF)
- Moses Shagluk, from Point Lay, recalled that he had once killed a porcupine at Point Lay village. He did not recall the year or date. (DCF)

Alces americana Moose

No additional notes on Moose are offered.

Rangifer arcticus Barren-Ground Caribou

All observations and notes on this species are incorporated into Mr. Lent's portion of this report.

Ovis dalli Dall Sheep

Lawrence Sage recalls once having seen a Dall Sheep near Nasoaruk Creek. At the time he was a lad living at Ogotoruk and was on a boat trip to Point Hope. He also recalls that his father once saw tracks of two sheep near Sinroalik (misnamed Singoalik on maps). The trail came from inland, followed the coast and returned inland via Shaaktut.

Other Mammals

Ovibos moschatus Muskox. During the summer 1960 Miss Anore Bucknell found a muskox horn-core near the beach at Kipaloq (Cape Dyer).

Because of the sparse regional snow cover and the lushness of the willows along the creeks and rivers, the Ogotoruk-Kukpuk region gives promise of being suitable muskox range. Indeed, the Kukpuk valley between Angmakroq Mountain and the junction with the Ipewik River bears a striking resemblance (in regard to vegetation and snow cover) to parts of the muskox range in the Thelon Game Sanctuary in the Northwest Territories.

Food-Web

During the period covered by this report many days have been spent in detailed analysis of the contents of numerous pellets and scats. As was predicted in the December 1959 Mammal Report, no substantial change in the food web pattern, as diagrammed in that report, has become evident. Our methods and techniques are of such a limited scale and are far too coarse to be able to distinguish such phenomena as shifts in food habits concurrent with population fluctuations of prey species.

As a result of the more recent food-web investigations the following solid lines should be added to the food-web diagram found on page 15(a) of the December 1959 Mammal Report:

1. Shrews to owls and hawks, accompanied by numeral 2.
2. Weasels to owls and hawks, accompanied by numeral 2.
3. Marine mammals to wolverine, accompanied by numeral 1.
4. Fish to man, accompanied by numerals 1 and 3.
5. Ground squirrels to wolf, accompanied by numeral 2.
6. Voles and lemmings to wolf, accompanied by numeral 2.
7. Caribou to wolf, accompanied by numeral 2.
8. Voles and lemmings to gulls, accompanied by numeral 2.

Eye Lens Data

As previously noted we have been cooperating with Dr. Rexford D. Lord of the Illinois State Natural History Survey in utilizing eye lenses as an aging technique. Because of the low populations of small mammals found in 1960 not enough eye lenses were collected for significant trends to be observed. Nonetheless, the few data available

appear to fit our morphometrically-determined aging patterns fairly well. The data for very large and very small individuals (very old? and very young?) agree nicely. The points that disagree are found in the individuals I interpret as young-adult. Undoubtedly these points will clear up with greater numbers of specimens.

Winter Work

On 20 March 1961 I arrived at Kivalina. On 22 March Lawrence Sage and I departed up the Kivalina River with a sled and 14 dogs. The previous day had seen a fall of about 3 cm. of fresh snow which in this region still lay undisturbed by wind.

Not much mammal sign, save for an occasional track of white fox, was noted until above Kitingurok (the "narrows" of the Kivalina valley). From this point on there were many tracks of red fox, wolverine and mice. One striking feature of the willow-covered flats of the Kivalina valley was the tremendous number of willow ptarmigan there. The total number in this valley must have been many thousands of individuals. Flocks were constantly flushing from each side of us so that the dogs eventually became blasé and did not get excited about them. We camped overnight at Camp 1 (see Figure 1).

On 23 March we continued up the Kivalina River, finally crossing the height of land at the head of Akkutorot Creek into the Kukpuk drainage. The weather in the Kukpuk valley was noticeably different from that prevailing in the Kivalina valley. It was about 10°C colder (-28°C.) and the wind was stronger. The first caribou were noted on the height of land. After this point and Camp 2 we began to see small bands of caribou. They increased in numbers as we went downriver.

We spent 24 March winding down the Kukpuk River. The trail was rough and tiring, combining fresh snow, rough ice and ablation needles. The terrain features here did not agree with the map. Caribou sign was frequent. There were also occasional wolf, wolverine and red fox tracks. We camped that night (Camp 3) at the north end of the big south trend of the river in a magnificent country of high rolling hills with the river winding in a deeply incised, sometimes precipitous, valley.

On 25 March we continued down the Kukpuk to the mouth of a small steep-walled creek where we started climbing to the height of land

between the Kukpuk River and Kissimilouk Creek. Although landmarks could not be recognized from the poor map, Lawrence Sage knew the trail well. He had herded reindeer over all this country as a young man and the trail is frequently used by caribou hunters from Kivalina and Point Hope.

The height of land between the Kukpuk and Kissimilouk drainages formed the boundary of "Ogotoruk snow," characterized by being sparse and worked into exceedingly hard and dense kaioglaq (see June 1960 Mammal Report for description of drift succession and nomenclature). The boundary is remarkable sharp.

When we arrived at Chariot camp, we met Patrick Atungana and Rev. Keith Lawton of Point Hope. They had left Kivalina the previous day but had been forced to stay overnight at the Cape Seppings shelter cabin because of weather.

On 26 March we rested and repaired and dried equipment. On 27 March we made a trip up the Ogotoruk valley to Angmakroq Mountain to sample the snow on the plots there. (Figures 25&26). I was impressed with the great amount of caribou feeding sign in the middle and upper Ogotoruk valley and the Kukpuk valley. Several caribou were on Angmakroq Mountain just above my plots; trails and scats were on the plots.

The unusual fall and winter rains had converted many wet meadows into marshes. Here the ice was domed in typical tundra-marsh fashion. The liquid precipitation caused profound effects on the snow cover as may be seen from inspection of the various snow profiles (Figures 2-28). For example, the pond near plot OTK-34, which in winter 1959-1960 was glare ice, was covered this winter with hard kaioglaq. The Kukpuk River at Angmakroq Mountain, however, was a broad sheet of glare ice in both 1959-60 and 1961. Apparently the water level was much higher at freeze-up in the fall 1960 than in fall 1959. Areas that were extensive bare gravel in winter 1959-1960 were glare ice this year.

On March 28 Lawrence Sage and I traveled northwestward along the base of the cliffs to Point Hope. My plans were to climb to plots CT-1 and CT-2. The anticipated drift by which I hoped to ascend the cliff to the plots did not materialize. Because of the amount of glare ice I deemed it too hazardous to climb up even this low cliff and decided to reach these plots later by a different route.

We noted 5 ravens along the cliffs and several caribou on top of the cliffs. There were numerous caribou tracks and scats on the snow at the base of the cliffs. At the base of one cliff near Bird Colony 2 there was open water where a fresh-water spring came out. According to Lawrence Sage this open water is present all winter.

I spent 29 March in exchanging mammal notes and discussing matters of mutual interest with Don Foote and Burton Ostenson.

On 30 March we returned to Chariot camp. On the way back we went to plots CT-1 and CT-2 by going up the valley of Ibrulikhoruk Creek (misnamed Eegikruttoosook Creek on maps). Again, caribou were noted on and about the cliffs. There were 6 caribou on CT-2 when we arrived. The wind was particularly troublesome this day. No matter the wind direction, it swooped in great whirlwinds and updrafts around the cliffs. By funneling down some of the creek valleys its speed appeared to be increased to a point where the loaded sled was pushed sideways and dogs were knocked off their feet.

We spent 31 March and 1 April visiting all the mammal plots in the Ogotoruk valley and in sampling the snow on each (Figures 2-28). On 2 April we were weathered in at Chariot camp. On 3 April we returned to Kivalina by way of the beach trail.

Table 3 shows the distribution of snow cover in the Ogotoruk valley as measured on 31 March and 1 April 1961. The percentage bareness of each plot in 1961, the range in percentages for each vegetation type and the raw and weighted averages are given; and, for comparison, the per cents for 1960 are given in parentheses adjacent to them. To make comparison easier the per cent of each vegetation type in the total area of the valley is again based on the 1960 vegetation map instead of the final 1961 map. Use of the 1961 map would increase the apparent per cent of the valley bare of snow because the major expansion of vegetational mapping was in areas of Dryas fellfield uplands (the "upper basin" of the Ogotoruk).

Table 4 presents snow cover thicknesses for 1960 and 1961.

Careful study of Tables 3 and 4 plus the snow-cover profiles (Figures 1 through 24 in June 1960 Mammal Report and Figures 2 through 28 in this report) reveals several points of interest.

Undoubtedly the most striking feature of the data is the remarkable constancy of snow conditions between the two winters. As one would expect, the greatest change in conditions occurred in snow beds.

Table 3. Distribution of Snow Cover, Ogotoruk Valley, 1960 and 1961.

[illegible]

Table 4. Snow cover thickness, Ogotoruk Valley, 1960 and 1961.

Plot and Vegetation Type		Thickness (in centimeters)		Difference between 1960 and 1961
		1960	1961	
<u>Dryas fellfield</u>	OTK-33	10	too little to measure	-10
<u>Eriophorum-Carex</u> wet meadow	1	15 (10-24)	14	- 1
	12	19	14	- 5
	45	15	14	- 1
	34	22	27	+ 5
	48	12	23	+11
<u>Eriophorum</u> tussock	4	11-30	19	- 1
	42	15	26	+11
	46	27	18	- 9
	36	21	27	+ 6
	32	26 (25-28)	26	0
<u>Carex bigelowii</u>	13	14	too little to measure	-14
frost scar (Ecotone	25	9	9	0
Communities)	35	14	11	- 3
<u>Eriophorum-Carex</u>	7	17	12	- 5
solif. slope	9	20	15	- 5
<u>Carex bigelowii</u> high-center polygons	49	22	19	- 3
Ericaceous shrub polygons	40	11	too little to measure	-11
Mixed grass saline meadow	no sample			
Dryas steps and stripes	no sample			
Snow beds	15	37	87	+50
	28	46	15	+31
Gravel bars and benches	5	18	8	-10
	19	106	122	-16
	47	48	85	-37

These, of course, are so situated that they are in the wind shadow of some topographic eminence. Thus, relatively slight differences in wind direction could conceivably cause relatively large differences in the pattern of drift deposition.

It may also be seen that the measured thickness of the snow does not necessarily bear any close relationship to the per cent bareness of the particular sample plot. The great increase in snow density in 1961 over 1960 leads one to suspect that more water was present in 1961 than in 1960 even though a greater per cent of the valley was bare in 1961 than in 1960.

One is now led to postulate a topographic control of the amount of snow cover deposited in the Ogotoruk valley. In other words, topography (along with wind force and direction) sets the upper limits on the amount of snow cover possible. Below these limits the amount of snow cover is possibly, but not necessarily, regulated by amount of precipitation. We have seen (June 1960 Mammal Report) how snow particles (siqoq) are transported along the surface of the snow cover (api). The distance a given particle (and its spalls) travels is not known, but undoubtedly this distance is governed by a number of factors such as original size, temperature regime, wind force and direction, and nivographic details. It would seem that as the snow cover develops during a winter a snow particle would have to travel farther and farther before being immobilized behind some topographic eminence. Eventually a threshold of accumulation is reached after which no more particles can fit into the snowscape. After this stage the snow cover may be spoken of as mature, for no further growth can occur.

Although the standardized synoptic records do not, of course, indicate such aspects of weather, the rain that fell in January was of extreme ecological importance. (See Pruitt 1959b for discussion of the non-applicability of standard weather records to phases of Arctic ecology. Also see Wolfe, Wareham and Scofield (1949) for general discussion of this point.) Conversations with Kivalina and Point Hope people who traverse and hunt the region revealed that one of the striking results of the rain was to reduce the already small amount of snow on the ridges and hills (Dryas fellfields). The rain itself remained as a glaze of ice which made walking treacherous for humans. Close inspection revealed, however, that remarkably

little of the exposed lichen growth was covered by the ice. The ice tended to be in the slight depressions between rocks, pebbles and the lichens which grow as weak eminences.

On areas of well-developed snow cover, the rain had a completely different effect. Here the liquid precipitation apparently soaked into the dry snow as if into a sponge. The subsequent return to below-freezing temperatures hardened the soaked surface sufficiently to enable it to resist the abrading and transporting action of the wind. Thus, the drift pattern that was extant at the time of the rain became fossilized, as it were, and remained for the duration of winter conditions. This fossilized drift pattern did not necessarily agree with the drift pattern dictated by later wind conditions. Thus portions of it were covered by later snow deposition, but as far as I could determine no appreciable part of it was eroded away.

Reflection on the above sequence of events allows one to see how there could be more actual water in the snow cover of the region even though the percentage cover is less than in other years. Data to substantiate these statements could be obtained by an adequate number of snow observation stations operated for sufficient time.

Our studies are hardly adequate in scope or magnitude to enable one to advance biological implications of these peculiar snow conditions. A few suggestions may be made, however. The action of the rain in clearing snow may have been one factor influencing the distribution of caribou to the northwest of Ogotoruk Creek during the winter 1960-1961 instead of to the Northeast. (See Foote's report for distribution of winter caribou hunting by Point Hope people and Lent's report for distribution of caribou). The hardening action on established snow cover probably had some effect on the feeding activities of foxes, weasels and wolverines, with effects, in turn, on populations of voles and lemmings.

Figure 2

Plot: OTK-1 1 April 1961 Air Tem = -11°C. , Pukak Temp = -14°C.

Plot 25 per cent bare. Photograph from A-1.

Surface hardness = 500 to 10,000 gm/cm^2

Caribou scat and feeding
sign.

Figure 3

Plot: OTK-4 1 April 1961 Air Temp = -12°C , Pukak Temp = -13°C

Plot 30 percent bare. Photograph from A-1

Surface hardness = 1,000 to 80,000 gm/cm^2

Snow at center of plot:

Caribou scat.

Figure 4.

Plot: OTK-5 1 April 1961 Air Temp = -12°C

Plot 20 percent bare (about 50 percent bare of snow, remainder is ice cover).

Photograph from A-1

Surface hardness = 100 to 100,000 gm/cm^2

Snow at center of plot:

Figure 5

Plot: OTK-7 1 April 1961 Air Temp = -12°C , Pukak Temp = -12°C

Plot 40 percent bare. Photograph from A-1

Surface Hardness = 2,000 to 80,000 gm/cm^2

Snow at center of plot:

Figure 6

Plot: OTK-9 1 April 1961 Air Temp = -12°C , Pukak Temp = -13°C

Plot 50 percent bare. Photograph from A-1

Surface hardness = 10 to 3,000 gm/cm^2

Snow at center of plot:

Garihou scat.

Figure 7

Plot: OTK-12 1 April 1961 Air Temp = -14°C , Pukak Temp = -13°C

Plot 50 percent bare. Photograph from A-1

Surface hardness = 3,000 to 60,000 gm/cm²

Snow at center of plot:

Figure 8

Plot: OTK-13 1 April 1961 Air Temp = -13°C

Plot 75 percent bare. Photograph from A-1

Surface hardness = 500 to 7,000 gm/cm²

Not enough snow to measure.

Figure 9

Plot: OTK-15 1 April 1961 Air Temp = -13°C , Pukak Temp = -12°C
 Plot 30 percent bare. Photograph from A-1, and along line of
 snow poles.

Surface hardness = 30,000 to 70,000 gm/cm^2

Snow, between 3rd and 4th snow pole:

Figure 10

Plot: OTK-19 31 March 1961 Air Temp = -4°C , Pukak Temp = -10°C

Plot with complete cover, only tips of willows protruding

Pole at A-1 = 70 cm.; no others visible. Photograph from about
A-5

Surface hardness = 8,000 to 10,000 gm/cm²

Snow at about A-10:

Tracks - caribou
wolverine
white fox
4 caribou on hill to N.

Figure 11

Plot: OTK-25 1 April 1961 Air Temp = -13°C

Plot 30 percent bare. Photograph from A-1

Surface hardness = 60 to 60,000 gm/cm²

Snow at center of plot:

Caribou scat.

Figure 12

Plot: OTK-28 1 April 1961 Air Temp = -14°C , Pukak Temp = -14°C
 Plot 10 percent bare. Photograph from A-1, both ends of snow pole
 transect.

Surface hardness = 3,000 to 100,000 gm/cm²

Snow below 3rd snow pole from bottom:

Caribou scat.

Figure 13

Plot: OTK-32 31 March 1961 Air Temp = -5°C
 Plot 10 per cent bare. Photograph from A₂₁
 Surface hardness = 2,000 to 100,000 gm/cm²

Snow at center of plot:

Figure 14

Plot: OTK-33 31 March 1961 Air Temp = -4°C , Pukak Temp = none

Plot 90 percent bare. Photograph taken from A-1

Almost complete cover of ice

Surface hardness of occasional drift: 1,000 to 100,000 gm/cm²

Caribou scat.

Figure 15

Plot: OTK-34 31 March 1961 Air Temp = -4°C , Pukak Temp = -13°C

Plot 5 percent bare. Photograph from A-1

Surface Hardness = 6,000 to 100,000 gm/cm^2

Snow at center of plot:

Figure 16

Plot: OTK-35 31 March 1961 Air Temp = -5°C

Plot 30 percent bare. Photograph from A-1

Surface hardness = 400 to 5,000 gm/cm^2

Snow at center of plot in depression:

Many caribou scats,
much feeding sign.

Figure 17

Plot: OTK-36 31 March 1961 Air Temp = -5°C , Pukak Temp = -12°C

Plot 25 percent bare. Photograph taken from A-1

Surface hardness = 1,000 to 90,000 gm/cm^2

Snow at center of plot:

Caribou scat.

Figure 18

Plot: OTK-40 1 April 1961 Air Temp = -12°C

Plot 80 percent bare. Photograph from A-1

Too little snow to measure. Surface hardness of drift = 10,000
to 100,000 gm/cm^2

Caribou scat.

Figure 19

Plot: OTK-42 31 March 1961 Air Temp = -8°C , Pukak Temp = -12°C

Plot 10 percent bare. Photograph from A-1

Surface hardness = 2,000 to 10,000 gm/cm^2

Snow at center of plot:

Caribou scat.

Figure 20

Plot: OTK-45 31 March 1961 Air Temp = -3°C , Pukak Temp = -12°C

Plot 20 percent bare. Photograph from A-1

Surface Hardness = 2,000 to 10,000 gm/cm^2

Snow in center of plot:

Figure 21

Plot: OTK-46 31 March 1961 Air Temp = -3°C , Pukak Temp = -9°C

Plot 20 percent bare. Photograph from A-1

Surface hardness = 1,000 to 10,000 gm/cm^2

Snow at center of plot:

Wolverine tracks

Figure 22

Plot: OTK-47 31 March 1961 Air Temp = -5°C , Pukak Temp = -11°C

Plot with complete cover. Photograph from A-1

Surface hardness = 2,000 to 8,000 gm/cm²

Snow at center of plot:

Figure 23

Plot: OTK-48 31 March 1961 Air Temp = -5°C , Pukak Temp = -9°C

Plot 5 percent bare. Photograph from A-1

Surface hardness = 3,000 to 7,000 gm/cm^2

Snow at center of plot:

Figure 24

Plot: OTK-49 31 March 1961

Air Temp = -6°C , Pukak Temp = -12°C

Plot 25 percent bare. Photograph from A-1

Surface hardness = 3,000 to 10,000 gm/cm^2

Snow at center of plot:

Caribou scat and feeding
sign.

Figure 25

Plot: ANG-1 (Angmakroq Mtn.) 27 March 1961

Air Temp = -16°C , Pukak Temp = -15°C

Plot with complete cover. Photographs taken from J-10 looking west and southwest.

Surface hardness =

H		D
	250 cm.	
4,000 gm/cm ²	221	.40
2,000	196	.33
10,000	176	.43
20,000	140	.35
30,000	120	.32
7,000	20	
		<hr/>
3,000		.38

Caribou tracks and scats.

Figure 26

Plot: ANG-2 (Angmakroq Mtn.) 27 March 1961

Air Temp = -17°C , Pukak Temp = -14°C

Plot 20 percent bare.

Surface hardness = $20,000 \text{ gm/cm}^2$

Caribou tracks and scat

Figure 27

Plot: CT-2 (Cape Thompson, top of cliffs) 30 March 1961

Air Temp = -15°C , Pukak Temp = -14°C

Plot 75 percent bare. Photograph from A-10

Surface Hardness = $4,000 \text{ gm/cm}^2$

Snow in center of plot, drift downwind of frost mound:

caribou on plot
wolverine tracks below
plot

Figure 28

Plot: CT-1 (Cape Thompson, lower)

Air Temp $=-15^{\circ}\text{C}$

Plot 95 percent bare. Photograph from A-1.

Snow: Only a few patches of snow and black sand mixture; too little to measure.

ECOLOGICAL INVESTIGATIONS
OF THE ARCTIC GROUND SQUIRREL, CITELLUS PARRYII

Ernest A. Carl

A study of the population dynamics and the ecological implications of behavior in the Arctic Ground Squirrel was initiated in the Ogotoruk Creek region during June 1960. The Terrestrial Mammal report of December 1960 indicated the status of the study as of that date. The present report will consider 1960 data processed since December and data gathered in the field between 18 April and 15 May, 1961. Methods of investigation remain essentially the same as those reported in December.

Population Size

The 1960 live-trapping data indicated that the population of the study area was 41 squirrels on 15 June 1960. The emergence of the young of the year between 29 June and 2 July brought the total population up to 182 individuals. The directly observed mortality during the 1960 field season totaled 19 individuals. (See December 1960 Mammal Report for details)

An analysis of the trapping records shows that the mean interval between successive trapping of given individuals was 4.52 days with a standard deviation of 3.69 days. Thus, on the average, when an individual is not retrapped within 13.37 days, the chances are less than 5 per cent that it is still in the study area population. In the following calculation all animals failing to be retrapped have been dropped from the total population figures six days after they were last trapped. Figure 29 shows the resultant running population curve for the summer of 1960. Individuals may leave a population by emigration or death, but field observations indicated that no significant geographical shifts occurred during the summer of 1960, hence the entire population loss should be assigned to death.

The study area appears to have had a population of 110

Figure 29. Squirrel Population Levels,
 Summer 1960,
 Ground Squirrel Study Area, Ogotoruk Creek,
 Northwestern, Alaska

individuals just before the population entered hibernation in late October, 1960. Observations and trapping records indicate that the population stood at about 75 individuals during the first week in May, 1961. Five of these latter animals (all males) were immigrants. Thus, the study area showed a loss of 40 individuals between late October and early May. Observations indicate that this loss may be assigned to both emigration and death.

Hibernation

No winter field studies were conducted on hibernation. When I left the study area on 18 October 1960, at least part of the population was still active above ground despite the fact that freeze-up had occurred and the ground was covered with snow. Informants at the site reported that the last active squirrels were seen during late October.

Thermistors were installed in October 1960 in a burrow system to record data on hibernacula bioclimate. The winter caretaker crew, however, failed to make thermistor readings so no data were obtained.

In the spring of 1961 the first squirrels were observed active above ground on 20 April. Activity was limited to short periods spent digging and eating roots and clearing snow from the entrances of existing burrows. All squirrels observed between 20 April and 28 April were males. On 29 April the first females were observed above ground. Surface activity increased rapidly until 4 May, at which time it was judged that all squirrels had emerged from hibernation.

Territory formation

The distribution and size of the territories was discussed in the December 1960 Mammal Report. These territories were in existence on 15 June 1960 when the observations were begun, so no data were available on territory formation at that time.

Territory formation in 1961 began on 20 April with the emergence of the males. Each male cleared snow from the burrow entrances in the vicinity of his hibernaculum. Entrances not so cleared became plugged with ice during the spring melt. Since this activity occurred within 20 feet of the hibernaculum, the males did not come in contact with one another and no overt

territorial defense was observed. By 25 April the males were ranging as far as 70 feet from their hibernacula sites and contacts with neighboring squirrels began. Since that time, and continuing at present, contacts between males have rapidly increased in frequency due to enlarging territory size and the existence of wandering, displaced males in the population.

A complete behavior sequence during these "boundary disputes" contains the following steps:

(1) Two males sight each other and move toward one another rapidly and directly until the distance between them is less than 20 feet on smooth ground and as little as 10 feet on broken ground.

(2) Their approach becomes somewhat circuitous and slow, motion being accomplished by a low, squatting crawl with the ventral surface of the body in contact with the ground most of the time. For about one second out of every five or ten, the squirrels (usually synchronously) stand in an erect "observation posture," high on their hind legs and face each other.

(3) At a distance of about three feet, the squirrels stop moving toward each other and begin moving parallel to each other, alternating between the crawl described above and a high, stiff-legged strut. After progressing parallel for 4 to 12 feet, the squirrels assume a normal resting position and either remain motionless or begin nibbling at the vegetation or scratching at the ground. Step (3) behavior has been observed to occur as few as 4 or as many as 15 times for a maximum time span of 25 minutes.

(4) During the last of the strutting sequences described above, the squirrels change their direction of movement to about 20 degrees toward each other instead of parallel as before. They maintain a parallel orientation of their body axis and accomplish a collision course by a slight side-stepping. During this activity both animals maintain a high, stiff-legged strut with the back sharply flexed. The animals make contact first with their hind quarters, then with the entire length of their trunks. Their heads are held apart and directed ahead.

(5) The squirrels lean against one another while still moving forward. Sometimes one of the squirrels will push harder

than the other, and the pair will move on a diagonal course. Forward progress continues from 2 to 10 feet. Step (5) is exhibited only once.

(6) Suddenly a turbulent fight breaks out. The animals roll over and over each other, biting and clawing. This fight may last from one second to one minute.

(7) The combatants break apart and one animal runs away rapidly, usually in the direction from which it originally came. Occasionally an animal will run in a direction other than the one from which it originally came, but if so, it swings in a wide circle and picks up the original direction. If the pursuer catches up with the pursued, he will attempt to bite the latter on the rump. If this bite holds, another tumbling fight (6) ensues. A second, or even third fight has never been observed to reverse the roles of pursuer and pursued. If the bite does not hold, the pursuing squirrel usually pitches off balance, tumbles and gives up the chase. If the pursued squirrel gains distance, the chase is usually abandoned after 30 to 200 feet. One chase, including two fights enroute, lasted over a total distance of 850 feet.

(8) Upon abandoning the chase for one reason or another, the former pursuer moves 10 to 50 feet in the direction of his burrow, stops, and digs a pit about 3 inches in diameter and 4 to 6 inches deep, usually to the frost line. He then begins a meandering course in the general direction of his burrow system, stopping to dig out roots here and there and often rising to a high standing observation pose.

The steps described above represent a complete sequence, and most boundary disputes do not continue through all the steps. At any stage, one of the contenders may retreat toward his burrow system, at which time the non-retreating male generally skips to step (8). If a boundary dispute ends in the same area as a former one, the victorious male may dig out an existing pit instead of starting a new one. Squirrels coming to the boundary of their territories will often dig at one of these existing pits even though they have not recently engaged in a boundary fight. At such a time a "double call" ("Check-Check" or "Chit-chit") is delivered from an observation pose

between short spurts of digging activity.

Since territory formation is still in progress at the time of writing of this report, and the status of the various territories on the study area changes almost daily, a comparison between the 1960 and 1961 territories cannot be made at this time. No deaths have been observed in connection with territorial fighting, but all males examined exhibit many wounds, some pus-filled and draining, which are presumably the result of fighting.

Sexual Behavior

During the spring of 1961, the first females appeared in the active population on 29 April. The males appeared to ignore the females that operated on their territories. They would investigate and then ignore strange females that moved across or into their territories, but displayed no other behavior patterns toward them. The first overt sexual behavior was observed on 1 May. The first attempted copulation was observed by Mr. Max Thompson in the vicinity of Chariot Campsite on 10 May. I observed copulating squirrels on the study area on 11 May.

Four male specimens autopsied between 1 May and 12 May exhibited scrotal testes which contained motile sperm. Two female specimens autopsied on 1 May and 9 May, respectively, possessed well-developed genital tracts and protruding Graafian follicles in both ovaries, but contained no corpora lutea or embryo implantations. A female collected on 12 May contained 2 corpora haemorrhagica, 8 corpora lutea, 6 embryo implantation sites, and motile sperm in the vagina and uterus.

Five copulation sequences have been observed in detail on the study area to date (15 May). Since these examples deviated only slightly from one another, a description of the steps observed is presented despite the small number of observations. A complete sequence proceeded as follows:

(1) A territorial male approaches a female living on his territory from behind. He approaches with a low, crawling gait, following the small depressions in the ground.

(2) Male's nose contacts the female's rump about 1 inch above the base of her tail. Up to this point the female appears to ignore the male despite the fact that he may step on her tail.

(3) Upon contact of the male's nose, the female spins abruptly around through 180 degrees with a short hop and faces the male. The male recoils at the same instant to a position about 1 foot away and faces the female. The pair remains in these respective **positions** for about 30 seconds. The female then turns around to her original position and moves ahead for 5 to 10 feet.

(4) Steps (1), (2), and (3) may be repeated from five to twenty times, the pair moving in a roughly circular path with a radius of about 40 feet. Occasionally, the female may enter a conveniently located burrow. The male then also enters the burrow. Within a few seconds the female re-appears, followed by the male. About every fifth to tenth time that these steps are repeated the male may extend his head forward while the female still faces him, touch noses with the female, rotate his head 90° from vertical and lock his incisors behind hers. Within a few seconds the female breaks from him, turns around and moves ahead as before.

(5) The male approaches the female from behind as before, but just before his nose touches her rump, he alters his course slightly and rubs along her side, moving on past her by about 6 inches. At this point he turns 90 degrees directly in front of the female and moves toward her with a side-stepping gait. Before the male contacts the female, she turns 90 degrees so as to face in the same direction as the male, then moves ahead about 5 feet. In the interval between the female's turning and moving, the male continues his side-stepping motion and at times may run into her, almost knocking her over. Step (5) may be repeated about eight times, the pair moving in a rough square about 5 feet on a side.

(6) As the female begins to move forward in the sequence described in step (5), the male gives a short leap forward at about a 45 degree angle, sliding up over the female's rump and onto her back. The female tries to scramble forward, but the male clasps her with his forefeet just behind her shoulders and by the nape of the neck with his teeth. The male vibrated his hind quarters for 3 to 4 seconds and released the female, who scrambled forward about 5 feet. In two instances the male repeated steps (5) and (6).

(7) The male then raises to a partially erect sitting position and begins licking his ventral and pelvic surfaces. The female begins doing the same to herself. After a few minutes of this grooming behavior, the pair begins to dig roots and slowly wanders apart.

The beginning steps of this sequence are often observed, but in most instances the participants fail to complete the behavior pattern and shift to other types of behavior.

Coincident with the onset of copulatory activity, the first females were observed carrying nesting material, mostly dried sedges. No males have as yet been observed engaging in this activity in the spring, however, the males do build and occupy their own nests later in the summer.

Burrow Site Selection

The relationship between population size, territorial behavior and burrow site selection poses some interesting problems. The slope of the population curve (Figure 29) suggests that the squirrel population of the study area will be about the same in 1961 as it was in 1960, despite a substantial reproduction rate for 1960. The territorial behavior of the males would seem to provide an adequate population control mechanism for that sex. The females, however, do not seem to engage in any type of territorial behavior and are able to live in fairly close association with one another and with the territorial male provided that they each have their own burrow. Such a situation, operating alone, would be expected to lead to a sex ratio heavily unbalanced in favor of females. The 1960 sex ratio was 17 males to 23 females, which is not greatly different from a 1 : 1 ratio expected genetically. The female population would therefore seem to be limited by some factor or factors not limiting the males.

On the bases of observations to date, the most likely possibility of control of female numbers appears to be burrow site selection. Sites actually chosen for burrows suggest that the choice is narrowly limited and correlated

with water run-off patterns, availability of certain vegetation types, (December 1960 Mammal Report; June 1961 Botany Report--Ground Squirrel section) and snow drift patterns.

Before the 1961 Spring melt occurred, 20 existing burrows were checked for snow cover. All were covered with snow to a depth of no less than 1 inch and no more than 6 inches (measured from the highest part of the entrance lip) although about 50 per cent of the study area was covered with snow. After the first week of melting temperatures, all of these burrows were on clear ground, although about 25 per cent of the study area surface was still covered by drifts.

Although the male ground squirrels set up the territories, it appears that they have no direct way of attracting the females to, or holding them on, these territories. Successful territories would therefore be the ones that contained habitat situations that would be innately chosen by the females as burrow sites. If the existence of this behavior complex is confirmed by the investigations presently in progress, it might be that future artificial alterations in the habitat, or of genetic behavior patterns, could be reflected in an acute post-alteration shift in sex ratio. The sex ratio is one of the more easily measured biological quantities.

Human Utilization of Squirrels

The squirrel pelt industry of Point Hope was mentioned in the December 1960 Mammal Report. On 14 May 1961 I traveled to the semi-permanent campsite of Mr. Austin Thomas and relatives near the mouth of Kissimilouk Creek about four miles east of the Chariot campsite. The 15 occupants of the camp (all from Kivalina) had moved there in mid-April and are planning to stay until early July. Mr. Thomas indicated that they had moved to this site to trap ground squirrels and because firewood was more readily available than at Kivalina.

The squirrels are taken by means of small steel-jaw type traps placed within a radius of about one mile from the camp. The traps are apparently checked several times per day. The

trapping had begun about three weeks prior to my visit and is to be continued throughout their stay at this site. Mr. Thomas explained that under most conditions squirrels are not taken after the females are carrying young but, since the squirrels are the camp's only source of food, hunting will not be interrupted this year.

The trapped squirrels are killed with a stick and skinned by freeing the skin around the lips and inverting it back over the body. The result is a bag-like pelt, inside out, which is dried and worked by hand until soft, then soaked in water, dried and hand worked again several times. The finished pelts are to be used for the manufacture of parkas. The bodies are eviscerated and boiled until the meat falls from the bones if for human consumption or are fed raw with viscera to the dogs. The number of squirrels taken is not readily estimatable.

Mrs. Thomas stated that when she was younger her family lived at times just east of Crowbill Ridge (i. e. on the present squirrel study area) and here they trapped squirrels as well as Puffins and Buluga whales, with great success.

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