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BIOLOGICAL SURVEYS IN THE FIRTH-MANCHA
RESEARCH NATURAL AREA, ALASKA, 1979-1980

by

Michael A. Spindler
Michele A. Mouton
Stephen O. MacDonald

*Nick - this is the title label that gets glued
on the cover of each binder*

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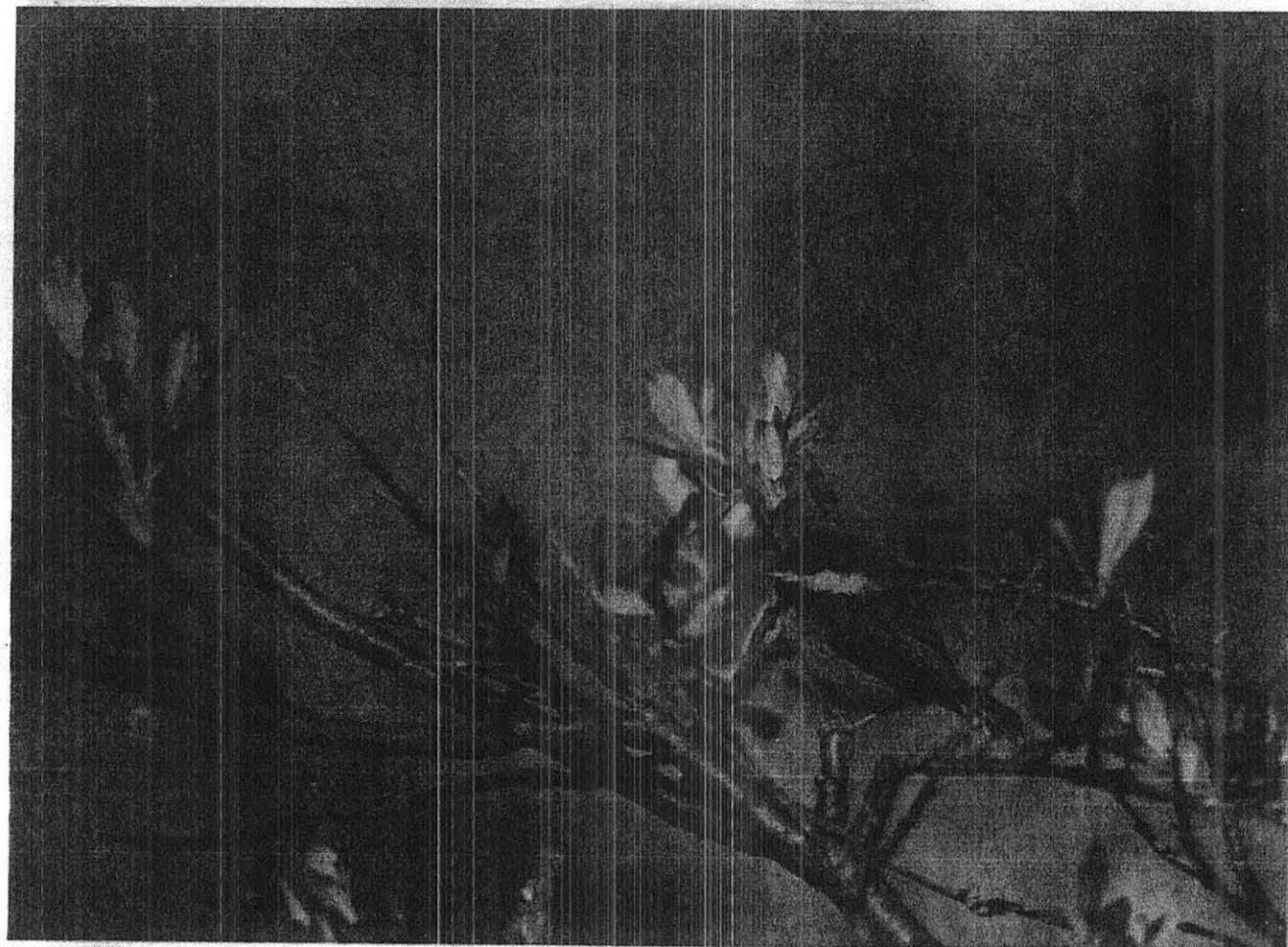
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May 1980

ABSTRACT

At Mancha Creek, an area within the forest-tundra ecotone, five major habitat types were identified and studied intensively for aspects of vegetation composition, plant species diversity, and status, distribution, and relative abundance of bird and mammal species. The five habitats studied were Wet Sedge Meadow, Low Shrub Thicket-Wet Sedge Meadow, Tall Willow-Poplar Thicket, White Spruce Woodland, and White Spruce Forest. Thirteen other less prevalent habitat types were identified.

A total of 192 plant species were observed on the study area. The greatest plant species diversity occurred in the White Spruce Woodland, while the lowest diversity occurred on the Low Shrub Thicket-Wet Sedge Meadow. A new species, or at least hybrid of two species, of Oxytropis was discovered (illustrated on page 36).

Eighty-seven bird species were documented on the study area. Over half of the bird species were breeders, whereas only seven were permanent residents. The avifauna was composed largely of taiga/boreal forest breeders, with a minority of specifically arctic or montane, or Alpine Tundra breeders. Bird populations in the forest and woodland habitats were similar to the levels characteristic of the same habitat types in the interior. The Tall Shrub Thicket habitat was depauperate compared to its taiga counterpart. Population levels in the tundra habitats were similar to those levels typical of the arctic tundra on the Wildlife Range. The extensive cliff habitats of the Mancha Creek area were occupied primarily by Golden Eagles, with lesser numbers of Gyrfalcons and Rough-legged Hawks. The Gray-headed Chickadee (cover photo) was documented as breeding on the study area, the first such record for Alaska.

Fifteen mammal species were recorded on the study area. Showsheo

hares were close to a population high, while most small mammal species were unusually low. The Tall Willow-Poplar Thicket supported the highest small mammal numbers, largely Red-backed Voles. The area also supported one of the farthest north recorded Beaver populations in Alaska. Moose commonly wintered in the Mancha Creek Valley, and Caribou were an abundant migrant and winter resident in 1979.

ACKNOWLEDGEMENTS

This project was supported financially by the William O. Douglas Arctic Wildlife Range. The authors are indebted to the contribution provided by the staff of the Wildlife Range: Biological Technician Phil Koehl censused two transects and helped with the raptor survey. Assistant Managers Don Ross, Mike Jacobson, and Administrative Officer Paul Liedberg helped with logistics. YACC clerk/typists Susan Weeden and Lori King typed the manuscript.

Dr. Bill Stringer of the University of Alaska Geophysical Institute kindly provided satellite imagery for the vegetation map.

We thank all these people for their help and patience which made the completion of this project possible.

PREFACE

The U.S. Fish and Wildlife Service initiated this study because of the relative lack of baseline data available for plant, bird, and mammal communities on the south slope of the William O. Douglas Arctic Wildlife Range. In 1979, after preliminary surveys by the senior author in 1978, a team of four biologists was organized to perform the study. The team included two Range employees, Mike Spindler, Wildlife Biologist, and Phil Koehl, Biological Technician, and two Range volunteers, Michele Mouton, Botanist, Ester, AK., and Stephen O. MacDonald, Curatorial Assistant - Vertebrate Collections, University of Alaska Museum, Fairbanks. In late 1979 and early 1980, Spindler, Mouton, and MacDonald analyzed data and prepared the bird, vegetation, and mammal sections of the report, respectively. The final report was then compiled and edited by the senior author.

Information in this report may be cited, provided the usual credits are given.

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INTRODUCTION

The Firth-Mancha Research Natural Area encompasses a 210,526 ha portion of biologically unique habitats within the William O. Douglas Arctic Wildlife Range. Most important of the natural features in the study area are that it was apparently an arctic montane refugium during Pleistocene glaciation, and that it includes the farthest north spruce forest growth in Alaska. The research natural area was designated in 1975 specifically to provide a sizeable undisturbed and discrete drainage unit for ecological studies which, because of research objectives, must occur in an area largely free of the influences of man. The Firth-Mancha area is located in one of the most remote corners of Alaska and is far enough (>120km) from any permanent human habitations so as to alleviate most man-caused impacts which could alter research results. The size, remoteness, and unique natural features make the Firth-Mancha Research Natural Area a major component of the statewide system of Ecological Reserves and potential research sites offered by the National Wildlife Refuge System.

This study was undertaken as an initial biological inventory of the major habitat types in the Firth-Mancha Research Natural Area. Specific objectives were to determine species composition and relative abundance of plants, birds, and mammals on the study area and to identify any critical habitat types present.

The major landscape units and interrelated factors of topography, vegetation types, and soil types of the study area were described in detail by Drew and Shanks (1965). Additionally, they generally described the physiography, climate, and geology of the area in relation to the forest-tundra ecotone of the region. Other prior biological studies in the area included aerial raptor surveys in 1972, 1973, and 1974 (Roseneau

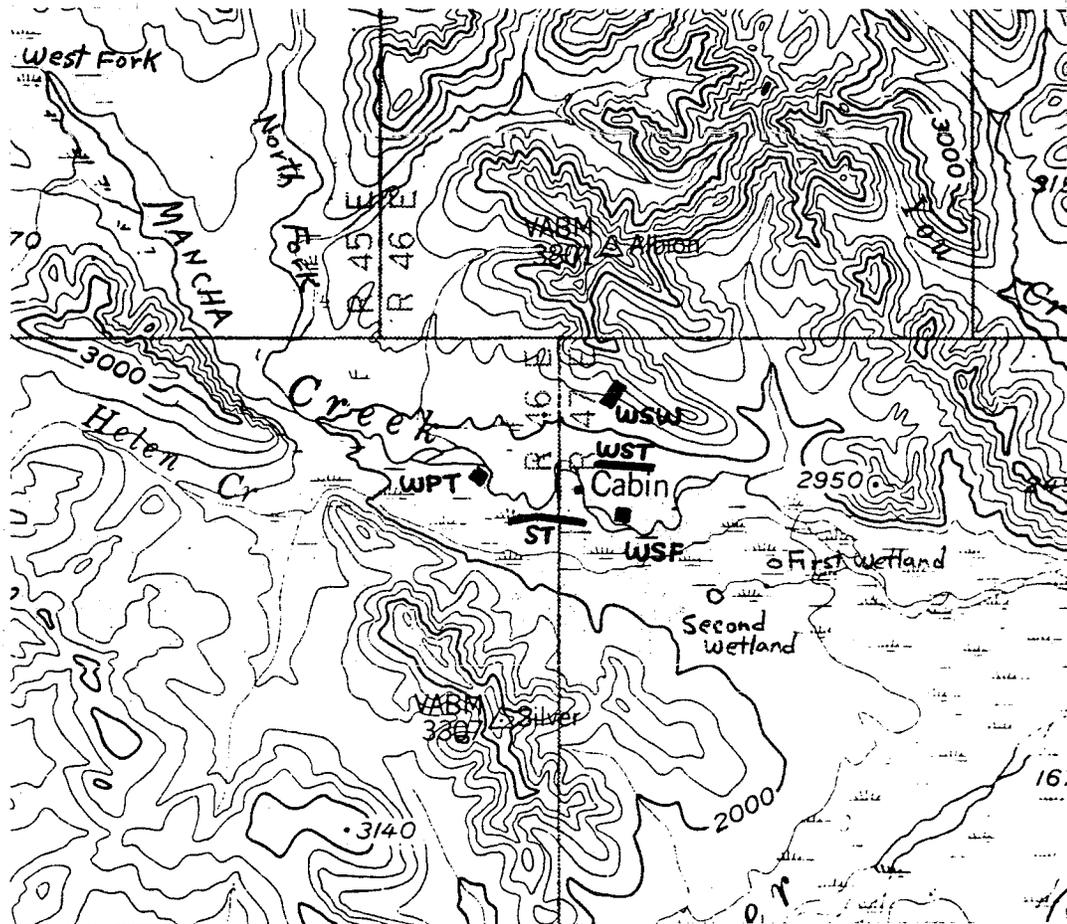


Figure 1. The Mancha Creek study area, and locations of base camp, intensive study plots, and other features. Symbols used for the plots are as follows: ST- Low Shrub Thicket-Wet Sedge Meadow, WST- Wet Sedge Meadow, WSW- White Spruce Woodland, WPT- Tall Willow-Poplar Thicket, WSF- White Spruce Forest. Scale: 1:125000, or about 1"=2 miles.

et al. 1974), aerial caribou surveys 1972-1976 (Roseneau et al. 1975, Warbelow et al. 1975, Roseneau and Curatolo 1976) and aerial moose surveys (Lenarz et al. 1974, and Benvenuti 1977). There have been no ground-based studies there since Drew, Shanks, Koranda, and Hulten visited the Firth and Mancha drainages in the late 1950's and early 1960's.

STUDY AREA AND GENERAL METHODS

The intensive study area included the valley bottom and hillside habitats of lower Mancha Creek drainage between 10 and 15 km upstream of the confluence with the Firth River (Figure 1). The predominant habitat types included White Spruce Forest and several types of shrub thicket growing in the Mancha Creek floodplain or on terraces immediately adjacent to it. White Spruce Woodland occurred on slopes, alluvial fans, and drier terraces. Sedge Meadows (most commonly Wet Sedge Meadow, Moist Sedge Meadow, and Low Shrub Thicket-Wet Sedge Meadow,) were found between the creek bed and adjacent hillsides. Other habitats above the valley bottom included Tussock Meadows, Alpine Tundra, Talus, Scree, and Rock Outcrops. Assignment of habitat type names generally follows Drew and Shanks (1965), and Kessel (1980). Names of habitat types are capitalized as proper nouns, e.g. White Spruce Woodland.

Field observations were made during the summer of 1979, but were supplemented by visits to the study area made on earlier and later dates. Members of the field party were present on the study area on the following dates: 1,2 December 1978; 6-8 April 1979; 18 May-7 July 1980; 9 August-5 September 1979; 6-12 November 1979; and 8-9 March 1980. The field crew consisted of the authors, and of Mr. Phil Koehl, Biological Technician and Mr. D.E. Ross, Assistant Manager, William O. Douglas Arctic Wildlife Range.

A tent camp was located near an abandoned cabin on Mancha Creek, about 11 km upstream from its confluence with the Firth River (Figure 1). Within 2 km of the base camp, three sample plots and two sample transects were selected in five different, but relatively homogeneous avian habitat types. The habitat types sampled were White Spruce Forest, 10 ha plot; White Spruce Woodland, 14.7 ha plot; Willow-Poplar Thicket, 10 ha plot; Low Shrub Thicket-Wet Sedge Meadow, 976 m x 122 m transect (11.9 ha); and Wet Sedge Meadow 610 m X 122 m transect (7.4 ha) (See Figures 1-6). A majority of the quantitative vegetation, bird, and mammal information was derived from systematic samples on these five plots and transects. Pertinent qualitative data from areas adjacent to the plots and transects, the surrounding mountains, and the entire length of Mancha Creek are included to supplement the quantitative data. Methods and results relating specifically to the vegetation, bird, and mammal portions of the study will be treated under those sections.

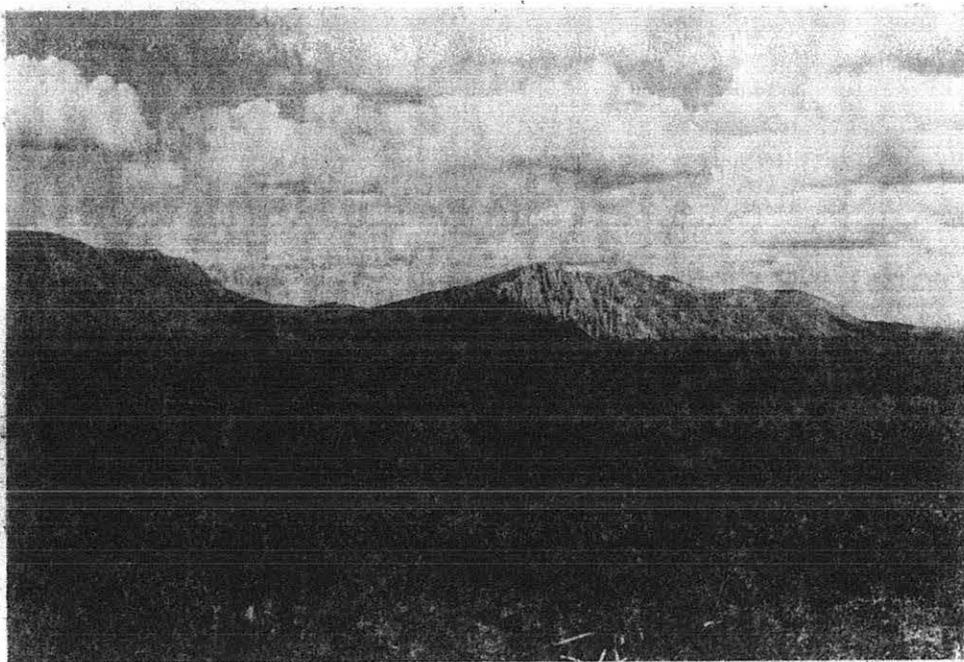


Figure 2. Low Shrub Thicket-Wet Sedge Meadow transect, June 1979.



Figure 3. Wet Sedge Meadow transect, June 1979.

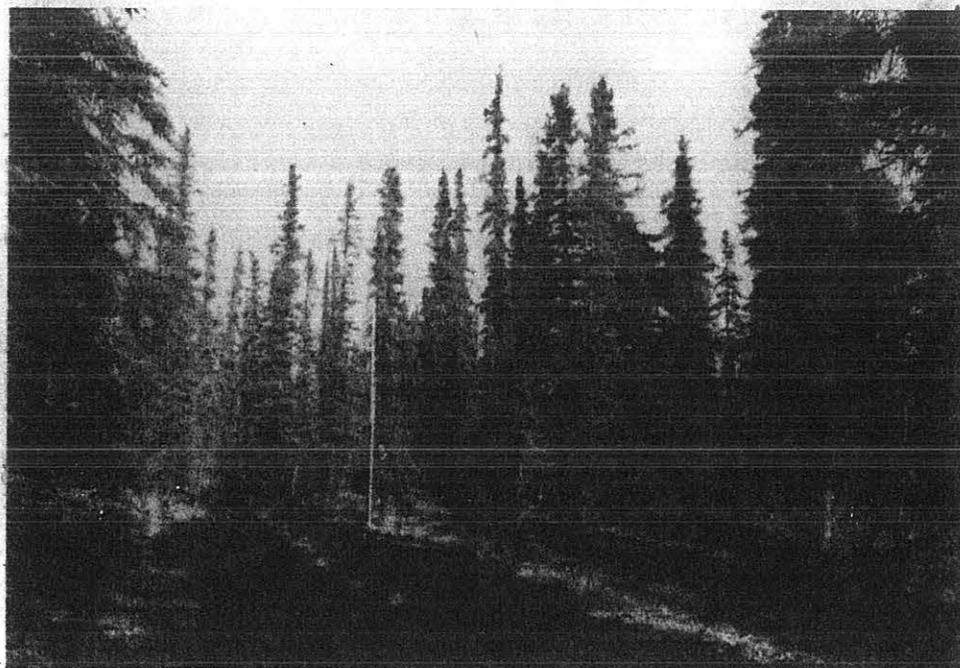


Figure 4a. White Spruce Forest plot, June 1979.



Figure 4b. Aerial view of the White Spruce Forest plot, May 1979.

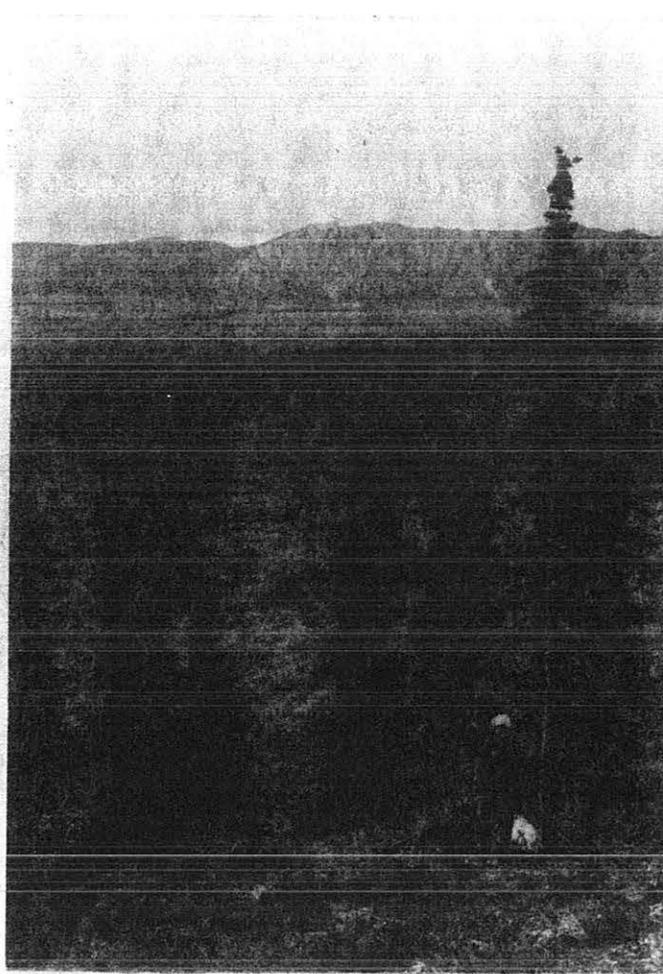


Figure 5a. White Spruce Woodland plot, June 1979.



Figure 5b. Aerial view of the White Spruce Woodland plot, May 1979.

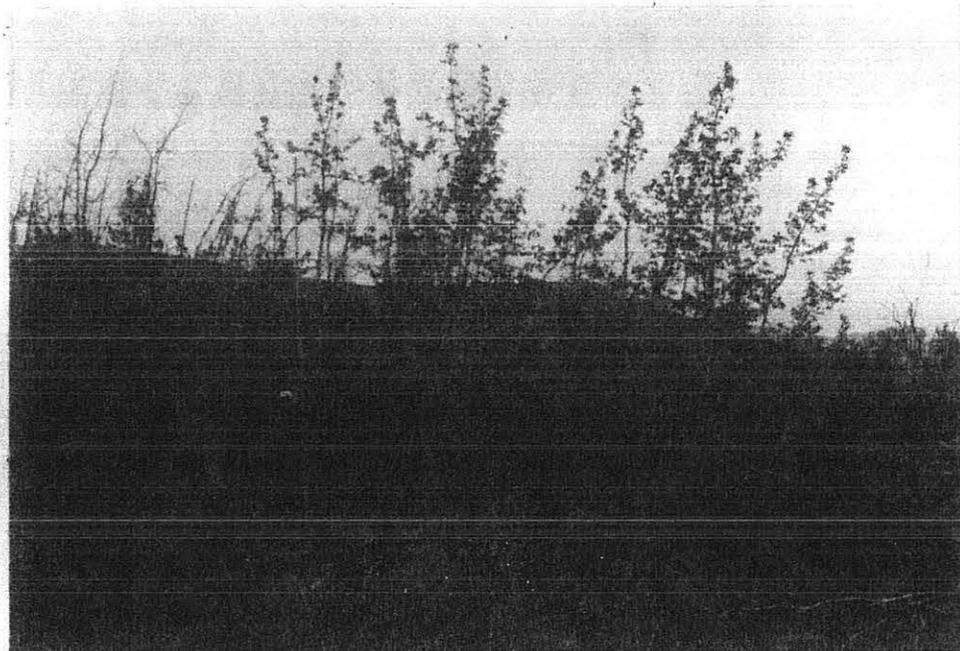


Figure 6a. Tall Willow-Poplar Thicket plot, June 1979

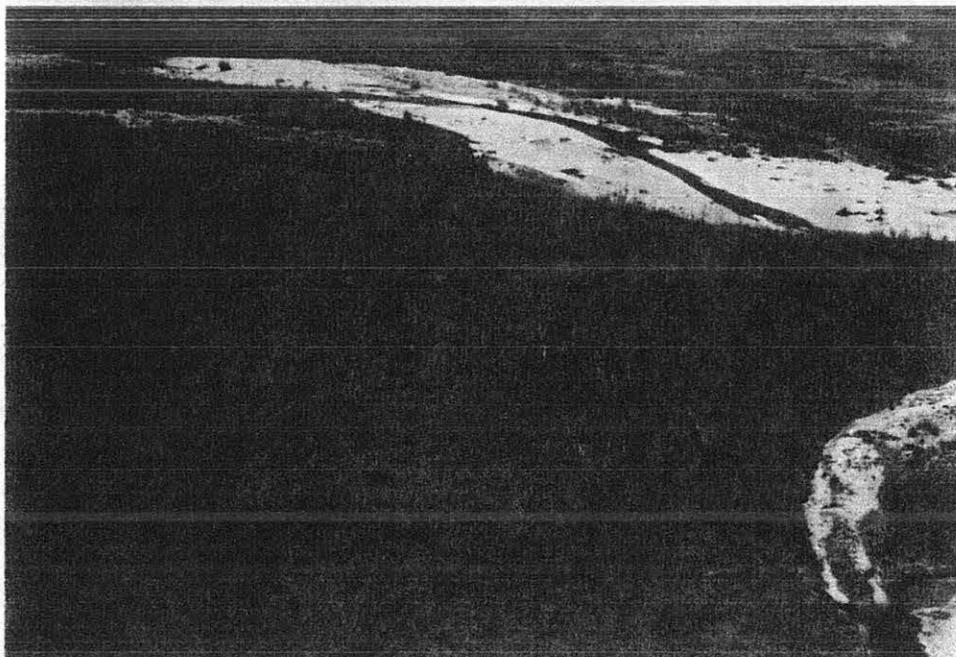


Figure 6b. Aerial view of the Tall Willow-Poplar Thicket plot, May 1979.

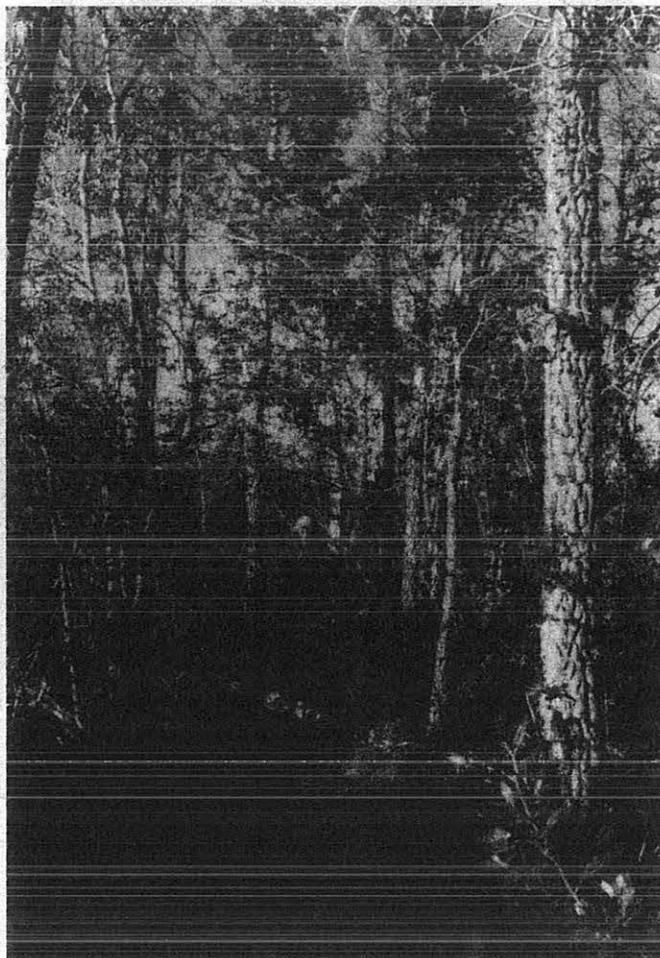


Figure 6c. Within a Poplar Forest clump about 50 m across, south side of the Tall Willow-Poplar Thicket plot, June 1979.

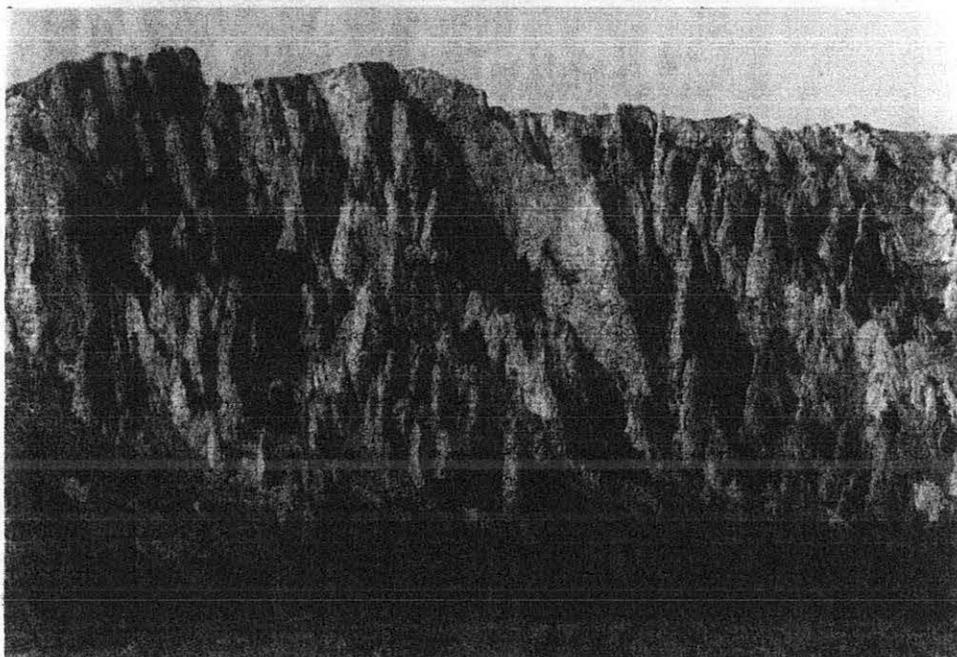


Figure 6d. Limestone spires, some of which rise to over 50 m high, comprise much of the available raptor nesting habitat in the Firth-Mancha Research Natural Area. Raptor Site # 1, 3 km east of the Tall Willow-Poplar Thicket plot, May 1979.

VEGETATION AND HABITAT STRUCTURE

by

Michele A. Mouton¹ and Michael A. Spindler²

Extensive botanical surveys have been conducted in several locales of the William O. Douglas Arctic Wildlife Range (Spetzman 1959, Kessel and Schaller 1960, Hettinger and Junz 1974, Batten and Batten 1975, Batten 1977, Magoun and Robus 1977 and Mouton in Spindler 1979). Additionally, Dr. David Murray and Mr. Alan Batten, University of Alaska Herbarium, have prepared a list of vascular flora which probably occur within the Range. One of the areas in which intensive botanical work is lacking is the Firth River-Mancha Creek basin within the forest-tundra ecotone.

Objectives of this portion of the project were to (1) compile a vascular plant checklist for the study area, (2) gather phenological data, (3) describe the vegetative communities within the study area (4) produce a habitat type map of the Mancha Creek drainage, and (5) describe the physical structure of the avian habitats censused.

METHODS

Vegetative sampling was performed on a systematic basis in the three wooded plots and two open transects. On each wooded plot, 24-26 sample points were located at 91 m intervals along a pre-marked bird census grid. The point-centered quarter method of Cottam and Curtis (1956) was employed to sample trees and tall shrubs, but including modifications for more detailed sampling of vegetation structure and plant species composition.

In using the point-centered quarter method, all measurements were

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based on selection of the nearest stem ≥ 2.5 cm in diameter at breast height (dbh). This stem sample was used to calculate tree and tall shrub frequency, density, dominance, importance value, stem height, stem diameter, basal area, and height distribution of foliage volume. Foliage volume was quantified with a 5.0 m tall stick, marked according to the three height intervals corresponding to layers characteristic of interior Alaska avian habitats -- 0-2.4 m (low and medium shrub), 2.5-4.9 m (tall shrub), and ≥ 5.0 m (tree). An imaginary cylinder 1 m in radius was circumscribed around the stick, and the percent of total volume occupied by foliage within each of the three height classes comprising the cylinder was visually estimated.

Percent cover and frequency of occurrence of dwarf shrub, grass, sedge, and forb species as well as other ground cover characteristics (moss, lichen, bare ground and litter) were determined by visual estimates within a 1 m radius circle around each sample point.

Vegetation and microhabitat data from the two open transects were collected from points located at 61 m intervals along the transect line. Ground cover data were collected in a manner identical for the plots described above. Shrub density, frequency, and height were determined by the point-centered quarter method (Cottam and Curtis 1956). Water depths were measured at each quarter with a ruler, and the micro-habitat type at each point was recorded.

Plant nomenclature follows Hultén (1968), with the exception of the genus Salix, which follows Argus (1973), and the genus Draba, which follows Mulligan (1976). Voucher specimens collected during the study have been deposited in the University of Alaska Herbarium at Fairbanks.

A vegetation type map was prepared using 1:125,000 scale LANDSAT imagery, and an enlarged U.S.G.S. topographic map (same scale) for a base. During the raptor survey to the headwaters of Mancha Creek (2-4

July) the field party stopped at vantage points and sketched in boundaries of habitat types according to a habitat classification updated from Drew and Shanks (1965) and Kessel (1980).

RESULTS

One hundred ninety-two species of vascular plants were observed on the study area (Table 1). Species in the plant checklist (Table 1) are listed phylogenetically by family and genus, and alphabetically within the genera. Some species may be missing from the checklist since observations were not made after 6 July. The taxa observed include 93 genera and 37 families. The greatest number of species for any one genus was 20 for Carex, followed in representation by 13 species of Salix, 9 of Pedicularis, 7 of Saxifraga, 6 of Oxytropis, and 5 each of Senecio, Stellaria, Equisetum, and Minuartia. The dates on which species were first observed flowering on the study area are presented in Table 2.

Ground cover data for the five avian habitats are presented in Tables 3A, 4, 5, 6, and 7. In dealing with plots 10 ha in size it is difficult if not impossible to find a totally homogeneous vegetative unit. Usually what is found on a plot of one homogeneous avian habitat type (e.g., spruce forest) is a mosaic consisting of several smaller microhabitat units (e.g., lichen-Dryas ground cover adjacent to a moister area of moss, sedge, and Salix) but still dominated by the spruce forest. Consequently on the five plots chosen for this study, factors such as permafrost, drainage, soil types, slope, elevation and microrelief greatly added to species diversity and the difficulty of applying any one plant community name.

Table 1. Plant species observed on the Mancha Creek study area, William O. Douglas Arctic Wildlife Range, Alaska, 1979. Location refers to avian habitat plots: SF - White Spruce Forest; SW - White Spruce Woodland; TW - Tall Willow - Poplar Thicket; LS - Low Shrub Thicket - Wet Sedge Meadow; W - Wet Sedge Meadow; O - Other areas in the Mancha Creek study area.

Species	Location						
	SF	SW	TW	LS	W	O	
<i>Lycopodium selago</i> ssp. <i>appressum</i>						X	
<i>Equisetum arvense</i>	X	X					
<i>E. palustre</i>				X	X		
<i>E. pratense</i>			X				
<i>E. scirpoides</i>	X	X	X				
<i>E. variegatum</i> ssp. <i>variegatum</i>	X		X	X	X		
<i>Cystopteris fragilis</i>						X	
<i>Picea glauca</i>	X	X	X				
* <i>Juniperus communis</i> ssp. <i>nana</i>		X					
* <i>Triglochin maritimum</i>					X		
* <i>Heirochloe pauciflora</i>						X	
<i>Arctagrostis latifolia</i>	X			X			
<i>Calamagrostis inexpansa</i>						X	
<i>Calamagrostis purpurascens</i> ssp. <i>purpurascens</i>		X				X	
<i>Trisetum spicatum</i> ssp. <i>spicatum</i>						X	
<i>Poa alpina</i>		X				X	
<i>Poa glauca</i>						X	
<i>Arctophila fulva</i>						X	
<i>Festuca altaica</i>	X	X	X		X	X	
<i>Festuca arundinacea</i>			X			X	
<i>Festuca rubra</i>						X	
<i>Elymus innovatus</i>			X			X	
<i>Eriophorum angustifolium</i>		X		X	X		
<i>Eriophorum vaginatum</i>	X	X					
<i>Trichophorum caespitosum</i>					X		
<i>Carex aquatilis</i>	X			X	X		
<i>Carex atrofusca</i>				X		X	
<i>Carex bigelowii</i>		X			X	X	
<i>Carex capillaris</i>	X	X			X	X	
<i>Carex capitata</i>					X		
* <i>Carex concinna</i>		X	X				
* <i>Carex franklinii</i>	X	X					
<i>Carex gracialis</i>			X				
* <i>Carex heleonastes</i>					X	X	
<i>Carex krausei</i>						X	
<i>Carex lugens</i>		X					
<i>Carex membranacea</i>	X	X			X		
<i>Carex microglochin</i>					X		
<i>Carex misandra</i>						X	
<i>Carex nardina</i>						X	
<i>Carex rariflora</i>			X		X		
<i>Carex rotundata</i>				X	X		
<i>Carex saxatilis</i> ssp. <i>laxa</i>						X	
<i>Carex scirpoidea</i>	X	X				X	
<i>Carex vaginata</i>	X	X	X				
<i>Juncus castaneus</i> ssp. <i>castaneus</i>			X			X	
<i>Juncus triglumis</i> ssp. <i>albescens</i>	X						
<i>Juncus triglumis</i> ssp. <i>triglumis</i>		X			X		
<i>Tofieldia coccinea</i>						X	
<i>Tofieldia pusilla</i>	X	X	X	X	X	X	
<i>Zygadenus elegans</i>	X	X	X				
<i>Lloydia serotina</i>						X	
* <i>Platanthera obtusata</i>			X	X			
<i>Corallorrhiza trifida</i>		X				X	
<i>Populus balsamifera</i> ssp. <i>balsamifera</i>	X	X	X				
<i>Salix alaxensis</i>	X	X	X				
<i>Salix arbusculoides</i>	X		X	X			
<i>Salix arctica</i>		X		X	X		
<i>Salix brachycarpa</i> ssp. <i>niphoclada</i>	X	X	X				
* <i>Salix candida</i>					X		
<i>Salix fuscescens</i>						X	
<i>Salix glauca</i>	X	X	X	X	X	X	
<i>Salix hastata</i>	X	X	X	X	X	X	
<i>Salix lanata</i> ssp. <i>richardsonii</i>	X	X		X	X	X	

Species	Location					
	SF	SW	TW	LS	W	O
* <i>Salix novae-angliae</i>	X		X			
<i>Salix planifolia</i> ssp. <i>pulchra</i>						X
<i>Salix reticulata</i> ssp. <i>reticulata</i>	X	X	X	X		
<i>Salix rotundifolia</i>						X
<i>Betula nana</i> ssp. <i>exilis</i>	X	X	X	X	X	
<i>Betula glandulosa</i>	X	X		X	X	
<i>Alnus crispa</i> ssp. <i>crispa</i>				X		
<i>Rumex arcticus</i>		X				
<i>Oxyria digyna</i>						X
<i>Polygonum bistorta</i> ssp. <i>plumosum</i>	X	X	X	X	X	
<i>Polygonum viviparum</i>	X					
<i>Stellaria crassifolia</i>	X		X			
<i>Stellaria edwardsii</i>		X				X
<i>Stellaria laeta</i>	X					X
<i>Stellaria monantha</i>	X		X			
* <i>Stellaria ruscifolia</i> ssp. <i>ruscifolia</i>						X
<i>Minuartia arctica</i>		X			X	
* <i>Minuartia dawsonensis</i>		X				
<i>Minuartia rossii</i>						X
<i>Minuartia rubella</i>						X
* <i>Minuartia stricta</i>					X	
<i>Silene acaulis</i> ssp. <i>acaulis</i>		X				
<i>Delphinium brachycentrum</i>						X
<i>Aconitum delphinifolium</i> ssp. <i>delphinifolium</i>						X
<i>Anemone drummondii</i>						X
<i>Anemone parviflora</i>	X	X	X			X
<i>Anemone richardsonii</i>			X			X
<i>Ranunculus hyperboreus</i> ssp. <i>hyperboreus</i>						X
<i>Thalictrum alpinum</i>	X	X	X	X	X	X
<i>Papaver macounii</i>		X				
<i>Cardamine hyperborea</i>	X	X	X			
<i>Lesquerella arctica</i>						X
<i>Draba nivalis</i>						X
<i>Erysimum pallasii</i>						X
<i>Braya humilis</i> ssp. <i>arctica</i>						X
* <i>Parrya nudicaulis</i> ssp. <i>interior</i>	X	X				
<i>Parrya nudicaulis</i> ssp. <i>septentrionalis</i>	X	X	X			X
<i>Boykinia richardsonii</i>						X
<i>Saxifraga caespitosa</i>						X
<i>Saxifraga hieracifolia</i>		X			X	
<i>Saxifraga hirculus</i>		X			X	
<i>Saxifraga oppositifolia</i>						X
<i>Saxifraga punctata</i> ssp. <i>nelsoniana</i>						X
<i>Saxifraga reflexa</i>						X
<i>Saxifraga tricuspidata</i>						X
<i>Chrysosplenium tetrandrum</i>						X
<i>Parnassia kotzebuei</i>		X	X	X		
<i>Parnassia palustris</i> ssp. <i>neogaea</i>		X				
<i>Rubus chamaemorus</i>						X
<i>Potentilla biflora</i>						X
<i>Potentilla fruticosa</i>	X	X		X		
<i>Potentilla nivea</i> x <i>hookeriana</i>						X
<i>Potentilla palustris</i>						X
<i>Dryas drummondii</i>			X			X
<i>Dryas integrifolia</i>	X	X	X	X	X	X
* <i>Dryas octopetala</i> ssp. <i>alaskensis</i>						X
<i>Lupinus arcticus</i>						X
<i>Astragalus aboriginum</i>			X			X
<i>Astragalus alpinus</i> ssp. <i>alpinus</i>						X
<i>Astragalus eucosmus</i>				X		X
<i>Astragalus umbellatus</i>	X	X				X
<i>Oxytropis arctica</i>	X		X			X
<i>Oxytropis campestris</i> ssp. <i>gracilis</i>			X			
<i>Oxytropis campestris</i> ssp. <i>jordalii</i>	X	X	X		X	X
* <i>Oxytropis deflexa</i> ssp. <i>sericea</i>			X			
<i>Oxytropis maydelliana</i>	X	X				X
<i>Oxytropis nigrescens</i> ssp. <i>bryophila</i>						X
* <i>Oxytropis</i> sp. <i>novitae</i> ?						X
<i>Hedysarum alpinum</i> ssp. <i>americanum</i>	X	X	X	X		X

Species	Location					
	SF	SW	TW	LS	W	O
<i>Hedysarum mackenzii</i>		X	X			X
<i>Shepherdia canadensis</i>	X	X	X			
* <i>Epilobium angustifolium</i> ssp. <i>angustifolium</i>		X			X	
<i>Epilobium davuricum</i>						X
<i>Epilobium latifolium</i>			X			X
<i>Hippuris vulgaris</i>						X
<i>Bupleurum triradiatum</i> ssp. <i>arcticum</i>						X
<i>Pyrola grandiflora</i>	X		X			
<i>Pyrola secunda</i>	X	X				
<i>Empetrum nigrum</i> ssp. <i>hermaphroditum</i>	X	X				
<i>Ledum palustre</i> ssp. <i>decumbens</i>	X	X				X
<i>Rhododendron lapponicum</i>		X		X		
<i>Loiseleuria procumbens</i>		X				X
<i>Cassiope tetragona</i> ssp. <i>tetragona</i>		X				
<i>Andromeda polifolia</i>	X	X		X	X	
<i>Arctostaphylos rubra</i>	X	X	X	X	X	X
<i>Arctostaphylos uva-ursi</i>		X	X			
<i>Vaccinium uliginosum</i>	X	X	X	X		
<i>Vaccinium vitis-idaea</i> ssp. <i>minus</i>	X	X				
<i>Douglasia ochtensis</i>						X
<i>Androsace chamaejasme</i> ssp. <i>lehmanniana</i>	X	X	X			
<i>Dodecatheon frigidum</i>			X			
<i>Gentiana prostrata</i>			X			
* <i>Menyanthes trifoliata</i>					X	X
<i>Phlox sibirica</i> ssp. <i>sibirica</i>		X				
<i>Polemonium acutiflorum</i>		X				
<i>Eritrichium arcticoides</i>		X				X
<i>Myosotis alpestris</i> ssp. <i>asiatica</i>		X			X	
<i>Lagotis glauca</i> ssp. <i>minor</i>		X				
<i>Castilleja caudata</i>			X			X
<i>Castilleja elegans</i>					X	
<i>Castilleja hyperborea</i>		X				
<i>Pedicularis capitata</i>	X	X	X			X
<i>Pedicularis kanei</i> ssp. <i>kanei</i>	X	X	X			
<i>Pedicularis labradorica</i>		X			X	
<i>Pedicularis lapponica</i>						X
<i>Pedicularis langsdorffii</i> ssp. <i>arctica</i>	X	X	X			
<i>Pedicularis oederi</i>		X				
<i>Pedicularis sudetica</i> ssp. <i>albolabiata</i>		X		X	X	
<i>Pedicularis sudetica</i> ssp. <i>interior</i>						X
<i>Pedicularis verticillata</i>	X		X	X		
<i>Pinguicula vulgaris</i> ssp. <i>vulgaris</i>		X			X	X
<i>Valeriana capitata</i>		X			X	X
<i>Solidaga multiradiata</i> var. <i>multiradiata</i>		X		X		X
<i>Aster sibiricus</i>				X		X
* <i>Erigeron caespitosus</i>						X
<i>Antennaria friesiana</i>						X
<i>Artemisia borealis</i>						X
<i>Petasites frigidus</i>						X
<i>Petasites hyperboreus</i>		X				
<i>Arnica alpina</i>	X		X			
<i>Arnica frigida</i>	X					
<i>Senecio atropurpurea</i> ssp. <i>frigida</i>	X	X			X	
<i>Senecio congestus</i>						X
<i>Senecio conterminus</i>						X
<i>Senecio lugens</i>	X	X	X	X	X	X
<i>Senecio resedifolius</i>		X				X
<i>Saussurea angustifolia</i>	X	X				X
<i>Taraxacum</i> sp.						X
<i>Crepis nana</i> var. <i>nana</i>						X

Total number of species = 192

63 87 57 34 44

*Asterisks indicate range extensions based on Hultén (1968).

Table 2. First observed flowering dates of plant species, Mancha Creek study area, Arctic National Wildlife Range, Alaska, May 18-July 6, 1979.

18 May	<i>Eriophorum vaginatum</i>
21 May	<i>Anemone parviflora</i> <i>Saxifraga oppositifolia</i>
22 May	<i>Arctostaphylos rubra</i> <i>Carex ocirpoides</i>
24 May	<i>Equisetum arvense</i> <i>Ranunculus nivalis</i>
26 May	<i>Pedicularis kanei</i> ssp. <i>kanei</i>
27 May	<i>Arctostaphylos uva-ursi</i> <i>Parrya nudicaulis</i> ssp. <i>septentrionalis</i> <i>Petasites hyperboreus</i> <i>Shepherdia canadensis</i>
2 June	<i>Loiseleuria procumbens</i> <i>Oxytropis nigrescens</i> ssp. <i>bryophila</i> <i>Rhododendron lapponicum</i>
3 June	<i>Lagotis glauca</i> ssp. <i>minor</i>
4 June	<i>Androsace chamaejasme</i> ssp. <i>lehmanniana</i> <i>Dryas integrifolia</i> <i>Lesquerella arctica</i>
6 June	<i>Carex concinna</i> <i>Oxytropis arctica</i> <i>Pedicularis langsдорffii</i> ssp. <i>arctica</i> <i>Salix alaxensis</i> <i>Salix arbusculoides</i> <i>Salix lanata</i> ssp. <i>richardsonii</i>
7 June	<i>Populus balsamifera</i> ssp. <i>balsamifera</i>
8 June	<i>Andromeda polifolia</i> <i>Astragalus aboriginum</i> <i>Betula glandulosa</i> <i>Cardamine hyperborea</i> <i>Cassiope tetragona</i> ssp. <i>tetragona</i> <i>Phlox sibirica</i> <i>Salix novae-angliae</i> <i>Salix reticulata</i> ssp. <i>reticulata</i> <i>Silene acaulis</i> ssp. <i>acaulis</i>
9 June	<i>Vaccinium uliginosum</i>

- 10 June
- Anemone drummondii*
 - Anemone richardsonii*
 - Artemisia borealis*
 - Aster sibiricus*
 - Braya humilis*
 - Carex glacialis*
 - Crepis nana*
 - Draba nivalis*
 - Minuartia rubella*
 - Oxytropis campestris* ssp. *gracilis*
 - Salix fuscescens*
 - Saxifraga tricuspida*
 - Senecio resedifolius*
 - Rubus chamaemorus*
 - Thalictrum alpinum*
- 11 June
- Carex membranacea**
- 12 June
- Dryas drummondii*
 - Eritrichium aretiodes*
 - Saxifraga hieracifolia*
- 13 June
- Carex atrofusca*
- 14 June
- Carex aquatilis*
 - Carex capillaris*
 - Corallorrhiza trifida*
 - Douglasia arctica*
 - Erysimum pallasii*
 - Hedysarum alpinum* ssp. *americanum*
 - Minuartia arctica*
 - Myosotis alpestris* ssp. *asiatica*
 - Oxytropis campestris* ssp. *jordalii*
 - Oxytropis maydelliana*
 - Pedicularis capitata*
 - Pedicularis sudetica* ssp. *albolabiata*
 - Picea glauca*
 - Tofieldia pusilla*
 - Triglochin maritimum*
- 15 June
- Hedysarum mackensii*
- 16 June
- Juncus triglumis* ssp. *albescens*
- 17 June
- Arnica alpina* ssp. *angustifolia*
 - Arnica frigida*
- 18 June
- Astragalus umbellatus*
 - Juncus castaneus*
 - Pedicularis verticillata*
 - Pyrola grandiflora*
 - Stellaria monantha*
 - Zygadenus elegans*
 - Castilleja caudata*
- 19 June
- Potentilla fruticosa*
 - Solidago multiradiata* var. *multiradiata*

- 20 June *Bupleurum triradiatum* ssp. *arcticum*
Pedicularis oederi
Valeriana capitata
- 21 June *Juncus triglumis* ssp. *albescens*
Ledum palustre ssp. *decumbens*
Minuartia dawsonensis
Pedicularis labradorica
Picea glauca
Polemonium acutiflorum
Polygonum viviparum
Rumex arcticus
Saxifraga hirculus
Senecio atropurpureus ssp. *frigidus*
Senecio lugens
Stellaria edwardsii
- 22 June *Astragalus eucosmus* ssp. *sealei*
Parnassia kotzebuei
- 23 June *Astragalus alpinus**
Boykinia richardsonii
Epilobium latifolium
*Menyanthes trifoliata**
Pedicularis lapponica
Platanthera obtusata
Poa glauca
Potentilla biflora
- 25 June *Chrysosplenium tetrandrum*
Pinguicula vulgaris ssp. *vulgaris*
Potentilla palustris
Ranunculus hyperboreus ssp. *hyperboreus*
Saxifraga punctata ssp. *nelsoniana*
Senecio congestus
Trisetum spicatum ssp. *spicatum*
- 28 June *Castilleja hyperborea*
- 29 June *Gentiana prostrata*
*Oxytropis deflexa**
- 4 July *Saussaurea angustifolia*
- 5 July *Aconitum delphinifolium* ssp. *delphinifolium*
Dodecatheon frigidum
- 6 July *Festuca arundinacea*
*Lupinus arcticus**

* Also fruiting when first observed flowering.

Table 3A. Percent cover and frequency of occurrence of ground cover that occurred on the Low Shrub Thicket-Wet Sedge Meadow plot. Based on 15 quadrat samples, June 1979, Mancha Creek, Alaska.

Ground Cover	Percent Cover	Percent Frequency
Litter	17.7	100
Sedge	15.0	93.3
Moss	13.0	100
<i>Salix lanata</i> ssp. <i>richardsonii</i>	12.3	100
<i>Equisetum</i> sp.	9.3	100
<i>Salix reticulata</i>	5.0	66.7
<i>Betula glandulosa</i>	4.7	66.7
<i>Vaccinium uliginosum</i>	4.7	53.3
<i>Salix hastata</i>	3.3	46.7
<i>Dryas integrifolia</i>	3.0	53.3
<i>Arctostaphylos rubra</i>	2.7	53.3
Water	2.0	20.0
<i>Hedysarum alpinum</i>	2.0	40.0
<i>Potentilla fruticosa</i>	2.0	40.0
<i>Andromeda polifolia</i>	1.0	33.3
<i>Pedicularis sudetica</i>	1.0	26.7
<i>Salix arctica</i>	0.3	26.7
<i>Salix arbusculoides</i>	0.3	6.7
<i>Polygonum</i> sp.	T	33.3
<i>Parnassia kotzebuei</i>	T	20.0
<i>Rhododendron lapponicum</i>	T	6.7
<i>Pedicularis verticillata</i>	T	6.7
<i>Stellaria</i> sp.	T	6.7
<i>Tofieldia pusilla</i>	T	6.7

Table 3B. Percent ground cover for the two vegetative units of the Low Shrub Thicket-Wet Sedge Meadow.

<u>Wet Sedge Meadow</u>		<u>Low Shrub Thicket</u>	
Ground Cover	Percent	Ground Cover	Percent
Sedge	20.6	<i>Salix lanata</i>	16.4
Litter	18.8	Litter	16.4
Moss	14.4	Moss	11.4
<i>Salix lanata</i>	10.0	<i>Equisetum palustre</i>	10.7
<i>Vaccinium uliginosum</i>	6.9	<i>Salix reticulata</i>	8.6
<i>Equisetum variegatum</i>	6.3	Sedge	8.6
<i>Betula glandulosa</i>	6.3	<i>Salix hastata</i>	7.1
<i>Potentilla fruticosa</i>	4.4	<i>Dryas integrifolia</i>	6.4
Water	3.8	<i>Hedysarum alpinum</i>	4.3
<i>Arctostaphylos rubra</i>	1.9	<i>Arctostaphylos rubra</i>	3.6
<i>Salix reticulata</i>	1.9	<i>Andromeda polifolia</i>	2.1
<i>Pedicularis sudetica</i>	1.9	<i>Betula glandulosa</i>	2.1
<i>Salix arctica</i>	0.6	<i>Vaccinium uliginosum</i>	2.1
<i>Parnassia kotzebuei</i>	T	<i>Potentilla fruticosa</i>	0.7
<i>Dryas integrifolia</i>	T	<i>Salix arbusculoides</i>	0.7
<i>Rhododendron lapponicum</i>	T	<i>Polygonum</i> sp.	T
<i>Salix hastata</i>	T	<i>Salix arctica</i>	T
<i>Stellaria</i> sp.	T	<i>Pedicularis sudetica</i>	T
		<i>Pedicularis verticillata</i>	T
		<i>Tofieldia pusilla</i>	T

Table 4. Percent cover and frequency of occurrence of ground cover that occurred on the Wet Sedge Meadow plot. Based on 11 quadrat samples, June 1979, Mancha Creek, Alaska.

Ground Cover	Percent Cover	Percent Frequency
Sedge	18.6	100
Moss	13.2	100
Litter	10.5	63.6
Bare ground	10.0	72.7
<i>Betula</i> sp.	6.8	90.9
Water	6.4	54.6
<i>Andromeda polifolia</i>	5.9	100
<i>Arctostaphylos rubra</i>	5.9	72.7
<i>Tolieldia pusilla</i>	4.1	100
<i>Pedicularis sudetica</i>	4.1	90.9
<i>Triglochin maritimum</i>	4.1	72.8
<i>Salix arctica</i>	3.2	63.6
<i>Equisetum variegatum</i>	1.8	81.9
<i>Salix candida</i>	1.8	63.6
<i>Pinguicula vulgaris</i>	1.4	81.9
<i>Festuca altaica</i>	0.9	36.4
<i>Salix fuscescens</i>	0.9	27.3
<i>Dryas integrifolia</i>	0.5	18.2
<i>Senecio atropurpurea</i>	0.5	18.2
<i>Salix glauca</i>	0.5	9.1
Algae	0.5	9.1
Lichen	T	54.6
<i>Thalictrum alpinum</i>	T	45.0
<i>Polygonum</i> sp.	T	27.3
<i>Saxifraga hirculus</i>	T	27.3
<i>Valeriana capitata</i>	T	9.1
<i>Pedicularis labradorica</i>	T	9.1
<i>Menyanthes trifoliata</i>	T	9.1
<i>Minartia stricta</i>	T	9.1
<i>Minartia arctica</i>	T	9.1
<i>Epilobium angustifolium</i>	T	9.1
<i>Salix lanata</i> ssp. <i>richardsonii</i>	T	9.1

Table 5. Percent cover and frequency of occurrence of ground cover that occurred on the White Spruce Forest Plot. Based on 24 quadrat samples, June 1979, Mancha Creek, Alaska.

Ground Cover	Percent Cover	Percent Frequency
Moss	21.5	100
Litter	15.4	100
<i>Arctostaphylos rubra</i>	9.4	100
Lichen	9.2	91.7
<i>Dryas integrifolia</i>	8.3	91.7
<i>Carex</i> sp.	4.8	33.3
Grass	4.2	83.3
<i>Hedysarum alpinum</i> ssp. <i>americanum</i>	2.3	66.7
<i>Shepherdia canadensis</i>	2.3	33.3
<i>Equisetum</i> sp.	2.1	50.0
<i>Pyrola grandiflora</i>	2.1	50.0
<i>Vaccinium uliginosum</i>	2.1	45.8
<i>Salix glauca</i>	1.9	16.7
<i>Betula glandulosa</i>	1.7	16.7
<i>Picea glauca</i>	1.3	29.2
<i>Salix alaxensis</i>	1.0	20.8
<i>Vaccinium vitis-idaea</i>	1.0	20.8
<i>Empetrum nigrum</i> ssp. <i>hermaphroditum</i>	0.8	20.8
<i>Pedicularis capitata</i>	0.8	20.8
<i>Salix reticulata</i>	0.8	20.8
<i>Salix brachycarpa</i>	0.8	16.7
<i>Salix lanata</i> ssp. <i>richardsonii</i>	0.6	12.5
<i>Salix hastata</i>	0.6	8.3
<i>Salix novae-angliae</i>	0.6	8.3
<i>Polygonum</i> sp.	0.4	41.7
<i>Astragalus umbellatus</i>	0.4	16.7
<i>Potentilla fruticosa</i>	0.4	12.5
<i>Pedicularis kanei</i> ssp. <i>kanei</i>	0.4	12.5
<i>Oxytropis campestris</i>	0.4	8.3
<i>Equisetum arvense</i>	0.4	8.3
<i>Equisetum variegatum</i>	0.4	8.3
<i>Anemone parviflora</i>	0.2	50.0
<i>Zygadenus elegans</i>	0.2	12.5
<i>Populus balsamifera</i>	0.2	8.3
<i>Senecio atropurpurea</i>	0.2	8.3
Water	0.2	4.2
<i>Betula nana</i>	0.2	4.2
<i>Senecio lugens</i>	T	12.5
<i>Andromeda polifolia</i>	T	8.3
<i>Pyrola secunda</i>	T	8.3
<i>Tofieldia pusilla</i>	T	8.3
<i>Pedicularis verticillata</i>	T	8.3
<i>Cardamine hyperborea</i>	T	4.2
<i>Thalictrum alpinum</i>	T	4.2
<i>Ledum palustre</i> ssp. <i>decumbens</i>	T	4.2
<i>Parrya nudicaulis</i>	T	4.2
<i>Pedicularis langsдорffii</i>	T	4.2

Table 6. Percent cover and frequency of occurrence of ground cover that occurred on the White Spruce Woodland Plot. Based on 26 quadrat samples, June 1979, Mancha Creek, Alaska.

Ground Cover	Percent Cover	Percent Frequency
Litter	15.2	100
<i>Dryas integrifolia</i>	9.0	85.6
Moss	8.9	85.6
Lichen	6.2	88.5
<i>Arctostaphylos rubra</i>	6.2	80.8
<i>Salix reticulata</i>	5.4	50
<i>Rhododendron lapponicum</i>	5.0	46.2
<i>Equisetum arvense</i>	5.0	42.3
<i>Cassiope tetragona</i> ssp. <i>tetragona</i>	3.7	38.5
<i>Picea glauca</i>	3.7	26.9
<i>Carex</i> sp.	3.1	96.2
<i>Equisetum scirpoides</i>	2.7	61.5
<i>Arctostaphylos uva-ursi</i>	2.7	19.2
Grass	2.3	65.4
<i>Salix lanata</i> ssp. <i>richardsonii</i>	2.1	19.2
<i>Vaccinium uliginosum</i>	1.9	23.1
<i>Salix glauca</i>	1.7	11.5
<i>Andromeda polifolia</i>	1.5	30.8
<i>Hedysarum alpinum</i>	1.0	38.5
<i>Eriophorum</i> sp.	1.0	23.1
<i>Potentilla fruticosa</i>	1.0	23.1
<i>Salix arctica</i>	1.0	15.4
<i>Betula glandulosa</i>	0.8	11.5
<i>Salix hastata</i>	0.8	2.7
<i>Oxytropis campestris</i>	0.6	26.9
<i>Silene acaulis</i>	0.6	23.1
Water	0.6	7.7
<i>Betula nana</i>	0.6	3.9
<i>Tofieldia pusilla</i>	0.4	57.7
<i>Phlox sibirica</i>	0.4	30.8
<i>Senecio atropurpureus</i>	0.4	26.9
<i>Thalictrum alpinum</i>	0.4	19.2
<i>Petasites hyperboreus</i>	0.4	15.4
<i>Papaver macounii</i>	0.4	11.5
<i>Pedicularis labradorica</i>	0.4	7.7
<i>Hedysarum mackensii</i>	0.4	7.7
<i>Salix brachycarpa</i>	0.4	3.9
<i>Empetrum nigrum</i> ssp. <i>hermaphroditum</i>	0.4	3.9
<i>Zygadenus elegans</i>	0.2	19.2
<i>Polygonum</i> sp.	0.2	19.2
<i>Shepherdia canadensis</i>	0.2	15.4
<i>Minuartia arctica</i>	0.2	15.4
<i>Androsace chamaejasme</i> ssp. <i>lehmanniana</i>	0.2	15.4
<i>Vaccinium vitis-idaea</i>	0.2	11.5
<i>Pedicularis sudetica</i>	0.2	11.5
<i>Parrya nudicaulis</i>	0.2	7.7

Table 7. Percent cover and frequency of occurrence of ground cover that occurred on the Tall Willow-Poplar Thicket Plot. Based on 25 quadrat samples, June 1979, Mancha Creek, Alaska. 23

Ground Cover	Percent Cover	Percent Frequency
Litter	16.6	92
<i>Arctostaphylos rubra</i>	14.2	92
Moss	10.0	88
Grass	8.6	100
<i>Carex</i> sp.	5.8	88
Mud	5.6	28
<i>Shepherdia canadensis</i>	5.0	62
<i>Dryas integrifolia</i>	5.0	48
<i>Salix brachycarpa</i> ssp. <i>niphoclada</i>	4.4	48
<i>Hedysarum alpinum</i>	3.4	84
<i>Salix hastata</i>	2.8	24
<i>Salix novae-angliae</i>	1.8	24
<i>Pyrola grandiflora</i>	1.6	84
<i>Anemone parviflora</i>	1.4	84
<i>Hedysarum mackenzii</i>	1.4	2
<i>Populus balsamifera</i>	1.2	24
<i>Salix alaxensis</i>	1.2	24
<i>Oxytropis campestris</i>	1.2	20
<i>Astragalus umbellatus</i>	0.8	30
<i>Pedicularis capitata</i>	0.8	20
<i>Arnica</i> sp.	0.8	16
<i>Salix arbusculoides</i>	0.8	12
<i>Oxytropis arctica</i>	0.8	12
<i>Zygadenus elegans</i>	0.6	28
Lichen	0.6	28
<i>Betula nana</i>	0.6	8
<i>Salix glauca</i>	0.6	4
<i>Aster sibiricus</i>	0.4	20
<i>Equisetum pratense</i>	0.4	16
<i>Equisetum scirpoides</i>	0.4	16
<i>Thalictrum alpinum</i>	0.4	12
<i>Pedicularis verticillata</i>	0.4	12
<i>Salix reticulata</i>	0.4	8
<i>Anemone richardsonii</i>	0.4	8
<i>Senecio</i> sp.	0.2	28
<i>Equisetum variegatum</i>	0.2	24
<i>Pedicularis kanei</i>	0.2	16
<i>Polygonum</i> sp.	0.2	12
<i>Vaccinium uliginosum</i>	0.2	12
<i>Solidago multiradiata</i>	0.2	12
<i>Astragalus aboriginum</i>	0.2	8
<i>Castilleja caudata</i>	0.2	4
<i>Senecio lugens</i>	T	12
<i>Stellaria crassifolia</i>	T	8
<i>Stellaria monantha</i>	T	8
<i>Eqilobium latifolia</i>	T	8
<i>Dryas drummondii</i>	T	8
<i>Arct staphylos uva-ursi</i>	T	8
<i>Androsace chamaejasme</i>	T	8
<i>Parnassia kotzebuei</i>	T	8
<i>Cardamine hyperborea</i>	T	8
<i>Dodecatheon frigidum</i>	T	4
<i>Gentiana prostrata</i>	T	4
<i>Tofieldia pusilla</i>	T	4
<i>Valeriana capitata</i>	T	4
<i>Oxytropis deflexa</i>	T	4
<i>Platanthera obtusata</i>	T	4
<i>Polemonium acutiflorum</i>	T	4

Tundra Habitats

Low Shrub Thicket-Wet Sedge Meadow--mainly Low Shrub Thickets of less than 1 m in height with interspersed areas of Wet Sedge Meadow.

The Low Shrub Thicket-Wet Sedge Meadow transect was located on a flat river terrace south of Mancha Creek and north of Helen Creek. It was bordered on the north by a White Spruce Forest along Mancha Creek, and on the south by a low ridge of Tussock Meadow. Two distinct vegetative units existed on this plot. About half was composed of peat ridges and drier sites; the other half was composed of Low Shrub Thicket growth on relatively dry ground (Table 8.).

The Low Shrub Thicket-Wet Sedge Meadow had the greatest brush density of any habitat sampled. Mean height of shrub growth was 0.35 m, and the taller shrubs reached over 0.50 m tall. Water depth averaged 0.2 cm, which was less than the Wet Sedge Meadow transect.

In the Wet Sedge Meadow portion of the plot, high and low-centered polygons, peat ridges, and shallow-sedge pools were the major microrelief forms present. The polygon and peat ridges were relatively large (up to 1 m in width and 20 cm high). The low shrub element was well developed on these raised areas and in some of the high-centered polygons. Salix lanata was the dominant shrub. Associated species on the drier sites included Betula glandulosa, Potentilla fruticosa, Vaccinium uliginosum, Parnassia kotzebuei, moss, Equisetum variegatum, Arctostaphylos rubra, Salix reticulata, and Dryas integrifolia (Table 3B). The wetter low-centered polygons and pools were dominated by Carex aquatilis and Eriophorum angustifolium. Other species which were present included moss, Pedicularis sudetica, Equisetum variegatum and occasional shrubs of Salix lanata, Salix arctica, and Betula nana.

Moving southwest along the plot the ground became more flat and uniform and the shrub element increased, grading into thicket status.

Table 8. Summary of mean values for habitat variables describing the structure of two tundra habitats, Mancha Creek, Alaska, 1979. Values are followed (+) by standard deviation where appropriate.

Variable	Low Shrub Thicket- Wet Sedge Meadow	Wet Sedge Meadow
No. of sample points	15	11
No. of stems sampled	60	44
Distance between stems (m)*	0.42+0.59	0.85+0.63
Stem height (m)	0.35+0.67	0.20+0.08
Brush density @ 0.10m (stems x 10 ³ /ha)*	56.4+28.4	13.7+25.2
Index of stem heterogeneity**	141.0	73.8
Shrub species (density/frequency/importance)*		
<u>Betula glandulosa</u>	21/15/36	
<u>Betula nana</u>		55/73/128
<u>Potentilla fruticosa</u>	15/8/23	
<u>Rhododendron lapponicum</u>		5/2/7
<u>Salix candida</u>		40/25/65
<u>Salix lanata</u>	37/54/91	
<u>Salix myrtilifolia</u>	15/13/28	
<u>Vaccinium uliginosum</u>	12/19/22	
Microhabitat type (% frequency)		
Low Shrub Thicket	46.6	
Wet Sedge Meadow	36.7	54.5
Moist Sedge Meadow		18.2
Peat ridge	16.7	27.3
Water depth (cm)	0.2+0.6	0.6+2.1
Slope	0	0

*See Stam and Curtis (1956)

**See Roth (1976)

This portion of the plot was close to a bend in the river and received some flooding during spring break-up. The soil was fairly deep (greater than 12 cm). The dominant shrubs were Salix lanata and Salix hastata (Table 3B). Moss, Equisetum palustre, Salix reticulata, Dryas integrifolia, and sedges (predominantly Carex membranacea) dominated the ground cover (Table 3B). Herbs frequently observed but not appearing in Table 3B included: Oxytropis campestris, Platanthera obtusata, and Senecio lugens.

Thirty-four species of vascular plants were observed on this plot (Table 1).

Wet Sedge Meadow

Sedge-dominated meadows with greater than 20% of the ground cover occupied by shallow pools of open water. Shrub growth, if any, is dwarfed or sparse.

The Wet Sedge Meadow plot was located 0.5 km north of Mancha Creek. The plot was bordered on the north side by White Spruce Woodland growing on a solifluction fan which drained onto the meadow, and thus contributed to its wet character. East and south of the plot were river terrace White Spruce Woodlands, Forest, and Tall Shrub Thickets. To the west was an extensive Tussock Meadow. The plot was flat, although the surface was irregular due to small peat ridges which ranged from 8-16 cm in height and 12-30 cm in width. Generally the water levels during June did not dominate the ground cover, but the soil, moss, and peat were saturated. While walking across the plot, one's feet would sink 5-8 cm into the wet ground. The plot had the highest water cover and depth of any area sampled (Table 8).

This plot supported a diverse population of sedges, along with several species of dwarf shrubs, herbs, grass and moss. The most frequently

observed sedges included:

Carex aquabilis
Carex capillaris
Carex capitata
Carex heleonastes
Carex microglochin

Carex rariflora
Eriophorum vaginatum
Eriophorum russeolum
Juncus triglumis
Trichophorum caespitosum

Other plant species associated with this plot are listed in Table 4. A total of 44 vascular plant species were observed on this plot during the course of the study (Table 1).

Wooded Habitats

White Spruce Forest -- Stands of White Spruce greater than 5.0 m tall with trees spaced closer together than they are tall.

The White Spruce Forest plot was located on a river terrace adjacent to and 1-2 m above Mancha Creek. The plot was mostly flat and well drained, however, moist areas with uneven ground were present especially on the northern side of the plot where a small creek (1 m wide) flowed along the boundary. The plot was bordered on the south side by a Tall Shrub Thicket.

White Spruce reached its maximum development on well-drained terraces such as the plot we sampled. White Spruce completely dominated the tree/ shrub frequency, density, and basal area (Table 9). Tree density on the White Spruce Forest plot was higher than any other plot and brush density was lowest. Mean distance between trees was 4.6 m, while the trees on the plot averaged 7.8 m tall and 12 cm in diameter (Table 9). Average age of the seven largest trees was 194 years; the largest tree on the plot was 38 cm dbh and 248 years old (Table 9). One spruce in similar habitat near the cabin was 43 cm dbh and 364 years old.

Willows (predominantly Salix alaxensis and S. glauca) dominated the understory shrub layer. Multi-stemmed clumps of Salix alaxensis ranged

Table 9. Summary of mean values for habitat variables describing the structure of three wooded habitats, Mancha Creek, Alaska, 1979. Values are followed (+) by standard deviation where appropriate.

Variable	White Spruce Forest	White Spruce Woodland	Willow-Poplar Thicket
No. of sample points	24	26	25
No. of stems sampled	96	104	100
Stem diameter (cm dbh)	12+7	8+3	8+6
Distance between stems (m)	4.6+3.1	9.2+10.7	10.2+16.5
Stem height (m)	7.8+3.4	4.6+1.5	4.8+2.2
Canopy thickness (m)	7.3+3.4	4.6+1.5	3.8+1.6
Total canopy coverage (%)	10+10	7+11	26+25
Distribution of foliage volume (absolute % volume; relative % volume)			
0-1.1m	8+7 36+22	13+15 59+45	19+12 36+22
1.2-2.4m	7+9 30+27	5+9 23+27	14+10 25+17
2.5-4.9m	6+10 24+30	3+7 15+22	12+13 23+24
5.0m	2+7 10+21	1+2 3+6	9+21 16+37
Brush density @ 1m (stems x 10 ³ /ha)	4.9+6.2	6.0+9.0	18.1+18.1
Tree density @ 1m (stems/ha)*	474.2+1046.0	120.8+89.9	98.5+37.6
(Index of stem heterogeneity)**	67.0	115.9	161.8
Basal area of stems ≥ 2.5cm dbh (m ² /ha)*	8.10	0.74	0.75
Tree species (density/dominance/frequency/importance)*			
White Spruce	86.5/97.4/64.9/248.8	100/100/100/300	3.0/18.7/4.4/26.1
Willow	10.4/0.6/27.0/38.0		52.0/7.8/48.9/108.7
Balsam Poplar	3.1/2.0/8.1/13.2		45.0/73.5/46.7/165.2
Stand age (years) and corresponding stem diameters (cm)			
Mean age	194+50 32+11	113+28 13+3	168+44 27+7
Maximum age	248 28	154 18	225 36
No. of samples	7 (all white spruce)	9 (all white spruce)	8 (3 white spruce; 5 Balsam Poplar)
Slope (mean %, max. %)	0	60; 75	0

*See Cottam and Curtis (1956)

**See Roth (1976)

in diameter from 1.5-3 m and grew to heights up to 5 m. Other shrubs (Betula glandulosa, Salix brachycarpa, S. hastata, S. novae-angliae, and S. lanata) grew in small thickets or as isolated multi-stemmed plants. The ground cover was dominated by moss, litter, Arctostaphylos rubra and lichen.

In large, flat, well-drained areas, where coarse gravel could be observed close to the surface, Dryas integrifolia and lichen were the principal species. The following species were associated with these sites: Anemone parviflora, Carex scirpoidea, Festuca altaica, Oxytropis campestris, Potentilla fruticosa, Shepherdia canadensis, and Zygadenus elegans. The ground was predominantly covered by a moss mat in which grew Equisetum scirpoides, E. variegatum and associated herbs and shrubs (Table 5).

In the White Spruce Forest, a total of 61 species of vascular plants were observed on the plot.

White Spruce Woodland

Stands of White Spruce greater than 5.0 m tall with trees spaced farther apart than they are tall.

The White Spruce Woodland plot was located on a south-facing slope, extending in elevation from 640 m to 800 m. It was bordered on the uphill side by dry alpine tundra and rock outcrops. The lower boundary extended to just above the treeless Wet Sedge Meadow transect (Figure 1, 7).

Mean distance between trees was 9.2 m, while mean height of trees was 4.6 m (Table 9). The largest trees averaged 113 years old and 13 cm dbh, while average tree diameter was 8 cm. The oldest tree cored was a 154 year old White Spruce 18 cm in dbh. The only tree species occurring on the plot was White Spruce; tree density and brush density values were intermediate for the three wooded plots.

There were two distinct vegetative units which could be separated on the basis of elevation and moisture levels. The upper two-thirds of the plot was steep (60-75% slope) and well drained. The spruce were stunted and the ground had a very irregular surface due to solifluction. Occasional isolated willows (Salix glauca and S. lanata) reached average heights of 1.0-1.5 m.

Species dominating the ground cover were indicators of the moisture levels of the soil. Those species which most frequently occurred and had the highest percent cover included lichen, Dryas integrifolia, Rhododendron lapponicum, Cassiope tetragona, Carex scirpoidea. Other important herbs and shrubs included:

Hedysarum alpinum
Arctostaphylos rubra
A. uva-ursi
Vaccinium uliginosum
V. vitis-idaea
Potentilla fruticosa
Pedicularis capitata
Zygadenus elegans
Minuartia arctica

Phlox sibirica
 Grass
Uxytropis campestris
Shepherdia canadensis
Andromeda polifolia
Thalictrum alpinum
Silene acaulis
Tofieldia pusilla

The lower third of the plot was characteristically less steep and had a higher level of soil moisture. Though not common, small pockets of standing water were present and occupied by sedges and mosses. The irregular nature of the ground produced more microhabitats which supported a more diverse community of ground-cover plant species than any other area sampled. Runoff areas, which were considerably wetter and bordered by ridges 0.1-0.5 m in height, were occupied by Eriophorum angustifolium, Salix reticulata, Carex membranacea, Lagotis glauca, Juncus triglumis, Pedicularis sudetica, and moss.

As expected, the total percent of moss increased while the percent lichen decreased as one descended down the plot. The spruce trees were widely spaced, but thick clumps of multi-stemmed willows, 2-3 m in

diameter were interspersed between spruce trees. These willow clumps were usually occupied by one species i.e. Salix lanata, S. glauca, or S. hastata. Other abundant species associated with this lower unit included:

Salix reticulata
Moss
Equisetum scirpoides
E. arvense
Tofieldia pusilla
Petasites hyperborea

Carex bigelowii
Arctostaphylos rubra
Senecio atropurpurea
Papaver macounii
Cardamine hyperborea

There were several species which appeared to grow in both vegetative units equally as well (Arctostaphylos rubra, Minuartia arctica, Anemone parviflora, Polygonum sp. and Tofieldia pusilla). The White Spruce Woodland plot had the greatest number of species, 87, observed on any one plot.

Tall Willow-Poplar Thicket

Predominantly Tall Shrub Thicket with occasional clumps of Balsam Poplar Forest.

The plot sampled was bordered on the north and east by Mancha Creek, and included several successional stages ranging from widely scattered medium-height shrubs to forest-height Poplar clumps.

Dominant tree/shrubs were willows (including Salix alaxensis, and an occasional S. arbusculoides), which showed the highest density and frequency, and Balsam Poplar, which had the highest basal area (Table 9). Of the wooded plots, the Tall Willow-Poplar Thicket had the highest brush density and lowest tree density. Three White Spruce and five Poplars on the plot were cored, indicating a mean age of 168 years; mean diameter for these largest trees was 27 cm. The oldest tree cored was a 225 year-old White Spruce.

A breakdown of sample points classified according to habitat type showed the plot to consist of 50% medium-tall Willow Thicket, 33% Poplar

Forest, 7% Scattered Medium Willow, 6% Scattered Tall Willow, and 4% unvegetated gravel. Hence this riparian habitat can really be considered a mosaic of vegetative units which reflect varying edaphic factors as well as proximity to the creek and frequency of flooding. The differing vegetative types appeared related to a gradient of distance from the creek, with the tallest Willows and Poplars occurring near the creek, and the more sparse, scattered, willows growing farther from the creek.

Close to the creek bed and most recently developed was a dense-willow thicket interspersed with young poplars. The ground cover was not continuous and patches of gravel, or more commonly sand, were interspersed among pioneer-herbaceous species such as:

Aster sibirica
Astragalus aboriginum
Castilleja caudata
Hedysarum alpinus
Hedysarum mackensii
 Grass
Arctostaphylos rubra
Parnassia sp.
Pedicularis verticillata

Epilobium latifolia
Shepherdia canadensis
Anemone parviflora
Oxytropis arctica
Senecio sp.
Arnica sp.
Solidago multiradiata
Juncus sp.
Dryas drummondii

Most visible when approaching the plot were the tall Balsam Poplar groves which were scattered throughout. In this older unit, the most abundant understory shrub was Salix hastata. Other important ground cover species included Carex concinna, Astragalus umbellatus, Stellaria sp., Equisetum sp., Pyrola grandiflora, Thalictrum alpinum, Anemone parviflora, and Platanthera obtusata.

The south side of the plot was considerably more open with a few tall spruce and skeletonized poplar. Multi-stemmed Salix alaxensis shrubs grew tall, reaching heights of 5 m and covering an area 5 m in diameter. In this unit, where more time had been allowed for organic matter accumulation and less disturbance by flooding, the following

small herbs dominated the ground cover: Oxytropis campestris, O. arctica, Hedysarum alpinum, H. mackensii, Festuca altaica, Pedicularis kanei, Arctostaphylos rubra, Zygadenus elegans and Dryas integrifolia.

A total of 57 vascular plant species were observed on the Tall Willow-Poplar Thicket plot (Table 1).

Habitat Type Map

The habitat type map (Figure 7) depicts the diversity of habitats to be found within the Mancha Creek drainage. Symbols used in the map, and definitions of the habitat types are given in Table 10.

In general terms, the headwaters of the West Fork were predominantly Tussock Meadows, with Low and Medium Shrub Thickets immediately adjacent to the creek valley. The West Fork also included occasional Rock Outcrops, Moist Sedge Meadows, Dryas-Lichen Gravel Terraces, and Alpine Tundra. The headwaters of the North Fork were quite different. Tussock Meadows were not as widespread, but occurred in smaller units. The creek valley was also lined with Low and Medium Shrub Thickets, but included numerous small units of Dryas-Lichen Gravel Terrace and Moist Sedge Meadow. South-facing slopes had patches of solifluction slope White Spruce Woodland, which occurred as far north as VABM Siwash, 68°48'N.

The greatest diversity of habitat types was found in lower Mancha Creek, between the confluence of the N and W Forks, and its confluence with the Firth River. The creek terraces were divided into many units of White Spruce Forest, White Spruce Woodland, Tall Willow-Cottonwood Forest, Medium and Tall Willow Thicket, and Dryas-Lichen Gravel Terrace. The adjacent valley bottom areas were generally Wet Sedge Meadow or peaty high center polygonized tundra. Wetlands were limited to two sites ESE of Base Camp. Solifluction Slopes and fans on the hillsides contained White Spruce Woodlands; more gradual slopes were Tussock

Table 10. Summary of habitat types and their definitions for the Mancha Creek drainage, Alaska. Symbols for each type are those used in the habitat type map, Figure 7.

Symbol	Habitat type	
Tundra		
AT	Alpine Tundra	
HCT	Peaty-high center polygonized Tundra	
TM	Tussock Meadow	
WSM	Wet Sedge Meadow (>20% open water, cannot avoid getting wet in tennis shoes)	
MSM	Moist Sedge Meadow (<20% open water, can keep dry in tennis shoes)	
DLT	Dryas-Lichen Gravel Terrace	
Wooded		
SS	Solifluction slope with White Spruce Woodland	Woodland means trees are farther apart than their height
SFS	Solifluction fan with White Spruce Woodland	
WT	White Spruce Woodland Terrace	
FT	White Spruce Forest Terrace	Forest means trees are closer together than their height
WCF	Willow-Cottonwood Forest	> 5.0 m
TS	Tall Shrub Thicket	2.4-5.0 m
MS	Medium Shrub Thicket	1.0-2.4 m
LS	Low Shrub Thicket	0-1.0 m
Other Habitats		
R	Rock Outcrops	
RR	Rock Outcrops extensive enough for Raptor nesting	
T	Talus & Scree	
W	Wetland (>50% open water)	

Meadows or Moist Sedge Meadows. Finally, the mountainous areas had Alpine Tundra with occasional areas of Rock Outcrop, Talus, and Scree.



BIRDS OF THE MANCHA CREEK DRAINAGE

by

Michael A. Spindler

Prior ornithological studies on the south slope of the William O. Douglas Arctic Wildlife Range contributed much status and distribution information (Kessel and Schaller 1960, Batten and Batten 1975, and Martin 1976). Additional data on bird species composition, diversity, and habitat use on the south slope is available from sites A-7, A-8, A-9, and A-10 of the Arctic Gas biological studies (Salter and Davis 1974), but unfortunately detailed population data were not gathered. Roseneau (1974) flew aerial raptor surveys over much of northeast Alaska, including the study area, and mapped locations of potential habitat, and active and inactive eyrie sites.

Specific objectives of the bird portion of this project were to (1) determine population levels and species composition of the major habitat types and (2) identify critical raptor nesting habitats.

Bird nomenclature follows the America Ornithologists' Union Checklist (1957) and Supplements (1973, 1976).

METHODS

Tundra Habitats

Two 122 m-wide transects were established and censused at weekly intervals. Transects were oriented in a direction which allowed the greatest length through continuous tundra habitat. The Low Shrub Thicket-Wet Sedge Meadow was 976 m long and was censused five times between 2 June and 2 July, 1979. The Wet Sedge Meadow transect was 610 m long and was censused five times between 4 June and 30 June, 1979. Data from both transects were analyzed and extrapolated according to methods given by Balph et al. (1977). This method requires that each bird observation be accompanied by an estimate of distance from transect centerline. Bird observations were then grouped into two distance intervals 30.5 and 61.0 m away from each side of centerline. According to Balph et al. (1977) the method "emphasizes the use of data obtained in the first interval from the transect line. Sightings outside of the first interval are of interest only, when due to small sample size, the number of individuals is largest in an interval other than the first."

Wooded Habitats

To census birds in the wooded habitats (forest and tall shrub) three plots were established in the following vegetation types: White Spruce Forest (10.0 ha, rectangular), White Spruce Woodland (14.7 ha, rectangular), and Tall Willow-Poplar Thicket (10 ha, square). Variation in plot size and shape was necessary in order to "fit" the plot into an area of homogeneous habitat and minimize the amount of edge near the

plot boundaries. Determination of breeding population was made using the territory mapping census method (Svensson 1970). Each plot was subdivided by grid lines, spaced 46 m apart, which resulted in 48 subplots in the White Spruce Forest plot, 70 subplots in the White Spruce Woodland plot, and 49 subplots in the Tall Willow-Poplar Thicket plot.

Whenever censusing a plot, the observer stopped at each subplot for 2-7 minutes, depending upon avian activity, and recorded all birds seen or heard. For birds seen, activity, height of observation, and vegetation used were also recorded. The observer especially concentrated on noting the locations of two or more males singing simultaneously as well as territorial disputes. Each census of a plot took approximately 4 hours, usually between 0400-0900 (Alaska Daylight Time), which was generally within the time of greatest singing activity. Seven censuses were completed on each plot between 27 May and 29 June 1979.

After all censuses were completed, the observations were sorted and copied onto separate species maps for each plot. Clusters of observations of singing males or territorial females indicated a breeding territory if at least two registrations could be documented (see Svensson 1970).

Locations of census transects and plots are given in Figure 1.

Cliff Habitats

Raptors and other bird species using cliff and adjacent montane habitats were sampled during special surveys made on 2, 10, 23 June and 2-4 July. The major areas of cliff habitat in the Mancha Creek drainage were scrutinized with binoculars and spotting scope. If indications of raptor activity were present, such as stick nests, "whitewash" on rocks, orange lichen on rocks, or actual bird activity, we carefully approached the site to determine: (1) species present, (2) number of adults present,

and (3) number of young (or eggs) present. The habitat type and exact location of active and recently-active eyries were recorded. In all cases, approach to an eyrie was made in such a manner that would not cause excessive disruption to adults or young. If it was impossible to avoid disruption, an approach was not made. (Locations of cliff habitats surveyed are given in Figure 9.)

RESULTS AND DISCUSSION

Tundra Habitats

Both tundra habitats censused, Low Shrub Thicket-Wet Sedge Meadow and Wet Sedge Meadow, had low to moderate bird populations during the breeding season, 10.5 and 14.1 birds/10 ha, respectively (Table 11). In the Low Shrub Thicket-Wet Sedge Meadow, the most common species were Savannah Sparrow, Lesser Yellowlegs, Least Sandpiper, and Tree Sparrow. The Low Shrub Thicket-Wet Sedge Meadow supported three more breeding species than did the Wet Sedge Meadow, however, the latter supported 34% higher bird density. The Wet Sedge Meadow had twice the shorebird numbers as the Low Shrub Thicket-Wet Sedge Meadow. The most numerous species were Least Sandpiper, Lesser Yellowlegs, Upland Sandpiper, Smith's Longspur, and American Robin. Total population densities in both transects were similar to those observed in North Slope tundra habitats (13.4-17.8 birds/10ha for four areas between Meade River and Canning River, and 11.2-24.5 for the Okpilak River delta; see Spindler 1978).

Table 11. Bird population densities during the breeding season on tundra habitats, Mancha Creek, William O. Douglas Arctic Wildlife Range. May-July 1979.

Species	Low Shrub Thicket- Wet Sedge Meadow (birds/10ha)	Wet Sedge Meadow (birds/10ha)
Kestrel		0.3
Willow Ptarmigan	0.5* ¹	
Whimbrel	0.2*	
Upland Sandpiper	0.3	1.9*
Lesser Yellowlegs	1.8*	3.0*
Solitary Sandpiper	0.2	0.3
Common Snipe	0.5*	T
Least Sandpiper	1.3*	4.0*
Pectoral Sandpiper	0.5	
Mew Gull	0.2	
Short-eared Owl		0.3
American Robin	0.7	1.3
Northern Shrike	0.2	
Savannah Sparrow	2.7*	T
Tree Sparrow	1.2*	0.3
White-crowned Sparrow	0.2	
Smith's Longspur		2.7*
Total Density	10.5	14.1
Total Species	14	11
Transect length (m)	976	610
Transect width (m)	122	122
Transect area (ha)	11.9	7.4

¹ Asterisks denote breeding species.

Wooded Habitats

Of the three woody habitats censused, the White Spruce Forest supported the highest density of breeding birds, 27.4 pairs/10 ha (Table 12). Densities in the other two habitats were about half that. The number of breeding species (breeding species richness) was similar among the three plots (11 to 13 species). The White Spruce Forest and Willow Poplar Thicket had greater numbers of total species (breeders and non-breeders) than did the White Spruce Woodland.

Breeding species composition, and especially density-dominance structure of the three habitats differed (Tables 12, 13, Figure 8). Six species occurred in densities greater than 1 pair/10 ha on the White Spruce Forest plot: Gray-cheeked Thrush, Ruby-crowned Kinglet, Varied Thrush, Dark-eyed Junco, American Robin and Yellow-rumped Warbler. Four species exceeded densities of 1 pair/10ha on both the White Spruce Woodland and the Tall Willow-Poplar Thicket plots. The four most abundant species of the Woodland plot were: American Robin, White-crowned Sparrow, Yellow-rumped Warbler, and Tree Sparrow. In the Tall Willow-Poplar Thicket, Gray-cheeked Thrush, Willow Ptarmigan, American Robin and White-crowned Sparrow were most abundant. The number of breeding species shared by the wooded plots was somewhat higher than for the tundra plots, but neither exceeded 22% similarity with another plot (Table 13).

Species composition of the wooded habitats was generally like that of the corresponding habitats in interior Alaska. The White Spruce Forest was nearly as rich in breeding species as its interior counterparts (Spindler and Kessel 1980). The Tall Willow-Poplar Thicket was greatly reduced in species, lacking notably the Northern Waterthrush, Yellow Warbler, Blackpoll Warbler, Lincoln's Sparrow and water-related species

Table 12. Breeding bird population densities in forest and tall shrub habitats, Mancha Creek, William O. Douglas Arctic Wildlife Range, Alaska, May-June 1979.

Species	White Spruce Forest (pairs/10ha)	White Spruce Woodland (pairs/10ha)	Tall Willow-Poplar Thicket (pairs/10ha)
Sharp-shinned Hawk		v ^a	
Merlin	V		
American Kestrel			+ ^b
Willow Ptarmigan	V	+	4.0
Rock Ptarmigan		+	
Upland Sandpiper		+	
Lesser Yellowlegs	V	V	
Solitary Sandpiper	+		
Hawk Owl	+		
Short-eared Owl		V	
Common Flicker	V	+	+
Tree Swallow	+		
Gray Jay	+	+	+
Gray-headed Chickadee			+
American Robin	2.5	4.4	1.5
Varied Thrush	3.0		1.0
Gray-cheeked Thrush	9.0		4.0
Ruby-crowned Kinglet	6.0		
Bohemian Waxwing	V	V	V
Orange-crowned Warbler			1.0
Yellow-rumped Warbler	2.5	2.1	V
Wilson's Warbler			1.0
Rusty-blackbird	V		V
Pine Grosbeak	1.0		V
Redpoll Sp.	V		+
White-winged Crossbill	+	+	
Dark-eyed Junco	3.0	1.0	
Tree Sparrow		1.4	V
White-crowned Sparrow	V	3.1	1.5
Fox Sparrow			1.0
Total breeding density	27.4	12.6	15.5
Total breeding species	12	11	13
Total species	20	15	18
Plot size (shape)	10ha (rect.)	14.7ha (rect.)	10ha (square)

^aVisitor to plot.

^bPortion of territory on plot; or breeding indicated for non-territorial species. Each "+" counted as 0.1 for total breeding density.

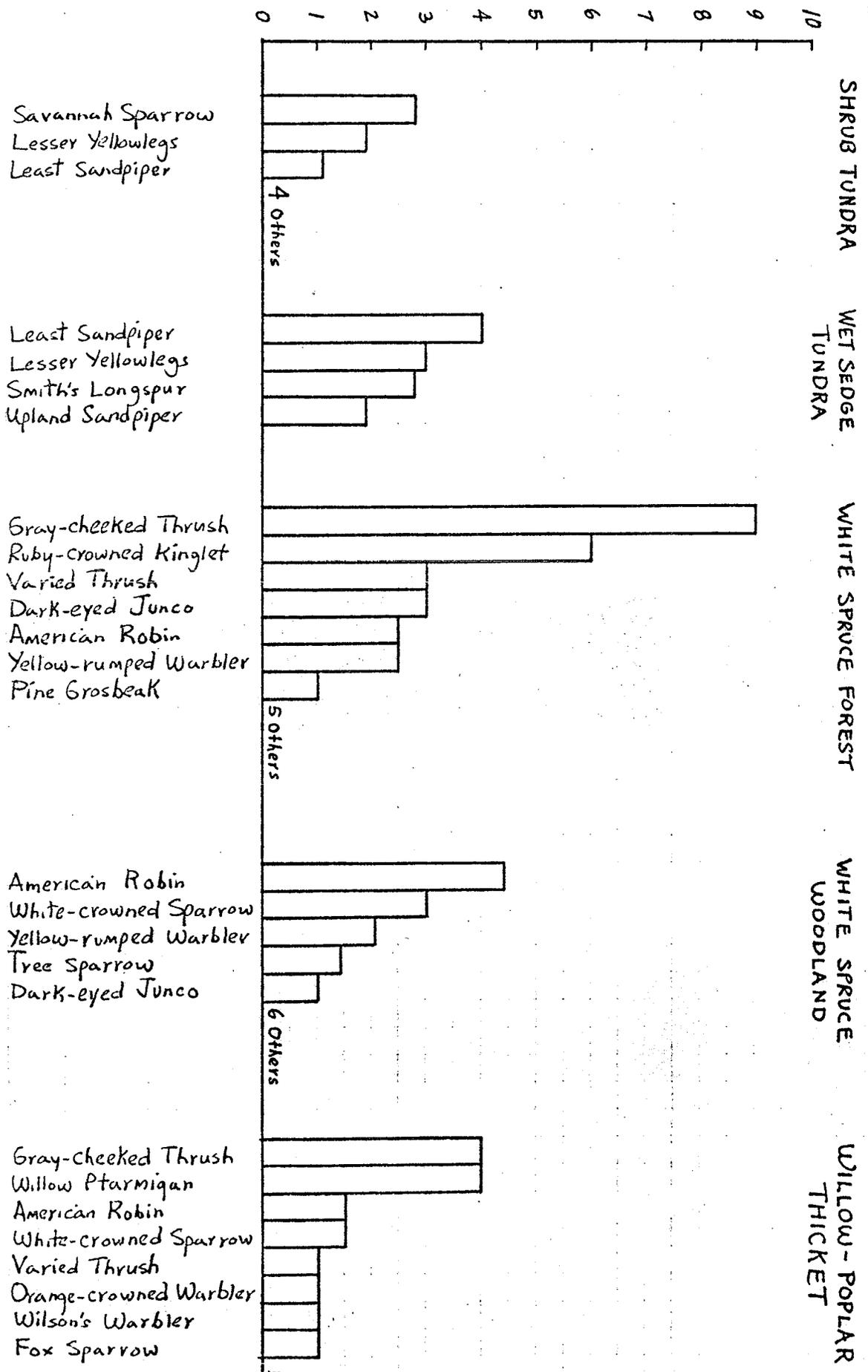


Figure 8. Density-dominance structure of five breeding bird communities, Mancha Creek, Alaska, 1979.

Table 13. Percent similarity for species composition of breeding birds among the major habitat types in Mancha Creek drainage, William O. Douglas Arctic Wildlife Range, Alaska, 1979. Values of the index increase whenever the number species common to a pair of habitats increases.

Habitat Type	White Spruce Forest	White Spruce Woodland	Willow-Poplar Thicket	Shrub Tundra	Wet Sedge Tundra
White Spruce Forest	1.00	0.22	0.16	0	0
White Spruce Woodland	-	1.00	0.21	0.11	0.05
Willow-Poplar Thicket	-	-	1.00	0.05	0
Shrub Tundra	-	-	-	1.00	0.08
Wet Sedge Tundra	-	-	-	-	1.00

that are so typical of the shrub habitats farther south. The White Spruce Woodland habitat was probably similar to, or slightly lower, in species richness compared to such ecotonal stands in the interior, but we lack sufficient comparative data.

Total breeding density in the White Spruce Forest plot was similar to, or exceeded, values observed by Spindler and Kessel (1980) for corresponding mature coniferous forests in interior Alaska. The White Spruce Woodland and especially the Tall Willow-Poplar Thicket showed breeding densities that were 60-70% lower than levels observed in similar habitat types in the Tanana Valley.

A total of six foraging guilds were represented among the woody habitats: ground-brush forager, foliage-searcher, aquatic forager, raptors, sallyers (flycatchers and swallows) and multiple (Gray Jay). All plots were dominated by ground-brush foragers in terms of numbers of breeding species and density. The White Spruce Forest plot had the highest proportion of foliage searching birds (35% of the density), and the greatest number of guilds (6).

Cliff Habitats

Perhaps the most striking physical feature of the Mancha Creek drainage is the prevalence of limestone spires, crags, and outcrops which seem to rise out of the rounded hills surrounding the creek. It is this series of cliffs in the Firth-Mancha area that represent some of the more extensive and favorable raptor nesting habitat available in the Range. For northeastern Alaska, Roseneau (1974:6) generally defined favorable raptor habitat as a combination of river cliffs or outcroppings at elevations below 914 m (3000 ft.), but with occasional Gyrfalcon

eyries at elevations of up to 1387 m (4550 ft.).

Of the 15 cliff habitat areas that we checked (13 discovered in 1973-1974 by Roseneau and two additional sites that we discovered) 11 were occupied by raptors and 6 had active raptor nests (Table 14 and Figure 9). A total of 5 Golden Eagle and 2 Rough-legged Hawk eyries were found. Although 2 pairs of adult Gyrfalcons were observed at 2 sites, we did not find any eyries. Of the 21 active and inactive sites found, one third (7) were active.

For the purposes of estimating bird and eyrie density, the census area was considered to include those portions of the Mancha Creek drainage surveyed between 2 June and 4 July, with a 3 km radius surrounding each nest site that was checked. Total area surveyed was estimated at 536 km². Since eyrie sites are stationary, they provide the most reliable basis for comparison of raptor nesting activity and potential among areas and over time.

Density of eyries in Mancha Creek was estimated to be: 1 active eyrie/76.6 km²; 1 recently-active eyrie/38.3 km²; and 1 active or recently-active eyrie/25.5 km². Total adult population was estimated at 1 adult/41.2 km², and production at 1 young/67.0 km². The adult population density estimate must be taken with some qualifications. It is subject to considerably more variation due to the large and changing home range of adult raptors. The home range is not usually known at the time of census, and must be estimated. Visibility of adults and the relatively long time periods of absence from the eyrie following hatching may greatly affect the numbers recorded during the surveys. Visibility of eyrie sites (especially for Gyrfalcon) is also a factor to be considered, but is not thought to be as significant as for adult birds.

The Rough-legged Hawk and Gyrfalcon were proportionately less common in the Mancha Creek area when compared to Roseneau's (1974) data

Table 14. Summary of birds using cliff habitats in the Mancha Creek drainage, William O. Douglas Arctic Wildlife Range, Alaska, June-July 1979.

Site	Inactive raptor nests/eyries	Rough-legged Hawk			Golden Eagle			Gyr Falcon			Say's Phoebe		Cliff Swallow	Gray-crowned Rosy Finch
		ad.	yg.	eyries	ad.	yg.	eyries	ad.	yg.	eyries	ad.	nests	nests	ad.
1	4			1	1	1	1	2					100's	
2	1										4	2		
3					1	1							many	
4	1				1									
5	1										2	1		
6	1				1	1	1							
7		1	3	1				2						
8	1				1	1	1				2			2
9	2										2	1	1	
10		1									2	1	2	
11	3				3	1	1							
Total	14	2	3	2	7	5	5	4			12	5	100's	2

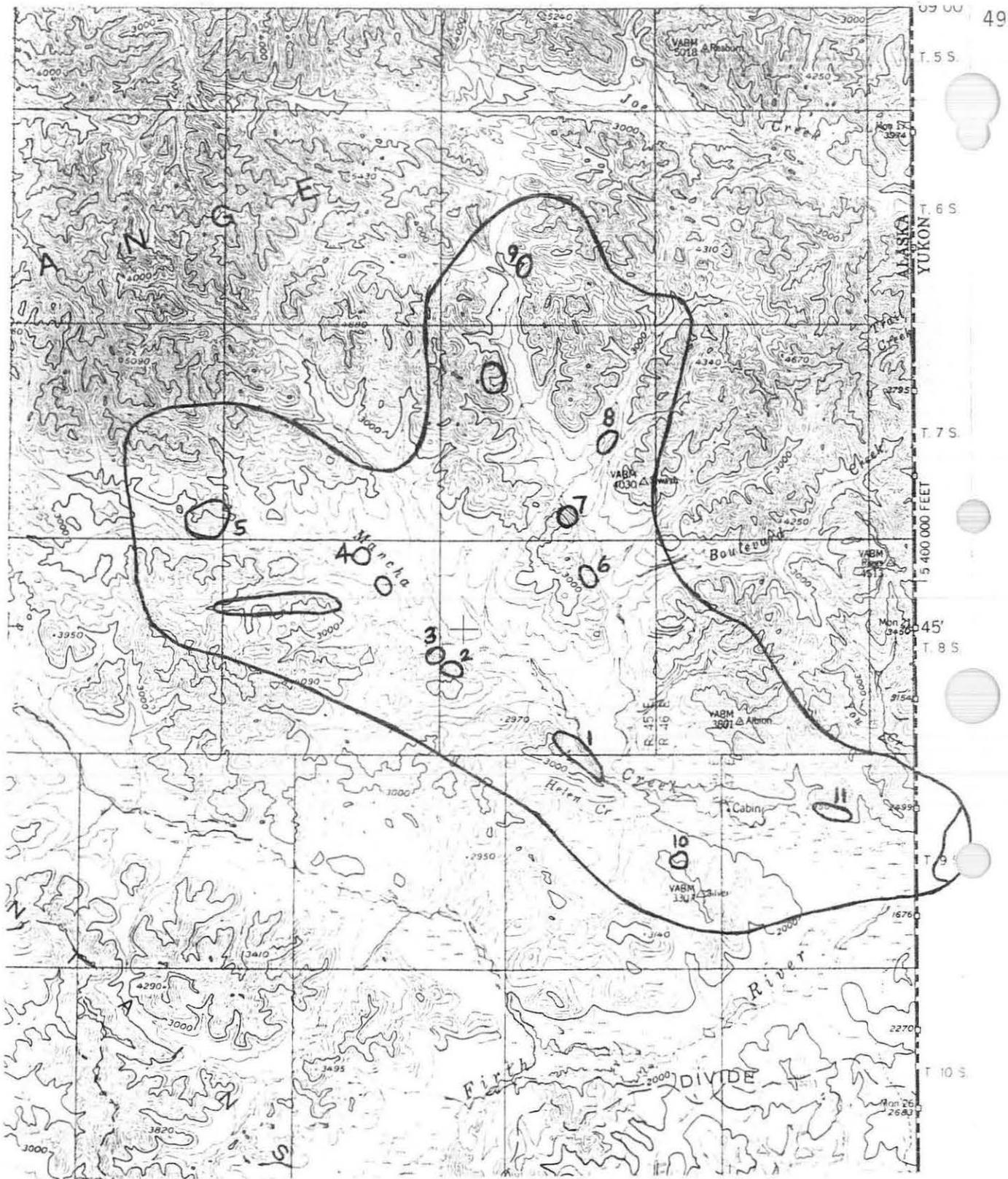


Figure 9. Cliff habitats (circled) and active or inactive raptor nest sites (numbered) in areas checked by ground survey, Mancha Creek, Alaska, 1979. Numerals refer to sites listed in Table 14. Boundary of area surveyed is indicated by dark line. Base map from northeast quarter of USGS Table Mtn. 1:250,000 quadrangle.

for northeast Alaska. The lower numbers of those species are probably a result of habitat differences.

Other species using the cliff habitat in Mancha Creek were Say's Phoebe, Cliff Swallow, and Gray-crowned Rosy Finch. The Say's Phoebe was most widespread, while the Cliff Swallow was most numerous. Nests of both species were observed in the same cliff habitats used by raptors.

ANNOTATED SPECIES LIST

The following list of bird species gives the status, relative abundance, and preferred habitats of species that were observed on the Mancha Creek study area. The status and abundance classes used were defined by Kessel and Gibson (1978).

The avifauna of Mancha Creek was composed of a predominance of taiga species. Of the 87 species observed during the year of study, 37 were primarily birds of the taiga and 19 were species typical of arctic tundra habitats, while an additional 11 species were primarily montane riparian, or alpine tundra breeders. Three species were birds characteristic of both arctic and alpine tundra.

A total of 60 species bred or probably bred on the study area. A majority of those 60 species, 54, were classified as breeders. Twenty-six species were classified as visitants or migrants. Two species were summer residents, and seven species were permanent residents. Several species usually classed as permanent residents in the taiga were not documented in winter at Mancha Creek (e.g. Hawk Owl, Pine Grosbeak, Boreal and Gray-headed Chickadees). It may be that in the forest-tundra ecotone these typically "resident" species of the taiga are actually

breeders which migrate south to the taiga to winter. We did not document any species as being solely a winter resident.

Arctic Loon

Uncommon summer resident. One bird was recorded on 4 June about 0.5 km SW of the Wet Sedge Meadow transect.

Whistling Swan

Uncommon migrant. Koehl observed one pair flying E over the cabin on 29 May.

White-fronted Goose

Common spring migrant. Two birds were observed flying N on 24 May, and 10 were observed flying NW on 1 June. On 2 June a flock was heard overhead. It is likely that a northerly movement of birds occurs from interior Alaska and Yukon through major river drainages in the Brooks Range out to the North Slope.

Snow Goose

Uncommon spring migrant. A flock of 35 birds was observed flying E over the cabin the evening of 22 May.

Pintail

Uncommon migrant and summer visitant. One pair was observed on Mancha Creek near Base Camp on 18 and 19 May.

Green-winged Teal

Fairly common summer resident and probable breeder. One male bird was seen on Mancha Creek or Helen Creek on 18 and 30 May, and on 1, 2, 7, and 10 June. A pair was observed on Mancha Creek near the cabin on 11 June.

American Wigeon

Uncommon summer visitant. Two pairs were observed, one at Mancha Creek on 4 June and one at Second Wetland on 10 June.

Lesser Scaup

Uncommon summer visitant. Two males and one female were seen at Second Wetland on 10 June, and one male was seen there on 25 June.

Oldsquaw

Common spring migrant and summer visitant. A flock of 70 birds was observed flying NE over Base Camp at about 300 m above ground. On 10 June one female was observed at First Wetland and seven pairs were observed at Second Wetland. Two males and three females were counted at Second Wetland on 25 June. As with the White-fronted Goose, a spring migration route over the interior and through Brooks Range valleys to the North Slope seems evident.

Surf Scoter

Uncommon summer visitant. One male was observed in Second Wetland on 10 June.

Red-breasted Merganser

Common summer resident and probable breeder. Pairs were observed regularly between 28 May and 21 June on Mancha Creek near camp. Several pairs were observed on 16 June in lower Mancha Creek and on the Firth River near its confluence with Mancha Creek. One pair was observed on 2 July on upper Mancha Creek near the confluence of the North and West Forks.

Goshawk

Uncommon summer resident. One bird was seen on 21 June near the Base Camp. One bird was observed by Koehl and MacDonald on 27, 29, and 30 August.

Sharp-shinned Hawk

Uncommon summer resident. One bird was seen on 24 and 26 May, 4, 6, and 8 June, and 25 and 27 August.

Rough-legged Hawk

Uncommon breeder. A single adult was seen on 23 and 25 May, and on 23 June. One eyrie (Site #7) with an adult and three young was discovered on 4 July. The nest was about 1 m wide, made of sticks, and located at the very top of a 35 m-tall limestone spire. Elevation of the site was about 915 m. The young were about 20 cm long and still down-covered. The adult in attendance was a light-phased bird with a nearly white head and upper breast.

Golden Eagle

Fairly common breeder. Adults were observed soaring near Base Camp regularly, from 20 May until our departure in July. Five active eyries were observed. Dates of discovery, status, and habitat are described for each site:

Site #11, 10 June. One adult was flushed off the nest, and another was observed soaring nearby. One down-covered eaglet was observed. The nest was constructed of many still-green white spruce branches placed at the mouth of a small cave, 10 m high on a limestone bluff, located about 60 m above the Mancha Creek Valley floor. Elevation of the site was about 600 m. There were three other stick nests within 2 km of the site, but none were occupied. Aspect was the E side of a bluff on a S-slope.

Site #1, 2 July. One adult was observed soaring near the site. One down-covered eaglet was seen in a loosely constructed stick nest located on a limestone spire about 25 m below the ridge-top. The site was located at an elevation of 900 m, which was 300 m above the valley floor. Aspect was the W side of a spire on a N-facing slope. There were two other unoccupied stick nests near the eyrie.

Site #3, 3 July. One down-covered young was seen in a stick nest. Two dead ground squirrels (uneaten) were seen in the nest. The site was located at an elevation of 800 m, and about 100 m above the valley bottom.

Site #6, 2 July. One adult was observed brooding an eaglet in a massive stick nest located atop one of several 15-30 m tall limestone spires. The eyrie was located at an elevation of about 730 m, and was situated about 50 m above the creek bed. Aspect was a NE-facing slope. There was one other stick nest of about equal size 30 m away, apparently unoccupied.

Site #8. One adult was flushed off a perch about 60 m above the nest. One down-covered eaglet was observed in the stick nest. The eaglet was down-covered but was beginning to show the black feather shafts of its primaries. One unoccupied Golden Eagle-sized stick nest was found adjacent to the eyrie. Elevation of the site was about 850 m, and was about 100 m above the valley floor. Aspect was an E-facing cliff-ledge.

Marsh Hawk

Uncommon summer visitant. One adult male was seen hunting over the Wet Sedge Meadow transect on 27 May.

Gyr Falcon

Uncommon resident. One white bird was observed incubating or brooding on spires at the confluence of Mancha Creek and Firth River on 25 May. A pair of gray birds was seen near site #1 on 2 June. One adult was seen flying near Base Camp on 12 June. One adult stooped near Site #7, and then perched on a nearby limestone pinnacle on 3 July.

Peregrine Falcon

Rare migrant. One bird flew over Base Camp on 1 June.

Merlin

Uncommon summer resident and probable breeder. One female was seen perched near the cabin on 20 May. A pair was observed in an undulating courtship flight near the cabin and hence downstream on Mancha Creek on 21 May. One bird was seen carrying food (possibly a vole) near the

cabin on 5 June. One bird was seen on 23 and 28 August.

Kestrel

Common breeder. Individuals and pairs were observed regularly between 19 May and 25 August. Nests were discovered in two locations, with a possible third. One nest was discovered on 12 June, when a pair was observed on the Tall Willow-Poplar Thicket plot in the vicinity of a cavity in a large poplar. On 29 June a female was observed leaving a 7 cm diameter cavity, which was located 3 m high in the 20 cm dbh poplar. A second nest was found on 28 May in a 35 cm dbh white spruce at a height of about 6 m above the ground. The nest tree within the mature white spruce stand immediately W of the cabin. A third nest was possibly located at the E end of the White Spruce Forest plot.

Willow Ptarmigan

Abundant breeder in riparian habitats, uncommon winter resident. Adults were observed courting on 18 May, and males were seen guarding territories as late as 7 June. By 15 June, males were observed flocking; molting males were commonly flushed between 15 and 25 June. The first nest was found on 31 May; the first young were seen on 22 June. Flight-capable young were first seen on 4 July. Birds were seen regularly through August, and tracks in snow were seen in dense thickets on 11 November, and 9 March.

Rock Ptarmigan

Common summer resident, probable breeder, and uncommon winter resident. Adults were regularly observed at or above timberline N of the White Spruce Woodland plot, and S of Helen Creek during May and

June. Several males were seen courting on 28 May. Tracks were observed in snow in dwarf birch thickets on 10 November, indicating probable wintering birds in the area.

Sandhill Crane

Uncommon summer visitant. One bird was seen circling over Base Camp on 7 June.

Semipalmated Plover

Locally abundant breeder. Defensive, breeding adults were observed to be abundant on open gravel bar habitats with sparse low-to-medium-height shrubs. The species was observed from the confluence of Firth River and Mancha Creek, all the way upstream to the headwaters of Mancha Creek as well as in upper Joe Creek. One nest with four incubated eggs was found 0.5 km downstream from Base Camp on 25 June.

Golden Plover

Common breeder in Alpine Tundra. The first individuals (probably migrants) were seen on 24 May 1.5 km W of Base Camp. Defensive adults were seen on tundra ridges N and S of base camp, in alpine tundra near the headwaters of Mancha Creek, and occasionally on open Dryas-Lichen-Gravel Terraces adjacent to the Creek.

Whimbrel

Locally common breeder. Defensive adults were observed in dwarf shrub-moist meadows 1 km S of Base Camp between 2 and 25 June. Nesting habitat appeared to be a moist Tussock Meadow rise (with occasional

dwarf shrubs) adjacent to lower Wet Sedge Meadow and White Spruce Woodland. On 9 June and again on 16 June we saw adults chasing Ravens and Mew Gulls from the nesting area. We estimated about 3-4 pairs in the one area S of Base Camp. As we approached the nesting area, Whimbrels were extremely secretive. They apparently would sneak away and then suddenly appear quite vociferous and defensive about 100 m away from where we suspected the nests were located.

Upland Sandpiper

Common breeder. Adults were first seen on 18 May, and courtship activity was first observed on 24 May. From 24 May until 24 June the whistled courtship call was prevalent, and often echoed across the valley on a calm evening. Courtship and defensive behavior seemed most frequent in hillside moist Tussock Meadows bordering White Spruce Woodlands. One nest was found which included four incubated eggs on a small mound within a moist sedge-dwarf shrub meadow about 60 m away from spruce woodland. Birds were seen on the study area as late as 30 August.

Lesser Yellowlegs

Abundant breeder. Adults were first seen courting on 18 May, and courtship was most intense during the period 28 May to 2 June, thereafter declining. The latest courtship flights were recorded on 15 June. Copulation was observed on 26 May. One nest was found on 7 June, located on a sedge tuft within the Wet Sedge Meadow-Low Shrub Thicket plot. The nest contained four eggs, three of which had hatched by 23 June. Independent young were first observed on 2 July. The Lesser Yellowlegs appeared to be most abundant at the margins of forest and woodland where an edge of low or medium shrub occurred in combination with wetlands.

Solitary Sandpiper

Common breeder. The first individual was observed on 24 May 0.5 km W of Base Camp. From 25 May until 30 May courtship flights were observed daily. On 28 May copulation was observed. Between 9 and 27 June a pair of very defensive adults was encountered regularly during censuses at the N edge of the White Spruce Forest plot.

Spotted Sandpiper

Common breeder. This species was first observed on 28 May while foraging on the gravel bars of Mancha Creek near Base Camp. Individuals and pairs were observed regularly thereafter, until mid-July. On 16 June a bird appearing enlarged near the abdomen was observed, which possibly indicated that the bird was a laying female. On 25 June and 4 July defensive adults were observed, which also suggested breeding activity on the study area.

Wandering Tattler

Fairly common breeder, especially farther upstream on Mancha Creek within surrounding Alpine Tundra and rocky exposures. The species was first seen on 30 May near Base Camp. On 3 July one defensive bird was seen at Site #9. The bird was apparently defending a nest or young on a steep W-facing talus slope 100 m from the nearest wet tundra and 200 m away from the nearest stream.

Northern Phalarope

Fairly common summer resident and possible breeder. The first birds, a pair, were seen on 4 June in a small pond between Base Camp and

the Helen Creek aufeis field. Presumably the same pair was again spotted in the same area the next day. On 10 June one bird was seen at First Wetland and a group of 10 birds including both males and females were seen at Second Wetland. On 25 June three birds were seen at Second Wetland, one of which may have been defending a nest or young.

Common Snipe

Common breeder. Birds were observed in courtship flight as early as 19 May. Thereafter, until 5 July, the winnowing of males in courtship flight was a characteristic background sound of the area, so much that their presence was more often indicated in the air than on the ground. Birds observed on the ground were most often flushed up from Low Shrub Thicket-Wet Sedge Meadow habitats or the boggy ground within White Spruce Woodlands. On 22 June and 4 July adults were observed in defensive behavior (including a broken wing act), indicating nearby nest or young.

Long-billed Dowitcher

Uncommon migrant. On 22 May three birds were seen flying over Base Camp; on 24 May two birds were seen in a Wet Sedge Meadow S of Base Camp.

Semipalmated Sandpiper

Uncommon migrant. On 22 May one bird was seen in a Wet Sedge Meadow S of base camp.

Least Sandpiper

Abundant breeder in Wet and Moist Sedge Meadows in Alpine Tundra or adjacent to forests and woodlands. The first birds were seen on 23

May. The first courtship flight was seen on 23 May, and regularly thereafter until 19 June. One nest was found on 8 June with three as yet unincubated eggs. The nest was located on a small sedge hummock 6-8 cm above a soggy moss pool and under the sparse cover of a Betula nana bush. By 14 June the clutch was completed as we found four incubated eggs. On 30 June we concluded that the nest had probably hatched successfully as it was vacant, undisturbed and had no sign of eggshells nearby. We determined that the species was probably breeding as far upstream as the headwaters of the N and W Forks of Mancha Creek since defensive birds were frequently observed.

Baird's Sandpiper

Common migrant in lower valley, common breeder in Alpine Tundra at headwaters of Mancha Creek. On 22 May four individuals were seen in a flock with one Least Sandpiper in Wet Sedge Meadow S of Base Camp. On 3 July, three defensive birds were observed near Raptor Site #9.

Pectoral Sandpiper

Fairly common migrant. Flocks of 10 and 30 birds were observed on 23 and 26 May, respectively. A few males in courtship flight were seen on 31 May. There are three other spring records for 2, 1, and 1 birds on 2, 7, and 10 June, respectively. "Fall" migration observations are for one bird each on 3 July, and 25 and 26 August.

Dunlin

Uncommon migrant. Three birds were observed flying downstream along Mancha Creek on 30 May.

Parasitic Jaeger

Uncommon migrant, possible breeder. One bird was seen flying over Base Camp on 19 May.

Long-tailed Jaeger

Uncommon breeder in Alpine Tundra. A pair of defensive adults was observed in an open Dryas River Terrace in the headwaters of N. Fork Mancha Creek on 3 July.

Glaucous Gull

Uncommon summer visitant. Two adults were seen at the Helen Creek aufeiss field on 18 May.

Herring Gull

Uncommon breeder. On 30 May the first bird was seen, flying over the Tall Willow-Poplar Thicket plot. On 25 June one nest was found near Second Wetland. The nest contained three eggs, one of which was pipped. It was located on a dry peat hummock surrounded by Wet Sedge Meadow. The two adults in attendance were not as aggressively defensive as are Mew Gulls and Glaucous Gulls. While checking the nest, the observers were not "dive-bombed" by the adults.

Mew Gull

Common breeder. The first birds seen were a group of three flying upstream on 20 May. Birds were seen regularly throughout the remainder of May and June. A breeding colony consisting of 6 adults and an undetermined number of nests was found at Second Wetland on 10 June.

Defensive "dive-bombing" and circling occurred when we approached the pond at Second Wetland on both 10 and 25 June.

Hawk Owl

Uncommon breeder. One pair was observed regularly in the vicinity of Base Camp from 26 May until 30 August. Their nest was found at the W end of the White Spruce Forest plot on 6 June. The nest was exposed to the weather, located near the top of a white spruce blow-down stub about 2 m tall. Four incubated eggs were contained in the nest on 6 June, and by 16 June the eggs were hatched. On 27 June there were two young in the nest, about 3/4 the size of the adults. Because of the absence of winter sightings, it is not likely that the species winters in Mancha Creek valley, but more probably migrates southward to the interior.

Short-eared Owl

Uncommon summer resident and possible breeder. One bird was observed hunting over Wet Sedge Meadow S of base camp on 21 May. Thereafter, individuals were seen hunting or soaring on the following dates: 22, 24, 27, 28 May, 2, 4, 15 June, and 3 July. The 24 May observation included one bird carrying a vole. All observations were within 3 km of Base Camp, except the 3 July, which was in the headwaters of the N. Fork Mancha Creek.

Belted Kingfisher

Uncommon summer visitor. One bird was seen near Base Camp on 4 September.

Common Flicker

Common breeder in wooded habitats. The first two birds of the season were observed on 19 May, one E of Base Camp and the other W of Base Camp, both in White Spruce Forest. Individuals were seen regularly until 25 August. On 10 June a nest hole was found 6 m high in a 25 cm dbh Poplar on the Tall Willow-Poplar Thicket plot. A pair was observed copulating on 14 June about 0.5 km E of the nest tree. On 24 June the male was observed entering and leaving the hole, and on 29 June the female was seen entering the hole with a bill full of insects. We suspected the pair began feeding young around 24 June. On 1 July another nest hole was found, this one located 1 m high in a 40 cm dbh white spruce tree that was about 12 m tall. Several live chicks could be heard giving a buzzing-clicking sound from within the nest hole.

Northern Three-Toed Woodpecker

Rare resident. One bird, probably of this species was seen by MacDonald on 25 August. Ross saw a bird, also probably of this species, foraging in a white spruce tree near the cabin on 9 March.

Say's Phoebe

Common breeder in cliff habitats with numerous overhangs. The first arrival was seen foraging in a riparian willow thicket near base camp on 27 May. A probable nesting pair was seen at a set of limestone cliffs 860 m in elevation on the ridge just N of the White Spruce Woodland plot on 14 June. One nest was found on the underside of a limestone overhang, at the N-facing slope of VABM Silver (Site #10) on 23 June. The nest was made of fine sticks and lined with ptarmigan feathers. The

adults acted bold, but not defensive, as they continued to feed the several young in the nest while we observed. The overhang had a W aspect and was at an elevation of 770 m. Koehl found three nests associated with raptor nesting habitat in the upper W. Fork of Mancha Creek on 2-4 July (Sites #2 and #5). During the same period, Mouton found two nests (at sites #8 and #9), also associated with raptor habitat. At the latter five nests, adults were also found to be feeding young.

Alder Flycatcher

Rare summer visitant. One bird was seen foraging in a Medium Willow Thicket 0.2 km N of Base Camp.

Horned Lark

Common summer resident and probable breeder on dry ridges in Alpine Tundra. Three separate males were seen giving courtship flight-song on the ridge between VABM Silver and Site #1 on 2 June, and again on 14 June. Three birds were seen on one of the N-running ridges and on the summit of VABM Silver on 23 June.

Tree Swallow

Common breeder. The first arrivals were seen on 24 May, a pair perched on a spruce snag above a meander pool in Mancha Creek. One bird gave a sort of flight display. Birds were seen regularly on the wooded portion of the study area through 27 June. A probable nest cavity was found on the White Spruce Forest plot on 12 June. The cavity was located about 2 m high in a 14 m tall dead white spruce. A pair of birds was seen in the vicinity of the nest tree five times between 1 and

27 June, often exhibiting defensive behavior (close flights and chattering vocalizations).

Cliff Swallow

Fairly common breeder in suitable cliff habitats. The first birds noted were a pair flying above Helen Creek on 2 June. We found four nesting colonies, one each at Raptor Cliff Sites #1, #3, #9, #10. The colony at site #1 had a few hundred nests, while the others had far fewer nests. Colonies were found from the lower valley on up to the headwaters of the drainage.

Gray Jay

Common resident. The species was seen on the study area in December, March, April, May, June, July, August, September, and November. On 1 December 1978 we saw only one bird, all other times we saw at least several. On 24 May 1979 three adults were seen flying together, apparently non-breeders. On 26 May, four adults were observed feeding together. On 28 May a family group of two adults and three fledglings was seen on the White Spruce Woodland plot. Adults were observed with juveniles from this date until 28 June, when begging juveniles were seen being chased away by adults. Gray Jays were observed in all types of wooded habitats, but most frequently in the White Spruce Forest and White Spruce Woodland.

Common Raven

Uncommon resident. Ravens were observed regularly between 24 May and 7 November, and probably bred in some of the cliff habitats near Mancha

Creek. Most of the observations were of birds flying across the valley, although we saw one pair of Ravens rob a Willow Ptarmigan nest on 14 June. Ravens were also seen being chased and scolded by Whimbrels on 9 and 16 June.

Gray-headed Chickadee

Uncommon breeder. The first bird seen was foraging at the edges between a Tall Willow Thicket and White Spruce Forest near Base Camp on 19 May. Adults were seen regularly in Willow Thickets throughout May and June. On 5 June one adult was observed carrying a bill full of food. On 15 June we saw two fledglings being fed by an adult near Base Camp. Both fledglings had a gray tip to their bill but a yellow-swollen gape. The boundary between gray cap and white side of head was hardly distinguishable. Only a very last bit of natal down was evident around the head. The fledglings gave a buzzy call similar to the adults. They shook their wings while being fed or about to be fed, and were capable of flying the 30 m across Mancha Creek. The adult was foraging on both sides of the creek, giving a "buzz" call and a "purring" call similar to a night frog. The last Gray-headed Chickadee of the season was seen by MacDonald near the cabin on 23 August.

Boreal Chickadee

Rare visitant. One individual was collected near the cabin by MacDonald on 28 August (SOM #292, specimen deposited in Univ. of Ak. Museum; weight 12g, sex unknown, prob.-juvenile).

Uncommon resident. One bird was seen on 23 June standing on a log in Helen Creek, near its confluence with the tributary draining the N. side of VABM Silver. The bird was both calling and singing.

American Robin

Abundant breeder in forest, woodland and shrub habitats. Robins were perhaps the single most abundant and conspicuous species in the wooded habitats. They were apparently present and well into courtship upon our arrival 18 May. Intensive morning and evening singing continued until about 28 May, thereafter we experienced only occasional periods of intensive singing on 1, 4, 25, and 28 June. These were generally after a clearing storm, or the first sunny morning after a stormy period. The first nest was found on 2 June in the White Spruce Woodland plot. The nest was located 1.5 m high in a 3 m tall white spruce tree, and included four incubated eggs. That nest was still incubated on 16 June, but had one hatched young by 21 June. One nest with three hatched young was found on the same plot on 14 June, and was located 1 m high in a very bushy white spruce tree. By 21 June the young of this nest had fledged completely. On 21 June a third nest was found on the White Spruce Woodland. It had two young nearly ready to fledge. The highest breeding density for the species (4.4 pairs/10ha) was observed on the White Spruce Woodland plot. Singing and apparently breeding birds were found far up to the headwaters of Mancha Creek at Raptor Site #9. Birds were seen near Base Camp as late as 9 September.

Varied Thrush

Abundant breeder in forest habitats, uncommon in other woody habitats. Like the robin, Varied Thrushes were well into courtship singing by 18

May. Between 19 and 27 May singing was intense throughout the day but thereafter most singing activity occurred only in the morning and evening. The last courtship singing was heard on 24 June, but the major decline coincided with hatching. A nest containing five incubated eggs was found in the White Spruce Forest plot on 1 June. The nest was located 2 m high in a 14 m tall white spruce. The adults acted quite defensive as we approached. The clutch hatched by 17 June, when four young were seen. On 19 June three young were still in the nest, and by 27 June the nest was predated by the Hawk Owls on the plot. After 26 June we observed some post-breeding singing by male Varied Thrushes.

Swainson's Thrush

Rare summer visitant. A single bird was observed singing in the spruce forest near Base Camp on 29 and 31 May and 1 June.

Gray-cheeked Thrush

Abundant breeder in White Spruce Forests, common breeder in Poplar Forests and Tall Shrub Thickets. The first Gray-cheeked Thrush was observed on 24 May, while active courtship song began 26 May and continued through 15 June. Singing activity became less frequent and more sporadic thereafter. Birds were noted as far upstream as 3 km up the N. Fork of Mancha Creek. Gray-cheeked Thrushes had the highest estimated breeding density of any species on the study area, with 9.0 pairs/10ha estimated for the White Spruce Forest plot. The latest observation of the species was one bird seen on 3 September by Koehl.

Townsend's Solitaire

Rare migrant. One bird was noted singing near the cabin on 20 May.

Arctic Warbler

Uncommon breeder in Tall Willow-Poplar Thickets. The first arrival was noted singing near base camp on 3 June and again in the same location on 14 June. On 15, 18, and 23 June one singing male was observed in Tall Willow-Poplar Thicket 1 km W of base camp.

Ruby-crowned Kinglet

Abundant breeder in White Spruce Forest. Birds were giving intense courtship song all day and night upon our arrival 18 May. Singing activity continued to be intense until the end of May, when it became infrequent and sporadic. Breeding density was the second-highest estimated for any species on the study area, 6.0 pairs/km².

Yellow Wagtail

Rare migrant. One bird was flushed from the willows near base camp on 31 May.

Water Pipit

Common breeder in Alpine Tundra. The first bird noted was one flying over base camp on 20 May. On 22 May and again on 2 June pairs were seen in courtship chases S of Helen Creek. On 23 June four birds were seen on the N-facing slopes of VABM Silver, and on 3 July several birds were observed along the N. Fork of Mancha Creek up to the headwaters near Raptor Site #9.

Bohemian Waxwing

Fairly common summer resident and probable breeder in wooded habitats.

The first birds seen were a flock of four individuals flying over a White Spruce Woodland 1.5 km W of Base Camp on 24 May. The species was seen irregularly in groups through the remainder of May and June. On 28 May a group of six individuals was seen feeding and resting in the White Spruce Woodland plot, and one bird was seen carrying a clump of nesting material which it later dropped. The area was searched but no nests were found.

Northern Shrike

Uncommon summer visitant. One adult was observed in some medium-height shrubs at the edge of a spruce woodland on 22 June.

Orange-crowned Warbler

Fairly common breeder in Tall Willow-Poplar Thickets. The first bird noted was one singing bird in the willow thickets near Base Camp on 24 May. Birds were observed regularly in medium and tall willow thickets during late May and early June. One territory was mapped on the Tall Willow-Poplar Thicket plot.

Yellow Warbler

Fairly common breeder in the more luxuriant Tall Shrub Thickets. The species was predictably present only in the lush, damp, and Tall Alder - Willow Thickets bordering Helen Creek N of VABM Silver. There, at least five different singing males were present on 23 June. Single Yellow Warblers were also heard singing near Base Camp on 2 June, near the Tall Willow-Poplar Thicket on 5 June, and 13 km up the N. Fork of Mancha Creek on 3 July. The latest individual recorded was on 17 August in the willows near Base Camp.

Yellow-rumped Warbler

Common breeder. Yellow-rumped Warblers were probably present on the study area a few days before the first record, which was one bird seen near the cabin on 19 May. The species was regularly observed in forest, woodland and tall shrub habitats through mid-June. Thereafter singing declined markedly. Breeding densities were similar in both the White Spruce Forest (2.5 pairs/10ha) and White Spruce Woodland (2.1 pairs/ 10ha) habitats, whereas the species was recorded as only visiting the Tall Willow-Poplar Thicket plot. Territorial males were observed at timberline S of Helen Creek, and even in the midst of low Willow Thickets adjacent to the White Spruce Woodlands. The latest observation of the species was two individuals seen by Koehl on 22 August near the Base Camp.

Wilson's Warbler

Uncommon breeder. The first record was of a singing male in the Tall Willow-Poplar Thicket plot on 31 May. Territorial males were observed in two other locations--one in a 5-6 m Tall Willow-Poplar Thicket (100 m E of the plot of that name), the other in a Tall Alder-Willow Thicket at Helen Creek due N of VABM Silver.

Rusty Blackbird

Fairly common summer resident and probable breeder. The species was first observed on 19 May when two individuals flew over Base Camp. During the remainder of May and June, Rusty Blackbirds were seen mostly in, or flying over, shrub habitats associated with wet areas. On 24 June a pair was observed scolding a male and female Kestrel near their

nest cavity on the Tall Willow-Poplar Thicket plot.

Pine Grosbeak

Uncommon summer resident and probable breeder. Singing and presumably territorial males were observed in three different locations--near the cabin on 23, 24, 28, 30, and 31 May; 100 m E of the Tall Willow-Poplar Thicket plot on 24 May; and on the White Spruce Forest plot regularly from 27 May to 27 June. The species was usually seen singing in mature white spruces but was seen foraging in willow thickets.

Gray-crowned Rosy Finch

Uncommon summer resident and probable breeder in cliff habitats. Two adults were seen atop the limestone ramparts at Raptor Site #8 on 4 July. The species is probably more common in the mountainous divide areas between Mancha Creek and the Kongakut and upper Firth Rivers.

Redpoll sp.

Common breeder and common winter resident. Most of the individuals seen were of the "hoary" type, but positive identification could not be made at all times. A probable nesting colony was found 50 m W of the White Spruce Woodland plot. Starting on 4 June, groups of 10 were regularly seen on the plot and on 14 and 21 June over 30 individuals were foraging and chasing each other on the plot. We followed the flock for several hours, and they seemed to be feeding on Willow buds and insects, and were centered about 50 m W of the SW corner of the plot. We searched the area where the activity was most consistent, but did not find any nests. Redpolls were seen as far upstream in the N. Fork of

Mancha Creek as Raptor Site #9. The individuals seen in winter also included mostly "hoary" types--27 of 29 were "hoary" types on 10 November 1979, and all 11 seen on 10 March 1980 were "hoary" types.

Pine Siskin

Rare summer visitant. One was seen flying over the Tall Willow-Poplar Thicket plot on 7 June, and one was seen 3 km downstream from Base Camp on 10 June.

White-winged Crossbill

Fairly common (and occasionally abundant) resident. Crossbills were seen on only four occasions during the usual breeding season for other species--a pair was seen flying over the White Spruce Forest plot on 28 May, one individual was seen calling in the same location on 12 June and again on 17 June. In early winter five crossbills were seen, between 7 and 10 November. In late winter a "breeding irruption" was apparently underway. On 9 March, hundreds of adults, many of which were singing males and calling females were observed in the mature White Spruce Forests near the cabin and on the White Spruce Forest plot. Within a 4 km radius of the cabin, well over 1000 Crossbills were estimated to have been present. The singing was as intense as a June morning is for other migrant breeders. Some birds were observed carrying nesting material in the forest behind the cabin on 9 March. The "breeding irruption" was not necessarily restricted to the Mancha Creek area. Jacobson (pers. comm.) reported that singing and apparently breeding males were abundant in the farthest N White Spruce grove in the Sheenjek drainage in March.

Savannah Sparrow

Abundant breeder in Dwarf and Low Shrub Thickets. The first of the species observed was a male singing in the Low Shrub Thicket-Wet Sedge Meadow transect on 21 May. The species was observed singing and foraging regularly on that transect throughout the remainder of May, June, July and August. Savannah Sparrow was the single-most abundant species observed in the Low Shrub Thicket-Wet Sedge Meadow transect, with a density of 2.7 birds/10ha. The latest record is 22 August, for a group including several immatures seen by Koehl in the openings among medium-height willows near base camp.

Dark-eyed Junco

Common breeder. The first adults were seen on 21 May, when 2 males were observed in a territorial chase on the steep N side of the White Spruce Woodland plot. Territorial males were observed throughout May and June in the White Spruce Forest and Woodland habitat types. The species reached its highest breeding density (3.0 pairs/10ha) on the White Spruce Forest plot. Juncos were heard singing as late as 27 June. They were seen throughout August near Base Camp, and the last observation was a small flock seen by Koehl near the cabin on 3 September.

Tree Sparrow

Abundant breeder in Low Shrub Thickets or open White Spruce Woodlands with interspersed low shrubs. The first singing males were observed on 21 May, one on the Low Shrub Thicket-Wet Sedge Meadow transect, the other was in the White Spruce Woodland plot. On 23 May singing activity was noted as increasing and by 3 June it was intense, with birds singing

at mid-day. A nest was found on 14 June, located on the ground at the base of a willow shrub in the White Spruce Woodland plot. The nest was lined with Ptarmigan feathers and contained five incubated eggs. The clutch was hatching on 21 June, when two hatched young were seen. Tree Sparrows were found to be abundant along the entire W. Fork of Mancha Creek and present in small numbers along the N. Fork during the period 3-4 July. The latest observation was of 2 individuals in the medium willows near Base Camp.

White-crowned Sparrow

Abundant breeder in open sections of Tall Shrub Thickets and in open White Spruce Woodlands with interspersed low shrubs. The species was present, and singing upon our arrival to the study area on 18 May. By 20 May White-crowned's were singing intensely from evening until mid-morning; on 25 May singing was noted to be most intense around midnight. The species was most abundant in the White Spruce Woodlands plot, with 3.1 pairs/10ha, whereas only 1.0 pairs/10ha was observed on the Tall Willow-Poplar Thicket plot. One nest was found on the former plot, concealed in the midst of a dense 1 m-tall willow patch within open White Spruce Woodland. The nest contained five young nearly ready to fledge. On 3-4 July White-crowned Sparrows were determined to be abundant along the W. Fork of Mancha Creek as far as 38 km upstream from Base Camp. They were also found in lower numbers along the N. Fork of Mancha Creek (3-4 July) and at upper Joe Creek. Flocks of up to 12 individuals were observed foraging in the openings among the willows near Base Camp between 17 and 22 August.

Fox Sparrow

Common breeder in Tall Shrub Thickets, especially at the edges near White Spruce Forest and streamside openings. The species was first seen singing at Base Camp on 18 May. Territorial males were observed in several localities during late May and early June--in Shrub Thickets along Helen Creek, and along Mancha Creek where it runs adjacent to Tall Shrub Thickets and White Spruce Forest from 4 km upstream of Base Camp to 3 km downstream of Base Camp. On 24 June an adult was observed carrying food in its bill on the Tall Willow-Poplar Thicket plot.

Lapland Longspur

Uncommon migrant in lower portions of valley; uncommon summer resident and probable breeder in Alpine Tundra of headwater areas. On 27 May two males and two females were identified in a mixed species flock (also including a few Smith's Longspurs) on the Wet Sedge Meadow transect. On 3 July one bird was observed calling near Raptor Site #7, in an alpine meadow along the N. Fork of Mancha Creek.

Smith's Longspur

Common breeder. The first arrival noted was on 27 May, one male within a mixed species flock of 20 longspurs (most of which were Lapland Longspurs) on the Wet Sedge Meadow Thicket. By 30 May, Smith's Longspurs were commonly observed foraging and singing in Wet Sedge Meadows. On 3 and 4 June two males were observed singing less than 6-10 m apart and only one female was noted in the area. No aggression among the males was noted. Following the singing, all three birds flew a long distance away. One nest was found in a moist sedge meadow halfway between First

and Second Wetlands. The nest was located at the base of an Eriophorum tussock, and was more deeply concealed than a Lapland Longspur nest. Four incubated eggs were contained in the nest. Several singing males were observed within 50 m of the nest. These observations cause one to wonder about polyandry in Smith's Longspurs despite the occurrence of polygamy in Lapland Longspurs. Smith's Longspurs were abundant in the extensive Tussock Meadows along the upper W. Fork of Mancha Creek, 3-4 July. They were less numerous along the N. Fork of Mancha Creek, perhaps because of the prevalence of drier types of Alpine Tundra. The latest observation was of one individual seen on the Wet Sedge Meadow transect by Koehl on 16 August.

MAMMALS OF THE MANCHA CREEK DRAINAGE

by

Michael A. Spindler and Stephen O. MacDonald¹

Objectives of the mammal surveys were to determine the status, distribution, and relative abundance of mammal species in the Mancha Creek area.

METHODS

Observations were made on an opportunistic basis during the course of vegetation and bird surveys. Additionally, small mammal trapping was conducted on the five avian census plots during 23-27 August 1979. A single straight line transect, consisting of 20 trap stations, was established in each habitat. Spaced every 15.2 m, each trap station had two baited "Museum Special" snap-traps set within 1 m of the station centerpoint. Traps were set for three consecutive nights and checked daily. Mammal nomenclature follows MacDonald (1978).

RESULTS AND DISCUSSION

From the small mammal trapping effort, a total of 27 individuals were taken during 600 trap nights of effort (Table 15). This total included 16 Northern Red-backed Voles (Clethrionomys rutilus),

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Table 15. Results of small mammal trapping, Mancha Creek, Alaska, 23-27 August 1979.

Plot	Number of trap nights	<u>Clethrionomys</u>	<u>Microtus</u>	<u>Sorex</u>
		<u>rutilus</u>	<u>oeconomus</u>	<u>cinereus</u>
Tall Shrub Thicket	120	13		
White Spruce Forest	120			
White Spruce Woodland	120	2		
Low Shrub Thicket- Wet Sedge Meadow	120		8	2
Wet Sedge Meadow	120	1		1
Total	600	16	8	3

8 Tundra Voles (Microtus oeconomus), and 3 Masked Shrews (Sorex cinereus). Trap disturbance by Snowshoe Hares (Lepus americanus) in the Tall Willow-Poplar Thicket was high. Arctic Ground Squirrels (Spermophilus parryii) were a minor disturbance factor on the White Spruce Woodland plot. Details of trapping data and a summary of opportunistic observations are given in the following annotated species list.

Masked Shrew (Sorex cinereus)

Three Masked Shrews were captured in the study area. Two were taken on the Low Shrub Thicket-Wet Sedge Meadow transect, and one on the Wet Sedge Meadow transect. One of the three animals was a lactating female. The capture locations, and the findings of Wrigley et al. (1979) indicate a preference for wet or moist sites having dense low shrub and/or herbaceous vegetation. Masked Shrews range from northeastern Siberia (Corbet 1978), through most of Alaska, Canada, and northern continental United States (Hall and Kelson 1959).

Snowshoe Hare (Lepus americanus)

Abundant resident in Medium and Tall Shrub Thickets. On 19 May an individual that still had white feet was seen near Base Camp. The species was seen commonly as individuals or in small groups throughout May, June and July. On 20 May two hares were seen chasing each other; and on 1 June, a group of five different hares were seen chasing each other in circles in the open willows near Base Camp. The animals were adults, so it may have been a breeding-related chase.

On 15 June a juvenile hare, about 15 cm long was first seen near the cabin. On 10 November 1979, and again on 9 March 1980, hares were observed to be very common around the cabin. The population was probably reaching a maximum, since evidence of overbrowsing was abundant in the Willow Thickets surrounding the cabin. Food may have been so scarce to have caused the hares to gnaw on the logs of the cabin and plywood corners of the out-house.

Arctic Ground Squirrel (Spermophilus parryii)

Common resident in well-drained soils of alpine ridges, slopes, and river terraces. The species was first observed on 21 May on the south-facing slopes of the White Spruce Woodland plot. Ground Squirrels were also seen on well-drained gravel terraces along Mancha Creek. On 15 June an individual foraging on a small gravel island in Mancha Creek was observed to swim 10 m across the creek ("dog paddle style") in an effort to escape the observers approach. On 23 June the skull and tail remains were found at a raptor perching site 1000 m in elevation on VABM Silver. On 4 July two juveniles were observed above the ground along the N. Fork of Mancha Creek, 8 km upstream from the confluences with the W. Fork. Prey remains were observed in raptor **site #3 on 3 July.**

Beaver (Castor canadensis)

Uncommon resident. Active Beaver dams and ponds were observed in sloughs of the Firth River at 68° 36'N, 141° 06'W on 18 May 1979. Freshly-chewed poplar sticks were evident.

Northern Red-backed Vole (Clethrionomys rutilus)

Common resident. Of the 16 individuals caught in snap traps, 13 were taken in riparian Tall Willow Poplar Thicket, two in the White Spruce Woodland plot, and one near the shrubby edge of the Wet Sedge Meadow plot. Two of the five females captured were pregnant with five embryos each.

Ecologically, this species is fairly ubiquitous in a large range of habitats. Its local distribution is tied closely to the presence of overhead cover (Guthrie 1968). This cover can be provided by dense low shrub vegetation, litter and other debris, sedge-shrub tussocks, or even rocks and boulders. Wet sites are avoided.

The Northern Red-backed Vole is a holarctic species which ranges through northern Eurasia, almost all of Alaska, and the northwestern third of Canada (Corbet 1978, Hall and Kelson 1959).

Tundra Vole (Microtus oeconomus)

Common resident. The eight tundra voles caught in the study area were taken in the Wet Sedge Meadow transect. Two of the six females taken were pregnant with three and four embryos.

This species has a wide tolerance to different habitats, but is most common in non-forested, wet or moist lowlands dominated by herbaceous vegetation.

Tundra voles are holarctic in distribution, ranging from northern and central Eurasia, throughout most of Alaska, and the northwestern corner of Canada.

Singing Vole (Microtus miurus)

Locally common resident. A few individuals were observed near Raptor Site #9, North Fork of Mancha Creek, on 4 July.

Porcupine (Erethizon dorsatum)

Uncommon resident in wooded habitats. Two individuals were seen, one in the White Spruce Forest near the cabin on 2 June, and one on the Tall Willow Poplar Thicket plot on 7 June. Porcupine-girdled trees were observed in the White Spruce Woodland plot as well.

Wolf (Canis lupus)

Uncommon resident. Wolf tracks were observed on a sand bar along Mancha Creek near the Tall Willow-Poplar Thicket plot on 24 May.

Red Fox (Vulpes vulpes)

Common resident. On 4 June one adult was observed crossing the White Spruce Woodland plot. On 21 June an individual was seen running across the Wet Sedge Meadow transect towards the White Spruce Woodland plot. Fresh tracks in the snow were observed on the White Spruce Woodland plot on 10 November.

Brown (Grizzly) Bear (Ursus arctos)

Fairly common resident. Bears were observed seven times between May and August. On 18 May we discovered that our cached food supply had been eaten by a bear. Examination of scats indicated that prior to the bear's visit to our cache, it was eating moose and caribou. During the visit, scats changed from predominantly moose and caribou hair to pieces of plastic, foil, paper, and even shreds of tin can. On 5 June a fresh set of tracks was seen in the Tall Willow-Poplar Thicket plot. A small blonde bear, probably 2-3 years old, was seen crossing Mancha Creek near base camp on 11 June. On 13 June the field crew was awoken by a grizzly tearing down the cook tent. Fresh tracks in the snow indicated that it was a very large bear, and evidently knew which types of containers could be readily opened. The bear ignored ammunition boxes full of food, but began rolling around an oil barrel full of food (in the 18 May observations, bears had emptied three full barrels of food, but could not open ammunition boxes).

On 16 June D. Livingston saw one large dark brown bear foraging near Wetland Number 2. On 3 July one large blonde bear was seen digging for ground squirrels at Raptor Site #7, on the North Fork of Mancha Creek. Between 6 July and 9 August a small bear had broken into the cabin and destroyed some building materials. One bear was seen by Koehl in the small slough in front of the cabin on 16 August. On 28 August, one adult was seen crossing a Low Shrub Thicket heading toward the hills near VABM Silver.

Based on the timing, and the color and size of the animals seen, an estimated five bears were frequenting the lower Mancha Creek area, within 10 km of the cabin.

Marten (Mustela erminea)

Uncommon resident. On 10 November a set of fresh tracks was observed on the White Spruce Forest plot. On 9 March 1980 Ross observed a Marten as it jumped behind a woodpile at the cabin.

Least Weasel (Mustela nivalis)

Probably a fairly common resident. One individual was observed and photographed while foraging in alpine tundra near Raptor Site #8 on 3 July 1979. The species was probably more common than indicated from casual observations.

Moose (Alces alces)

Common winter resident, uncommon summer resident. Moose winter in Mancha Creek in fairly high numbers. On a 26 September 1977 aerial survey, Benvenuti observed 11 moose (5 bulls, 3 cows, and 3 calves) within the Mancha Creek drainage. Bull, cow, and yearling moose were observed regularly between 18 May and 16 June 1979, while no moose were seen during the interval 17 June to 6 July. The first evidence of calves was two sets of fresh tracks seen on 7 June near the Tall Willow-Poplar Thicket plot. Moose were observed again by 26 August.

Caribou (Rangifer tarandus)

Occasionally abundant migrant, occasionally abundant winter resident, otherwise uncommon resident. During April 1979 caribou were abundant in the upper Firth River and middle Mancha Creek drainages. Tracks indicated that caribou had apparently wintered in the area, 1978-1979. On 8 April 1979 several hundred caribou were seen along Helen Creek. On 18 May 1979, a group of eight was observed along Bilwaddy Creek, and a group of five was seen near Helen Creek. By 21 May the first major migration through the study area was in evidence, with 74 seen 1 km S of base camp. Daily totals during migration 22-31 May, and 1-5 June were, respectively, 22, 33, 30, 24, 34, 7, 100, 4, 12, 11, 89, 100, 100, 50. Those observations included only animals that could be seen within a 3 km radius of base camp during walks to and from census plots. Direction of movement was upstream, generally toward the Kongakut River and Joe Creek. By 6 June, the number of caribou seen each day had declined to less than 15. June 10 was the first day that we did not see any caribou, however, tracks seen on a gravel bar on 16 June, and a lone individual seen on 3 July indicated that at least a few animals remained in the area after the main migration. Caribou were not seen on the study area after 3 July 1979, including several subsequent trips to the study area in August, September, and November 1979, and March 1980. Two caribou were seen at the pass between the upper Firth River and upper Coleen River on 8 November 1979.

Observations of foraging activity in late May and early June indicated that caribou were feeding extensively on greening sedges in wet meadows

along the river flats and within White Spruce Woodlands on south-facing hillsides. By 6 June, we noted that most of the caribou near base camp were feeding on greening willow leaves.

LITERATURE CITED

- American Ornithologists' Union. 1957. Check-list of North American birds. Fifth ed. A.O.U., Baltimore. 691 pp.
- American Ornithologists' Union. 1973. Thirty-second supplement to the American Ornithologists' Union check-list of North American birds. Auk 90:411-419.
- American Ornithologists' Union. 1976. Thirty-third supplement to the American Ornithologists' Union check-list of North American birds. Auk 93:875-879.
- Argus, G.W. 1973. The genus Salix in Alaska and the Yukon. Natl. Mus., Nat. Sci. (Ottawa) Publ. Bot. 2. 279 pp.
- Balph, M.H., L.C. Stoddart, and D.F. Balph. 1977. A simple technique for analyzing bird transect counts. Auk 94:606-607.
- Batten, A.R. 1977. The vascular floristics, major vegetation units, and phytogeography of the Lake Peters area, northeastern Alaska. M.S. Thesis, Univ. of Alaska, Fairbanks. 330 pp.
- Batten, A.R. and C. Batten. 1975. Sheenjek River, 1975 field report. Xerox report in files of U.S. Fish and Wildlife Service, Fairbanks, Alaska. 72 pp.
- Benvenuti, P. 1977. Moose surveys in the Coleen and Firth River drainages, Arctic National Wildlife Range. Memo in files of U.S. Fish and Wildlife Service, Fairbanks, Alaska. 2 pp.
- Corbet, G.B. 1978. The mammals of the palearctic region: a taxonomic review. Cornell University Press, Ithaca, N.Y.
- Cottam, G. and J.T. Curtis. 1956. The use of distance measures in phytosociological sampling. Ecology: 451-460.
- Drew, J.V., and R.E. Shanks. 1965. Landscape relationships of soils and vegetation in the forest-tundra ecotone, Firth River, upper Firth River Valley, Alaska-Canada. Ecol. Monogr. 35:285-306.
- Guthrie, R.D. 1968. Paleoecology of the late Pleistocene small mammal community from interior Alaska. Arctic 21:223-244.
- Hall, E.R. and K.R. Kelson. 1959. The mammals of North America. Ronald Press, New York.
- Hettinger, L., and A.J. Janz. 1974. Vegetation and soils of northeastern Alaska. Arctic Gas Biological Report Series 21, prepared by Northern Engineering Services, Co., Ltd. 206 pp.
- Hultén, E. 1968. Flora of Alaska and neighboring territories. Stanford University Press, Stanford. 1008 pp.

- Kessel, B. 1980. Avian habitat classification for Alaska. Murrelet 60:86-94.
- Kessel, B. and G.B. Schaller. 1960. Birds of the upper Sheenjek Valley, northeastern Alaska. Biol. Pap. Univ. Alaska No. 4. 59 pp.
- Kessel, B. and D.D. Gibson. 1978. Status and distribution of Alaska Birds. Studies in Avian Biology No. 1. 100 pp.
- Lenarz, M., J. Klingel, R. Quimby, and D.G. Roseneau. 1974. Moose studies in Northeastern Alaska, with emphasis within the Canning River Drainage. Arctic Gas Biological Report Series 24, prepared by Renewable Resources Consulting Services, Ltd. 31 pp.
- MacDonald, S.O. 1978. Check-list: Mammals of Alaska, University of Alaska Museum.
- Magoun, A.J. and M. Robus. 1977. A preliminary investigation of critical habitat types for birds on the arctic coastal plain, Arctic National Wildlife Range, U.S. Fish and Wildlife Service, Fairbanks, Alaska. 96pp.
- Martin, P. 1976. Annotated list of birds from northeast Alaska: observations from Beaufort Lagoon and the Kongakut River. Xerox report in files of U.S. Fish and Wildlife Service, Fairbanks, Alaska.
- Mouton, M. 1978. Botanical description of the major tundra habitats on the Okpilak River delta study area, Arctic National Wildlife Range, Alaska. p. 60-79 in Spindler 1978.
- Mulligan, G.A. 1974b. Cytotaxonomic studies of Draba nivalis and its close allies in Canada and Alaska. Can. J. Bot. 52:1793:1801.
- Mulligan, G.A. 1976. The genus Draba in Canada and Alaska: key and summary. Can. J. Bot. 54:1386-1393.
- Roseneau, D.G. 1974. A continuation of studies of raptorial bird nesting sites along proposed pipeline routes in Alaska. Prepared by Renewable Resources Consulting Services, Ltd. 71 pp.
- Roseneau, D.G., P. Stern, and C. Warbelow. 1974. Distribution and movements of the Porcupine Caribou Herd in Northeastern Alaska. Arctic Gas Biological Report Series 22, prepared by Renewable Resources Consulting Services, Ltd. 197 pp.
- Roseneau, D.G., J. Curatolo, and G. Moore. 1975. Distribution and movements of the Porcupine Caribou Herd in Northeastern Alaska and Yukon Territory, 1974. Arctic Gas Biological Report Series 32, prepared by Renewable Resources Consulting Services. 104 pp.
- Roseneau, D.G., and J. Curatolo. 1976. Distribution and movements of the Porcupine Caribou Herd in Northeastern Alaska and the Yukon Territory, 1975. Arctic Gas Biological Report Series 36, prepared by Renewable Resources Consulting Services. 82 pp.

- Salter, R. and R.A. Davis. 1974. Surveys of terrestrial bird populations in Alaska, Yukon Territory, Northwest Territories and Northern Alberta, May, June, July 1972. Arctic Gas Biological Report Series 12. Prepared by L.G.L. Limited.
- Spetzman, L.A. 1959. Vegetation of the Arctic Slope of Alaska. U.S. Geol. Surv. Prof. Pap. 302-B. 58 pp.
- Spindler, M.A. 1978. Bird populations and habitat use in the Okpilak River delta area, Arctic National Wildlife Range, Alaska. Xerox report in files of U.S. Fish and Wildlife Service, Fairbanks, Alaska. 83 pp.
- Spindler, M.A. and B. Kessel. 1980. Avian populations and habitat use in interior Alaska taiga. Syesis: in press.
- Svensson, S. 1970. Recommendations for an international standard for a mapping method in bird census work. Audubon Field Notes 24:727-736.
- Warbelow, C., D.G. Roseneau, and P. Stern. 1975. The Kutchin caribou fences of northeastern Alaska and the northern Yukon. Arctic Gas Biological Report Series 32. Prepared by Renewable Resources Consulting Services.
- Wrigley, R.E., J.E. Dubois, and H.W.R. Copland. 1979. Habitat, abundance, and distribution of six species of shrews in Manitoba. J. Mammal: 60:505-520.