U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

KOYUKUK/NOWITNA REFUGE COMPLEX

Galena, Alaska

ANNUAL NARRATIVE REPORT

Calendar Year
1996

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1996

KOYUKUK NWR

NORTHERN UNIT, INNOKO NWR

KOYUKUK/NOWITNA NATIONAL WILDLIFE REFUGE COMPLEX

Galena, Alaska

REVIEW AND APPROVALS

James R. Good, Acting — Complex Manager — 1-19-99 — Date

Acting Refuge Supervisor ~~GARD-N~~ — 05/30/2000 — Date

Regional Office Approval — 10/27/00 — Date

INTRODUCTION

This Annual Narrative Report is for the Koyukuk, Northern Unit of Innoko and Nowitna Refuges. These three refuges are administered collectively as the Koyukuk/Nowitna Refuge Complex. Narrative items common to all three units are discussed in the Koyukuk and Northern Unit of Innoko report. Any additional events are reported in respective sections.

Refuge office/headquarters gets a new look in 1996!

The **Koyukuk National Wildlife Refuge** (NWR) is located in west central Alaska, about 270 air miles west of Fairbanks and 330 air miles northwest of Anchorage. The exterior boundaries encompass 4.6 million acres, an area slightly smaller than the state of New Jersey. This refuge lies within the roughly circular floodplain basin of the Koyukuk River. The extensive forested floodplain is surrounded by hills 1500' - 4000' on the north, east, and west, and the Yukon River to the south.

The Koyukuk NWR was established December 2, 1980 with passage of the Alaska National Interest Lands Conservation Act (ANILCA). The refuge was established and is managed for the following purposes:

1. To conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, waterfowl and other migratory birds, moose, caribou, furbearers and salmon;

2. To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitat;

3. To provide the opportunity for continued subsistence uses by local residents; and

4. To ensure water quality and necessary water quantity within the refuge.

The refuge contains a 400,000 acre wilderness surrounding the 16,000 acre Nogahabara Sand Dunes, one of only two active dune fields in Alaska. Access to the refuge is by boat, aircraft, or snowmobile.

The **Northern Unit of the Innoko NWR** (known locally as the Kaiyuh Flats) encompasses 750,800 acres. Located south of the Yukon River, its northeastern boundary is directly across the river from the town of Galena. The Innoko Refuge was also established by ANILCA and is characterized by a wide, lowland interlaced by sloughs, creeks, and lakes. The gently rolling foothills of the Kaiyuh Mountains along the southeastern border rise to 2,000 feet. Only the first purpose for the Innoko Refuge differs from the Koyukuk Refuge. This purpose is:

1. To conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, waterfowl, peregrine falcons, other migratory birds, black bear, moose, furbearers, and other mammals and salmon.

Vegetation types of the Koyukuk and Northern Innoko units are typical of the boreal forest or taiga of interior Alaska. The lowland boreal forest of spruce, birch, and aspen gradually merges with tundra vegetation near 3,000 feet. Black spruce bogs with poorly drained permafrost soils are a dominant feature of the area. Large pure stands of white spruce can be found along rivers where soils are better drained. Dense willow

and alder are common along the rivers and sloughs. Winter ice scours sand bars which promotes a lush regrowth of vegetation each year. Numerous fires have set back vast areas to earlier seral stages consisting of aspen, birch, and willow. The most prominent characteristic of these refuges is the extensive mosaic of the vegetation types.

Perhaps the greatest value of the Koyukuk Refuge is its productive breeding areas used by waterfowl from the four migratory flyways. Thousands of waterfowl, primarily wigeon, pintail, scaup, white-fronted geese and Canada geese are joined by both tundra and trumpeter swans on the Koyukuk's lush breeding grounds each spring. Refuge streams and lakes also sustain large fish populations that support subsistence, commercial and sport fisheries. King, silver, and chum salmon migrate up the waters of the Yukon River and its tributaries, including the Koyukuk River. These three fish species are important in the region's subsistence and financial economies.

Major programs of the Complex include resource inventory, management related research, subsistence management, wildfire management, and information/education programs. Field investigations collect baseline data and quantify fish, bird, mammal, and habitat resources. An information and education program that stresses communications with the eight villages in or near the Complex is vital to the management of these natural resources.

The Complex staff currently has: 9 permanent, 3-7 temporary (varies seasonally), 2 term appointments, and 1 TAPER position. Facilities include a leased office and cold storage facility, three administrative cabins, nine government residences, and several smaller cold storage buildings.

The Koyukuk/Nowitna Refuge Complex headquarters is in Galena, a village located on the Yukon River. Galena was established about 1919 as a supply point for the mining of galena (lead sulphite ore) south of the Yukon River. Galena serves as a transportation hub for nearby villages. More like a town than a village, Galena has the advantages of direct air service to Fairbanks, modern communications, river access, two general stores, a K-12 school, health clinic, and a retail outlet for boats, motors, snowmachines and generators. The population of Galena is approximately 500 and includes approximately equal numbers of Alaska Natives and non-Natives. Many Galena residents depend on a subsistence lifestyle of fishing and hunting. The U.S. Air Force, commercial airlines and general aviation jointly use the Galena Airport. The U.S. Air Force Base formerly supported two F-15 Eagle interceptor aircraft, but the entire base was put in "caretaker" status as of October 1, 1993. A discussion of the base closure is included in Section J.3

INTRODUCTION

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G. WILDLIFE

H. PUBLIC USE

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

K. FEEDBACK

A. HIGHLIGHTS

E.4. Refuge volunteers provided over 2,400 hours of resource and public use work.

H.17. Refuge officers spent more time this year on enforcement activities during the moose season.

I.4. A new 1,000 gallon vaulted fuel tank was installed.

J.1. Gana-A'Yoo, Ltd./Refuge Challenge Cost Share Agreement continues to be a success.

J.2. ROS/Pilot Mike Spindler and Huslia residents Steven and Catherine Attla receive the "Goldie Award" for the Raven's Story radio broadcasts.

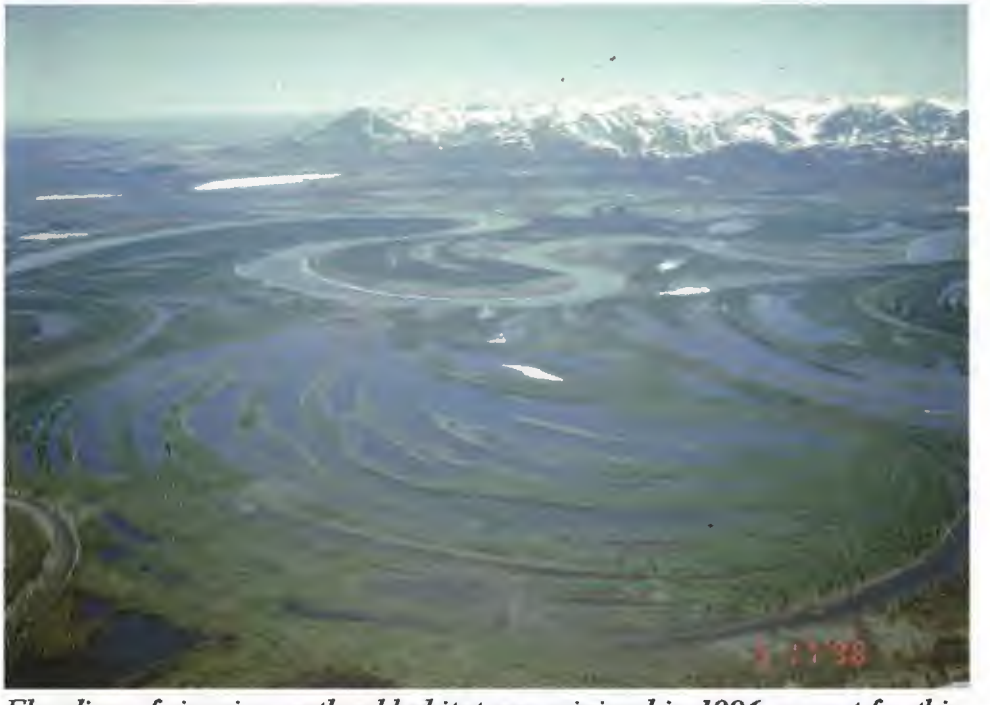
H.20. Conflicts occur between subsistence and non-subsistence moose hunters on the Koyukuk River.

B. CLIMATIC CONDITIONS

The climate of western interior Alaska is subarctic/continental with warm pleasant summer weather during June, July and August and generally cold, but calm weather from October to early April. The winters in the Galena area tend to fluctuate between periods of extreme cold (-70°F), caused by clear skies and no wind, to milder temperatures (-20°F to +20°F) with clouds, snow, and light to moderate winds. In interior Alaska the moderating effect from Bering Sea and Pacific storm fronts increases the farther west one proceeds. By late winter, the snowpack in the valley bottoms averages 2-3 feet. The months of April and May are transitional, with the arrival of most waterfowl in late April and breakup of the Yukon River ice in early to mid-May. Green-up of the trees and shrubs begins in late May. Summer daytime temperatures in the western Interior generally range from 50-70°F; however, extreme highs have exceeded 90°F. Compared to Fairbanks, summers in the Galena area are generally cooler, with more overcast skies and precipitation. Perhaps the most pleasant time of the year is late August to early October when cool nights, warm days, and dying vegetation spell the end of the bug season and the start of hunting season.

Temperatures during 1996 were at or near the long term averages during five months--January, April, June, July and November (Figure B.1). The year began with less than normal snow cover and normal temperatures, but the mean temperature rose above the long-term normals in February, March and May. The Yukon River ice at Galena first moved on May 14th and took several days to finish moving out (Table B.1). The 1996 ice-out date was two days later than the average since USFWS began keeping records in

1983, but seemed later to many people because of the early break up the previous year. The ice was thick due to below average snow cover and extreme cold in late 1995, and local officials were worried about flooding, but the threat subsided as most of the ice moved out by May 16th. On Koyukuk NWR breakup also went easy. On May 7, Dulbi River and Slough, and the Koyukuk River near Huslia had ice cover with moats and breaks; by May 17 all were open and flowing. Flooding was minimal, except for an isolated ice jam flood in the Treat Island area on May 17th.



Flooding of riparian wetland habitat was minimal in 1996, except for this localized ice-jam flood near Treat Island, north of Huslia. (MAS)

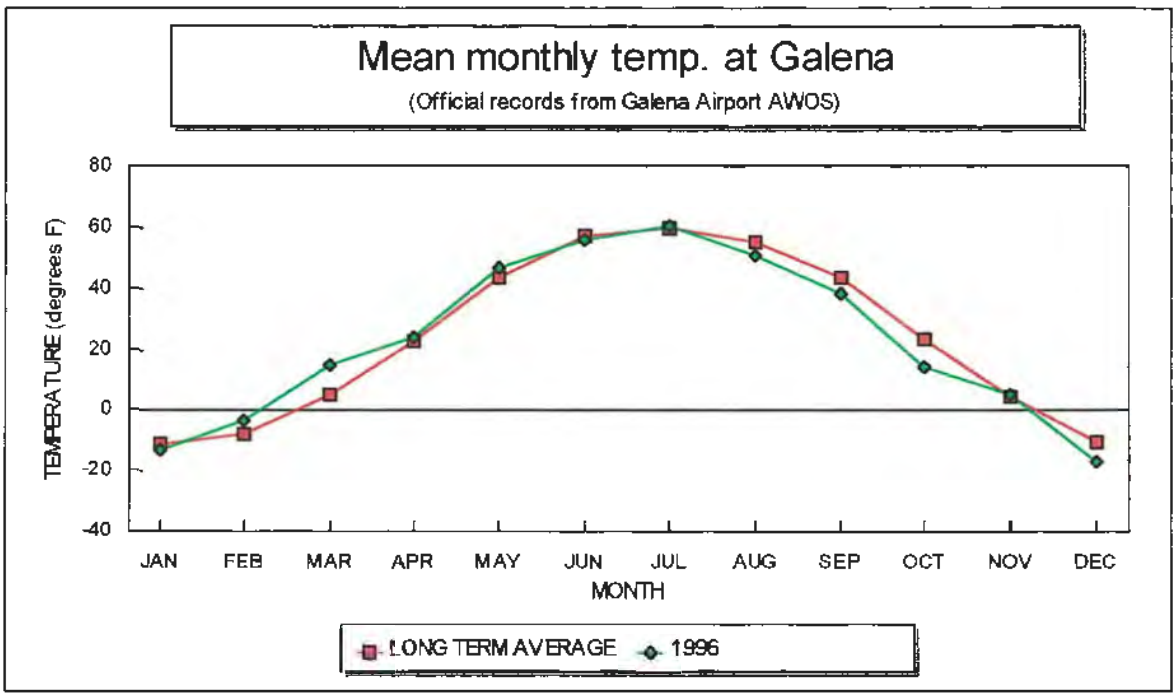


Figure B.1. Mean monthly temperature based on archived automated observations from Galena Airport (courtesy of Rick Thoman, National Weather Service, Fairbanks, AK.)

Table B.1. Break-up and freeze-up dates of the Yukon River at Galena, Alaska.

	Breakup (first ice movement)	Freeze up (ice stoppage)
1983	May 10	
1984	May 18	
1985	May 22	
1986	May 19	
1987	May 17	
1988	May 7	October 14
1989	May 7	October 25
1990	May 7	October 25/26
1991	May 7	November 1
1992	May 25	October 20
1993	May 12	November 3
1994	May 7	November 4
1995	May 2	October 30
1996	May 14	October 21
1997	May 7	
Mean	May 12	October 26

Temperatures in August, September, October and December were below average. The Yukon River ice stopped flowing on October 21, five days earlier than average. Early winter in 1996 had about average snowfall and accumulation because we were able to conduct moose surveys in November on schedule. During 1996 we did not have a full year of precipitation records available due to reduced observations at the Galena Air Force Base. The local radio station, KIYU, took over such observations late in 1996. In 1996 the nearest stations with complete climatological records were McGrath and Tanana, both over 100 miles from Galena.

D. PLANNING

5. Research and Investigations

The following approved refuge wildlife studies were active during 1996. Progress reports are available from the Complex office or the Alaska Resource Library in Anchorage. A brief report from each study is included in the appropriate sections of the Koyukuk and Nowitna narratives.

Nesting ecology and habitat requirements of white-fronted geese (Anser albifrons). This study was originally proposed and approved for Nowitna NWR in 1987. One season of field work occurred in 1987 and a progress report was completed in 1988. The study was then moved to Koyukuk NWR in 1991 because of historically low numbers of the species on the Nowitna, and the indication of a decline from former abundance on the Koyukuk. Progress reports were written in 1996. Results of the 1996 work are reported in Section G.3.

Foraging dynamics of moose in the Three Day slough area, Koyukuk, River. This project was proposed in 1994 and funded cooperatively by the USFWS, ADFG, and the University of Alaska, Institute of Arctic Biology. The emphasis of the study was to determine if the Three-Day Slough moose range was becoming overbrowsed due to high winter moose density. The investigation was conducted by Dr. Knut Kielland, who was assisted by Tim Osborne and Lisa Saperstein. Results of the 1996 work are reported in Section G.8.

In response to concerns regarding sustainability of a growing northern pike sport fishery on the Kaiyuh Flats, in 1994 we requested a study entitled *Seasonal migrations of northern pike in the Kaiyuh Flats, Innoko National Wildlife Refuge, Alaska.* The study was conducted cooperatively by USFWS Fisheries Resources Office and the ADF&G Sport Fish Division. A final report was prepared in 1996 and an abstract appears in Section G.11.

Water quality and metal and metalloid contaminants in sediments and fish of Koyukuk, Nowitna, and the Northern Unit of Innoko National Wildlife Refuges, Alaska, 1991.

This study was initiated on the Complex in 1985. Periodic sampling was conducted on the Koyukuk, Nowitna, and Northern Unit of the Innoko Refuges. The objectives of the study were to quantify the level and distribution of elevated mercury concentrations, compare heavy metal concentrations between watersheds with placer mining and those known to be free of previous mining activity, and determine the level of contaminants in wildlife resources that use known contaminated watersheds. A final report of 1991 field sampling was completed by USFWS Northern Alaska Ecological Services during 1996. A summary of the study results is presented in Section G.11 of the *Nowitna* Narrative.

E. ADMINISTRATION

1. Personnel

a. Permanent

1. Thomas J. Eley, Jr., Refuge Manager, GS-485-13, EOD 5/2/94, PFT
2. James R. Good, Deputy Refuge Manager, GS-485-12, EOD 4/28/96, PFT, transfer from Havasu NWR
3. Michael A. Spindler, Refuge Operations Specialist/Airplane Pilot, GS-485-12, EOD 2/11/90, PFT
4. Paul A. Liedberg, Refuge Operations Specialist/Airplane Pilot, GS-485-12, EOD 2/11/90, PFT, transferred to Yukon Delta NWR 5/25/96
5. Peter G. DeMatteo, Refuge Operations Specialist, GS-485-9, EOD 12/01/91, PFT
6. Walter (Buddy) N. Johnson, Wildlife Biologist, GS-486-11, EOD 5/21/89, PFT
7. Robert A. Rebarchik, Fire Management Officer, GS-401-11, EOD 9/3/95, PFT, transfer from Witchita Mountains NWR
8. Colin B. Brown, Airplane Pilot, GS-2181-12, EOD 4/20/84, PFT, Local Hire
9. Orville H. Huntington, Wildlife Biologist, GS-486-5, EOD 11/12/95, PFT, transfer from Arctic NWR
10. Heather N. Johnson, Park Ranger, GS-025-7, EOD 7/8/91, converted to PFT effective 3/5/95
11. Maudrey M. Honea, Administrative Technician, GS-318-6, EOD 10/7/85, PFT, Local Hire
12. Rosie M. Cassou, Refuge Clerk, GS-303-4, EOD 6/12/95, TFT, Local Hire, converted to PFT effective 9/17/95
13. Bernard Attla, Maintenance Worker, WG-4749-8, EOD 9/23/91, TAPER, FT-Seasonal

b. Term

14. Lisa B. Saperstein, Wildlife Biologist, GS-486-9, EOD 5/30/93, FT
15. Marlene R. Marshall, Biological Technician, GS-404-5, EOD 7/15/93, FT, converted to term position 3/5/95.

c. Temporary

16. Jenny M. Lowe, Biological Technician, GS-404-5, EOD 5/6/96, LWD 8/23/96 Local Hire, TFT
17. Delia Person, Biological Technician, GS-404-5, EOD 5/26/96, LWD 9/28/96, TFT
18. John Lane, Biological Technician, GS-404-5, EOD 5/31/96, LWD 11/9/96, TFT
19. Win Staples, Biological Technician, GS-404-5, EOD 5/30/95, LWD 1/11/96, TFT
20. Jean Fujikawa, Biological Technician, GS-404-7, EOD 7/10/96, LWD 10/11/96, TFT
21. Rachael Kangas, Refuge Clerk, GS-303-4, EOD 6/18/96, TFT, Local Hire, LWD 8/9/96
22. Hudson Sam, Maintenance Worker, WG-4749-5, EOD 7/14/96, LWD 9/14/96, TFT

d. Volunteer

Jack Moermond
Jean Moermond
Tom Paragi
Adam Eley
Judy Redmond
Karen Lehmkuhl
Win Staples
Llarissa Sommer
Laurie Good
Maryanne Dickey
Larry Wholecheese, Jr.
Zach Brown
Clinton Brown
Gunnar Carnwath

As our personnel listing above shows we had a number of changes during the year. Jim Good arrived in Galena with his family on August 27. Jim came from Havasu NWR where he had served as Refuge Manager for over 12 years. See the refuge staff photograph that follows.

Refuge staff, front row L-R,6,10,14,9,12,11,4; back row L-R 7,1,5,8,16,13. Not present 2 and 3.

2. Youth Programs

Larry Wholecheese, a sophomore at Galena City School, spent eight weeks working with field crews on waterfowl banding, Gisasa River salmon weir, and goose production float trips. Being a person who spends a lot of time outdoors, Larry was field savvy. Field staff from the Fairbanks Fisheries Resource Office reported that he did an excellent job working at the Gisasa Weir. Two shortfalls in the program that we will look to improve next year are: 1) finding tasks to keep the student busy between field projects, and 2) close counsel with the student to evaluate their performance throughout the work experience.

Larissa Sommer, a Galena resident and junior at Mount Edgecomb High School in Sitka, AK spent a total of 18 hours engaged in a variety of activities as part of her requirements for her American Government class. She researched refuge objectives and management programs, interviewed staff on moose hunting on the Koyukuk Refuge (a issue of interest to the community), visited a duck banding site, assisted with songbird banding and helped with an environmental education project for local schools. Larissa showed interest, responsibility and commitment - it was refreshing to work student with so much potential.

4. Volunteer Program

The refuge was fortunate to have 16 volunteers who contributed a total of 2,487 hours to resource support and public use programs. Volunteers participated in small mammal trapping, songbird banding, goose production and moose trend surveys, data analysis,

report writing and the development of environmental education materials. One of the volunteers who assisted with small mammal trapping plans to do her graduate thesis project on colonization aspects of yellow-cheeked voles which will compliment the refuge study.

Two dedicated individuals this year that deserve special recognition are Jack Moermond(left photo, on right side; Mike Spindler on left) and Jean Moermond (right photo) of Midland, Michigan. Jack contributed 944 hours (almost ½ an FTE) from 1995-96 to the biological programs. A retired patent lawyer with Corning/Dow Corporation, Jack has a passion for waterfowl and participated in many aspects of waterfowl management including surveys, banding, radio telemetry, data analysis, and report writing. His most significant contribution (408 hours) was the analysis of tundra swan data from Koyukuk and Selawik NWRs which he included in a paper he co-authored (he was the primary author) that will be published by the journal Wildfowl. Jack worked on this project during his two summers at the station and when he returned home between assignments. Jack's dedication made it possible for this project to be completed and for the work to be shared with the scientific community. His assistance on many other projects was invaluable to the Complex. His wife Jean returned the following summer to develop the Mammals of the Boreal Forest teaching kit. Jean spent more than 300 hours assembling hands-on materials and curriculum activities to complement the furs and skulls already existing at the refuge. We expect this kit will be popular in the schools.

5. Funding

Within the total funding this year, $58,000 was designated as subsistence funding. This funded the position for ROS Pete DeMatteo. The challenge grant project with Gana-A' Yoo continued this year with $52K in 1261 funds. MMS funding amounted to $15K this year and was used to correct fuel system safety hazards. For the second year ecosystem funding was provided to the ecoregions who ranked projects and then divided it between stations. This station received $7,000 to continue the neotropical bird banding project.

Table E.1. Koyukuk/Nowitna Refuge Complex Funding, 1992-1996.

Program	FY92	FY93	FY94	FY95	FY96
1230	6,000	1,500	8,000		22,000
1261	646,000	648,200	632,500	658,500	977,000
1262	301,000	320,000	313,000	336,000	140,000
1411		10,000			
8610	29,300	28,100	25,000	25,300	25,000
9110	125,000	78,000	55,000	104,000	105,000
9120	145,000	190,000	198,000	48,000	7,000
Total	1,252,300	1,275,800	1,231,500	1,171,80	1,276,000

6. Safety

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Tailgate sessions were held throughout the year. Our all-staff safety training session was held during the week of June 2-6. All necessary training was accomplished including CPR, basic first aid, bear safety, boat operations and administrative items.

The station safety committee met as needed during the year. No lost time accidents occurred.

Canoe safety training on Alexander Lake.

F. HABITAT MANAGEMENT

1. General

The rivers in the refuge lowlands are characterized by low gradients, meandering courses, and heavy spring flooding. Flooding during spring is common, and it is often mid-summer before most of the flood waters subside. The rivers, particularly the Yukon and Koyukuk, carry a heavy silt load at flood stage. Meandering creeks with steep banks are typically slow and shallow. Narrow bands of white spruce line higher banks, while willow and alder thickets are found in lower areas.

2. Wetlands

Lake and pond wetlands include upland basins, ice-formed lakes on the flats, river flooded lowlands, oxbows, and bog lakes. Spring runoff, rain, and river flooding recharge lakes. Water depths and shorelines can vary from year to year. Lake depths seldom exceed 15 feet and usually are much shallower. Water temperatures in shallow lakes reach 70°F or more in mid-summer, creating ideal conditions for growth of aquatic plants and invertebrates. Among the aquatic plants, duckweed (*Lemna*), horsetail (*Equisetum*), water milfoil (*Myriophyllum*), mare's tail (*Hippuris*), and smartweed (*Polygonum*) are abundant. One or more of 12 species of pondweed (*Potamogeton*) occur in almost all

lakes, and bog lakes usually contain water lilies (*Nuphar*). Several species of graminoids including sedge (*Carex*), bluejoint grass (*Calamagrostis*), and foxtail (*Hordeum*) provide cover on exposed shorelines. A variety of forbs grow on recently exposed soils along shorelines.

Shallow seasonally flooded basins (locally called "grass lakes") are common along the Koyukuk River. Grass lakes are usually wetlands during spring breakup and flooding, but otherwise are dry meadows with many showing the beginnings of shrub and forest succession. They are vegetated primarily by bluejoint in the drier parts, with *Carex aquatilis, C. rostrata* and other sedges in the wetter portions. During flooding, sedges, and occasionally bluejoint grass will survive as emergent vegetation in water depths exceeding four feet. Shorelines of bog lakes vary in character, but nearly always contain buckbean, wild calla, and various sedge species; cattails are rare.

3. Forests

Three broad forest vegetation types occur on the refuge.

Closed spruce-hardwood forests are found mainly along the major water courses and on warm, dry, south-facing hillsides where drainage is good and permafrost is absent. This type consists of moderately tall (50 feet) to tall (80 feet) stands of white and black spruce, paper birch, aspen and balsam poplar.

Open, low growing spruce forests are found in the northwestern and quarter of the refuge and are scattered throughout the central portion. This type is composed primarily of black spruce, but is often associated with paper birch and willows and is locally interspersed with treeless bog. This type frequently is found on north facing slopes and poorly drained lowlands usually underlain by permafrost.

Treeless bogs are the predominant vegetation type in the center of the refuge. The vegetation of these bogs consists of various species of grasses, sedges and mosses, especially sphagnum moss. On drier ridges, willow, alders, resin birches, black spruce and tamarack are found.

12. Wilderness and Special Areas

One needs only to step to the top of a 50-foot high dune within the 400,000 acre Koyukuk Wilderness to recognize the uniqueness of the Nogahabara Sand Dunes. This active dune area contains about 16,000 acres and is only a small part of a Pleistocene dune field that is now mostly inactive. The individual dunes have been recorded to be 50 to 200 feet high and 300 feet or more in length. The dunes are wind-blown deposits of sand that originated in glaciated areas to the northwest and were deposited in the periglacial Koyukuk area.

In addition to the sand dunes, the Koyukuk Wilderness includes the Three Day Slough area of the Koyukuk River. Three Day Slough contains several large meanders of an old Koyukuk River Channel which represent the Complex's best moose habitat with the densest concentration of moose. Increasing numbers of moose hunters enter this area by boat each fall. In 1996, 608 hunters passed through the Koyukuk River check station and the bulk of these hunters were headed for the Three Day Slough portion of the Wilderness Area.

The Koyukuk Wilderness was established by Public Law 96-487 (Alaska National Interest Lands Conservation Act) on December 2, 1980, in accordance with subsection 3(c) of the Wilderness Act (78 Section 892).

G. WILDLIFE

1. Wildlife Diversity

The Koyukuk National Wildlife Refuge has a high diversity of habitat types resulting from riverine erosion, deposition, and flooding, the actions of wildfire, and topographical variation. Baseline data continues to be collected to determine the status and distribution of bird, fish, and mammal species. Over 140 bird species, 30 mammal species, and 14 fish species occur on refuge lands. A refuge bird list was published in 1992 following a decade of active field surveys and local observations of staff living in Galena. Fish, mammal, and plant lists, published in the Comprehensive Conservation Plan in 1987, need to be updated and revised.

Included among the biodiversity monitoring efforts on the Complex in 1996 were surveys of spring bird migration phenology (collection of arrival dates), the North American Migration Count, breeding birds (Standard BBS and MAPS), inventory of plant species in goose habitats, and inventories of wintering birds (Christmas Bird Count, see Section G.7), and small mammals (see Nowitna Section G.10).

2. Endangered and/or Threatened Species

The American peregrine falcon (*Falco peregrinus anatum*) is listed as endangered and regularly nests along the Yukon and Koyukuk Rivers. Delisting has been proposed for the American peregrine. Region 1 is responsible for acting upon the proposal and is currently gathering information. The status of the arctic peregrine falcon (*Falco peregrinus tundrius*), which nests in the arctic but migrates across the refuge, was changed from endangered to threatened in 1994. Alaska Department of Fish & Game (ADF&G) has recommended that the American and arctic peregrine falcons be removed from the state's endangered species list but should be considered "species of special concern." A description of the raptor survey is included in Section G.6. It is unknown if any threatened or endangered plant species occur on the refuge. Disjunct species occur on the

Nogahabara Sand Dunes, and some species found there may represent range extensions. Also, inaccessible alpine and subalpine habitats on the refuge have received little botanical survey work to date.

3. Waterfowl

Wetlands within the Koyukuk River floodplain and Northern Unit of the Innoko NWR (Kaiyuh Flats) support large waterfowl populations. Principle duck species breeding on the Koyukuk NWR include American wigeon, northern pintail, mallard, green-winged teal, northern shoveler, surf scoter, white-winged scoter, common and Barrow's goldeneye, bufflehead, and lesser scaup. Less abundant breeding ducks include red-breasted merganser, greater scaup, canvasback, ring-necked duck, redhead, black scoter, and oldsquaw. Arctic, red-throated, and common loons also nest on the refuge, as do horned and red-necked grebes. Canada geese, white-fronted geese, trumpeter swans, and tundra swans are found on the refuge in moderate to high numbers. The greatest concentrations of waterfowl occur during spring and fall migrations on large, shallow floodplain waterbodies.

Weather Conditions and Waterfowl Migration Chronology

The arrival of pintails in Galena was on April 25, the same date as the long-term, and the arrival of mallards was April 27, two days later than the long-term mean. Arrival of Canada geese was on April 27, six days later than the long-term mean for the species. White-fronted geese arrived in Galena on April 21, two days earlier than average. About 30 white-fronts were seen on Dulbi Slough on April 25, but most radio collared geese were not heard until May 7th, about a week later than in 1995. Phenology for geese was judged to be about average, but later than the extremely early conditions in 1995. On May 1 snow cover between Galena and the Dulbi River mouth was highly variable, but estimated to be 50-95%; this declined to 5-10% snow cover by May 7. On May 7, Dulbi River and Slough, and the Koyukuk River near Huslia had ice cover with moats and breaks; by May 17 all were open and flowing. Along the Yukon and Koyukuk river drainages, there was minimal flooding in most areas, except for an isolated ice jam flood in the Treat Island area on May 17th. Nesting and brood production conditions were estimated to be good because of low water and minimal flooding, which was similar to 1995. This was in contrast to the 1993 and 1994 breakups along the Koyukuk and Kaiyuh Flats that caused above average water levels and flooded much of the available waterfowl habitat.

Ducks

Duck production surveys were conducted on the Koyukuk NWR from 1983 to 1993. Production survey methods continuously improved since 1984, so that during the period 1987-89 a stable sample base and reliable estimates were obtained. In 1990 the method

was again refined to obtain statewide estimates as well as relative estimates on a refuge basis. These procedures, however, were too costly to continue annually. WB Saperstein was tasked with summarizing the results of more than a decade of duck production surveys. Results of these surveys were summarized in a final report entitled, *A summary of ten years of duck production surveys, Koyukuk National Wildlife Refuge, Alaska, 1983-1993.* The abstract to that report follows.

"Annual duck production surveys were conducted on the Koyukuk NWR and the Northern Unit of Innoko NWR from 1983 to 1993. The estimated number of ducklings produced on both refuges ranged between a minimum of 62,050 in 1989 to a maximum of 199,155 in 1990. The estimated number of adults occurring on both refuges between 1990-93 ranged from 61,664 in 1993 to 117,449 in 1992. Production estimates were associated with high levels of variability each year. Survey methods were generally consistent among years, particularly after standardization in 1990, but number and location of sample units, methods for selecting sample units, and thoroughness of survey reports varied. Survey methods and results were summarized and consolidated into this comprehensive report, and additional comparisons were made among years when possible."

Following cessation of duck brood surveys in 1993, the only indication of trends in duck abundance on the refuge was the aerial duck breeding pair survey conducted by the Service's Division of Migratory Birds in Juneau. Estimates of the abundance of key duck species in the Koyukuk stratum (including Koyukuk and Kanuti NWRs) are presented in Table G.3.1. Most species were above the 13 year mean, only one was lower in 1996: American wigeon. It should be noted that the estimates in Table G.1 apply to the entire Koyukuk stratum, of which Koyukuk NWR is only a part. A comparison of the breeding pair estimates for the Koyukuk stratum (Table G.1) with estimates of adults summering on the refuge (based on brood survey extrapolations) suggested that, depending on the year, the Koyukuk NWR represented approximately 36-65% of the ducks estimated for the entire Koyukuk stratum. The mean Koyukuk Stratum estimate was 194,000 ducks between 1984 and 1996 (Table G.3.1).

Table G.3.1. Estimated ducks (in thousands) and coefficient of variation (CV) for the Koyukuk stratum, including Koyukuk and Kanuti NWRs, based on aerial breeding pair survey, USFWS, Migratory Birds, Juneau, AK.

	YEAR														
Species	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Mean	C.V.
Mallard	18.8	9.4	17.5	8.8	28.2	20.7	14.9	18.7	12.3	10.2	22.0	22.3	22.7	17.4	0.25
Wigeon	49.5	19.6	50.9	36.5	49.3	46.5	40.9	39.7	29.4	29.6	41.0	43.8	38.5	39.6	0.23
G.-w.teal	13.7	15.6	36.1	20.5	20.5	26.4	11.7	19.6	14.1	22.8	19.1	39.6	42.8	23.3	0.23
Shoveler	11.0	6.3	19.3	22.4	19.7	10.2	14.9	10.7	14.4	24.4	16.1	25.8	24.4	16.9	0.25
Pintail	80.2	38.1	75.1	53.8	47.7	44.7	48.3	32.1	20.8	24.4	19.8	24.3	29.8	41.5	0.63
Scaup	47.7	28.2	38.7	39.7	38.6	48.6	27.1	31.5	33.6	24.6	35.3	17.5	22.2	33.3	0.41
Scoters	6.1	8.9	10.6	9.3	6.5	5.2	7.5	2.8	6.4	5.0	3.3	2.5	6.5	6.2	0.37
Other	17.3	13.4	24.1	14.8	19.7	14.9	19.7	15.2	8.0	19.5	13.2	9.8	10.8	15.4	0.41
Totals	244.3		272.3		230.2		185.0		139.0		169.8		197.7		0.19
		139.5		205.8		217.2		170.3		160.5		185.6		194.0	

Geese

Production. River float-trip surveys have been conducted each summer on the Koyukuk NWR to assess goose production and record observations of other wildlife. In 1996, float surveys were conducted on three areas specified in the wildlife inventory plan: Dulbi River, Dulbi Slough, and Kaiyuh Slough. The results of the surveys through 1995 were summarized by BT Lowe and ROS/Pilot Spindler in progress report FY96-01, entitled *Goose production surveys on Koyukuk and Nowitna National Wildlife Refuges, Alaska.* The abstract from that report follows:

"River float-trip surveys were conducted annually on the Koyukuk NWR to assess goose production and record observations of other wildlife. Surveys began on the Dulbi River, a tributary of the Koyukuk River, in 1983. Geese were more abundant during the period from 1983 to 1990 than during the period 1991-1993. The observed decline in goose abundance from the 80's to the 90's on Koyukuk NWR appeared to reverse slightly in 1994 and 1995. Surveys in 1995 in most areas showed small increases over 1994 goose numbers, while some surveys experienced sharp increases, with some of the highest numbers ever seen (Canada geese at Dulbi Slough). Continued decline was seen in the survey estimates for greater-white-fronted and Canada geese at Kateel River, and greater-white-fronted geese at Kaiyuh Flats."

In 1996, white-fronted goose production declined from the record high 1995 levels, but was still 55% young, which was well above the long term average of 30% young. We were concerned that 1996 adult white-front numbers were near the all-time low observed in 1992. In 1996 Canada goose production showed the highest percent young (64) since 1988, but adult numbers were near average.

Greater-white-fronted goose nesting and staging study. A radio-telemetry project was initiated in 1994 to determine possible causes of the observed decline in white-fronts on the Koyukuk NWR. Specific objectives were to: (1) develop a reliable inventory procedure for the Koyukuk subpopulation; (2) assess spatial variation in goose abundance on the refuge; (3) identify geographic use areas and discreteness of the subpopulation; (4) determine preferred nesting, brood rearing and staging habitats; (5) determine factors affecting the breeding population and production; and (6) assess the impact of flooding and hunting. Progress on the study to date was summarized in a poster display by ROS/Pilot Spindler, that was

presented at the Alaska Bird Conference in April 1996. Following is an abstract of the presentation entitled: *Nesting and staging of Koyukuk River White-fronted geese: A progress report.*

An orphaned white-fronted goose was raised by BT Jenny Lowe. (MAS)

"Female white-fronted geese (n=42) likely to have attempted nesting (evidenced by brood patch) were radio-collared in July 1994 and 1995 on Koyukuk NWR. Geese were relocated by aircraft weekly from late April to late August 1995 to determine nesting, brood rearing, and staging habitats. Of 12 geese captured in 1994, 6 returned from their mid-continental wintering grounds in May 1995. Two of these radioed geese were found on nests; a third nest was found incidentally. Two nests were in upland black spruce-dwarf birch-*Eriophorum* woodland, and one was in the floodplain on a 0.5 m tall hummock within a *Carex-Calamgrostis* meadow. During brood rearing, geese used riparian mudflats where newly greened sedges and grasses were grazed as water levels dropped during the summer. Radioed geese remained on the Koyukuk until early August, when most birds (80% and 88% in 1994 and 1995, respectively) moved 170-230 km northwest to stage near Kotzebue Sound. During staging, marked geese were found grazing in estuarine meadows of river deltas (Kiwalik, Buckland, Kauk, and Kobuk) where grasses and sedges were delayed phenologically by proximity to coastal waters. Some geese also fed on *Vaccinium* berries in adjacent upland tundra where, compared to the interior, ripe berries were available later in the summer. In late August radioed geese overflew the Koyukuk, but apparently did not stop, on their way to Saskatchewan and Texas, where numerous collar sightings occurred. After winter mortality, up to 30 radioed geese could return to the study area in 1996, which should allow increased efforts to sample habitat use."

Watching the gosling eat during a lunch break are: BT Lane, BT Person, RAPS Larry Wholecheese, BT Lowe, and WB Saperstein. (MAS)

Radio-collared geese were monitored weekly during the field season in 1996, and ten nests were found and documented. Nine geese were monitored during brood rearing and molting, and in mid-August, 11 radioed geese were documented staging at Kotzebue Sound. The radio-telemetry, habitat use, and nest documentation aspects of the study were

closely coordinated with Kanuti NWR, where a similar study was ongoing. Efforts to find "missing" geese were extensive, and included Innoko, Selawik, Kanuti and Yukon Flats NWR's and much of the intervening areas. Tremendous cooperation was received by these refuges and the Division of Migratory Birds in Anchorage, Juneau, and Fairbanks. Movements aspects of the study were summarized on the refuge GIS in 1996. A progress report was scheduled to be written after results of 1997 telemetry became available.

Throughout the nesting and brood-rearing period BT Delia Person documented white-fronted goose food habits and forage availability on the Koyukuk. Three weeks before fall migration, the Koyukuk white-fronted geese make a north-westward staging movement in a direction opposite to their southeasterly migration, and we wanted to document any forage-related basis for going so far out of their way. Therefore, in mid-August, BT Person, assisted by a crew of three persons, went to Kiwalik Lagoon along Kotzebue Sound to obtain food habits and forage availability in the coastal staging areas. Selawik NWR and National Park Service offices in Kotzebue helped greatly with this work. A report summarizing these forage studies was still in progress during 1996.

WB Spindler and BT Lowe collected white-fronted goose scats and forage samples during field visits in June, July, and August, 1996.

Evaluation of inventory techniques. In 1996 major efforts toward improving goose inventory techniques continued. A progress report that compared the effectiveness and precision of 1994-96 intensive aerial surveys with concurrent float surveys was drafted during 1996. The final report will not be written until the 1997 data become available, but some tentative conclusions in a draft report were:

1. Stratified aerial transect surveys of white-fronted geese during the molting period resulted in estimates of sufficient precision to detect a major change.

2. Large molting and brood flocks of white-fronted geese usually swam to the center of a waterbody in response to an airplane, while individual broods exhibited elusive behavior. In lower reaches of tributaries and sloughs flocked Canada geese behaved similar to white-fronts. In upper reaches Canada geese often stood motionless on sandbars, which decreased their sightability.

Field crew resting during goose forage studies at Kiwalik Lagoon, near Candle, Alaska. (JEM)

3. A correction factor is needed to increase aerial survey estimates to a level that reflects actual numbers present. This factor may be as high as 6.0 for single females with broods, but may be as low as 1.3 for large molting flocks. A median factor of 3.6, also used previously by Lensink (1987), may be adequate until further research can be conducted.

4. The best correspondence between aerial and float survey counts occurred in years and areas where excellent survey conditions prevailed through the duration of the survey. Ideal aerial survey conditions for geese in the study area include even lighting from high thin overcast skies, or clear skies, no rain, wind < 15 km/hr, and no turbulence.

5. Float surveys on Koyukuk NWR included nearly all the white-fronted geese present during the molt. Float surveys also require rigid standardization, particularly consistency of crews, exact delineation of survey extent (to include all the inlets, sloughs, and connected oxbow lakes that are normally accessible, and adherence to minimum environmental conditions, similar to aerial surveys. A float survey of over 200 km in length provides ability to detect trends in adult numbers and production.

WB "Bud" Johnson on the Dulbi River goose float survey.

6. Aerial and float surveys were similar in cost but the aerial survey was less expensive *per unit area* than the float survey. The aerial survey was easier to standardize and provided estimates of white-fronted geese with confidence intervals, while the float survey was simpler, and could better enumerate other species such as Canada geese.

Swans

Swans are considered a key indicator species because their production trends tend to correlate well with that of other waterfowl species, they are sensitive to nest disturbance, and swan sightability is high during aerial surveys. Swan surveys have been conducted on the Koyukuk NWR by refuge staff since 1989 to determine trends and locate nesting and staging areas. In 1989 the staff selected six 1:63,360 trend maps to monitor swan population and production according to the refuge wildlife inventory plan. Both trumpeter and tundra swans nest on the refuge. Preliminary surveys in 1985 and 1987 indicated that abundance of tundra swans increased as one proceeds north of the Koyukuk, therefore, fall aerial production surveys have necessarily grouped the two species simply as "swans".

Complete statewide censuses of trumpeter swan summer populations in Alaska were conducted by the Service in 1968, 1975, 1980, 1985, 1990, and most recently in 1995. The survey covers 51,364 statute miles of aerial survey transects. All maps with swan habitat within the entire Koyukuk NWR were surveyed in 1990 and 1995. The purpose of this survey is to accurately detect any long-term population changes in Alaska. This effort is coordinated and funded by the Migratory Bird Management Field Office in Juneau.

The results of the past decade of aerial swan surveys were summarized by BT Lowe and ROS/Pilot Spindler in Progress Report FY96-02 entitled: *Aerial swan production surveys on Koyukuk and Nowitna NWRs, Alaska, 1985-1995*. A brief summary follows:

"Aerial censuses of all swan habitat on Koyukuk NWR and Kaiyuh Flats indicated that the population has increased. In the five years between the 1990 and 1995 censuses, swan estimates on the Koyukuk and Kaiyuh Flats increased 63% from a total of 617 to a total of 1,006. The estimated annual growth rate of the adult component was 12%. Annual aerial surveys of a sample of six trend maps indicated that adult swan populations on the

Northern Innoko gradually increased from 1985 to 1995. On the Koyukuk NWR during the same period they were highly variable, but increased in 1995. Slight declines in percent young were noted on the Koyukuk NWR in 1991, and on the Kaiyuh in 1992-93. The declines noted on the Kaiyuh Flats were partially reversed in 1995, when percent young increased."

During 1996, a year after the statewide census, only two aerial trend survey maps were completed on Koyukuk NWR (Kateel River C1 and D1). This small survey was performed to determine whether swan productivity correlated with goose productivity in the central Koyukuk NWR. This comparison showed a correlation between swan and white-fronted goose percent young in Dulbi River and Dulbi Slough (Spearman's rank correlation $T=80$, $p < 0.05$). In 1996 average brood size on those two units was 3.2, which was greater than the long-term mean of 2.6.

4. Marsh and Water Birds

A number of marsh and water birds are commonly observed on the refuge, including: common, Pacific, and red-throated loons, red-necked and horned grebes, and sandhill cranes. Yellow-billed loons are occasionally observed. Past duck production surveys indicated that red-necked grebes, common loons, and sandhill cranes were the most common marsh and water bird species.

5. Shorebirds, Gulls, Terns, and Allied Species

The following shorebird species are commonly observed on the refuge: lesser and greater yellowlegs, Arctic tern, glaucous, Bonaparte's, mew, and herring gulls, long-tailed jaegar, semipalmated plover, common snipe, spotted, least, pectoral, and solitary sandpipers, northern phalarope, Hudsonian godwit, and whimbrel.

6. Raptors

The refuge supports a diversity of raptor species. Raptors are generally sensitive to disturbance and, therefore, act as important indicator species. Raptors that nest on the refuge include rough-legged hawks, merlin, sharp-shinned hawks, northern harriers, red-tailed hawks, goshawks, great horned owls, great gray owls, boreal owls, northern hawk owls, American peregrine falcons, and bald eagles.

Raptor surveys have been conducted periodically on the Yukon River between the villages of Ruby and Kaltag and along the Koyukuk River just above Koyukuk village. The purpose of this survey is to monitor general trends in the number of raptors utilizing nesting sites along the river. The USFWS Endangered Species Office conducted the survey from 1979 to 1991 while the refuge conducted the survey from 1992-1994. No

surveys were conducted during 1996 because WB Saperstein was detailed to Yukon Delta NWR and other staff were fully committed to other projects.

7. Other Migratory Birds

Monitoring efforts of passerines in the Galena area in 1996 included surveys of spring bird migration phenology (collection of arrival dates and North American Migration Count), breeding birds (Standard Breeding Bird Survey - BBS, Monitoring Productivity and Survivorship -MAPS), and wintering birds (Christmas Bird Count). Migrant songbirds commonly seen in the summer include alder flycatcher, olive-sided flycatcher, tree swallow, bank swallow, ruby-crowned kinglet, American robin, Swainson's thrush, gray-cheeked thrush, varied thrush, northern waterthrush, yellow warbler, blackpoll warbler, orange-crowned warbler, yellow-rumped warbler, rusty blackbird, savannah sparrow, dark-eyed junco, American tree sparrow, white-crowned sparrow, fox sparrow, and Lincoln's sparrow. Common winter residents are common redpolls, common raven, gray jays, black-capped and boreal chickadees, and pine grosbeaks.

Phenology. These analyses are used to relate annual differences in temperature, precipitation, timing and duration of flooding, etc. with observed patterns in wildlife populations and productivity. To compare spring migration phenology among years, records of annual spring arrival dates for common and conspicuous birds were summarized (Table G.7.2). Most species for which we have long-term data arrived on or close to their mean arrival date. Canada geese arrived noticeably early and American Tree Sparrows noticeably late.

Table G.7.2 Spring arrival dates of common birds at Galena, Alaska, 1996.

Species	1996	Mean (1982-96)
Snow Bunting	26 F	26 Ma
Northern Pintail	25 A	25 A
Mallard	25 A	26 A
Canada Goose	21 A	26 A
Slate-colored Junco	27 A	27 A
Ruby-crowned. Kinglet	28 A	29 A
Mew Gull	29 A	1 M
American Robin	30 A	29 A
American Tree Sparrow	10 M	2 M
Common Snipe	5 M	6 M
Tree Swallow	9 M	9 M
Olive-sided Flycatcher.	21 M	24 M

Months are indicated by letters: Jan=January, F=February, Ma=March, A=April, M=May, J=June. Data collected by T. Osborne, ADF&G, Galena, and refuge staff. Data from 1982 to 1995 in refuge files and in 1994 Annual Narrative.

Migration Counts. The North American Migration Count was begun in 1992 to provide a "snapshot" of spring migration across the continent. Always held on the 2nd Saturday in May, the count coincides with International Migratory Bird Day and provides a good opportunity for public involvement. This year 163 individuals of 31 species of birds were recorded in the Galena area, compared to 268 individuals and 33 species the year before, The difference could have been due to a later breakup in 1996 compared to 1995.

Breeding Bird Survey. The refuge assists with national monitoring of songbirds, many of which are neotropical migrants, by conducting standardized Breeding Bird Survey (BBS) routes in taiga habitats near Galena. Two BBS routes were conducted on Koyukuk NWR in 1996 and a third route along the Ruby to Poorman mining road (see Nowitna NWR Narrative, Section G.7) The Nikolai survey route is run by boat which makes it especially challenging to complete within the allotted time limits. However, the route encompasses some excellent songbird habitat and is one of the most productive in terms of species diversity and abundance. The other local route is run on the Galena road system but due to the lack of roads is a half-route of 12.5 miles. WB Johnson is preparing a progress report on songbird monitoring efforts on the Complex, including the BBS.

MAPS Station. We ran our banding station again in 1996 in conjunction with the Monitoring Avian Productivity and Survivorship (MAPS) program coordinated by the Institute for Bird Populations (IBP). This was the second year of a minimum five year commitment to this effort. The MAPS program coordinates the efforts of bird banders all over North America with the goal of providing long-term population data on neotropical

migrants. Our station was one of 413 operating in 44 states and eight provinces and territories in 1996 .

Our MAPS site is five miles east of Galena in a closed stand of alder/willow scrub. The site is adjacent to the Yukon River and subject to periodic flooding. It is bordered on one side by white spruce, and a few small cottonwood stands occur within the transition between spruce and alder/willow. We chose a location close to Galena (versus a remote site on the refuge) to reduce operational costs. Our hope is that by reducing logistical and fiscal constraints, we will increase our chances of operating the station during "lean" years and meet the five year commitment requested by the IBP.

We banded 210 individuals of 19 species during 420 net hours and recorded 17 returns. Interesting captures included an arctic warbler banded in August that was the first record for this species in our area. We also captured and banded one "feisty" sharp-shined hawk which served to remind us why we carry leather gloves in our banding kit.

Overall captures of hatch year (HY) birds declined from 1995 (Table G.7.3) especially among Neartic migrants such as common redpolls and short-distance (Class B) Neotropical migrants such as ruby-crowned kinglets, myrtle warblers, and slate-colored juncos.

Table G.7.3. Change in captures[1] of HY birds of common species between 1995-96 MAPS program in Galena, Alaska.

Species	1995	1996	Percent Change
Alder Flycatcher	4	3	- 25
Black-capped Chickadee	8	6	-25
Ruby-crowned Kinglet	29	4	- 86
Swainson's Thrush	12	17	+42
Orange-crowned Warbler	18	6	- 67
Yellow Warbler	8	2	- 75
Myrtle Warbler	40	7	- 82
Blackpoll warbler	4	0	- 400
Northern Waterthrush	13	10	- 23
Wilson's Warbler	3	1	- 66
Fox Sparrow	1	4	+400
Lincoln's Sparrow	25	12	- 52
Gambel's White-crowned Sparrow	18	11	- 39
Slate-colored Junco	65	14	- 78
Common Redpoll	9	0	- 900
Total	257	97	- 62

[1]Does not include recaptures; there were no returns of birds banded and aged as HY in 1995.

Wintering birds. Wintering birds were monitored during the standardized Christmas Bird Count conducted by refuge staff and local volunteers on December 23. Totals of 8 species and 219 individuals were recorded on the count. Temperatures were colder than average (low -27°F) but the number of party hours (24) was actually above average. Observations included 6 willow ptarmigan, 1 unidentified grouse, 1 three-toed woodpecker, 9 gray jays, 150 ravens, 7 black-capped and 4 boreal chickadees, and 41 common redpolls. Also seen during count week were northern goshawk, boreal owl, hairy woodpecker, and pine grosbeak.

8. Game Mammals

Moose

In years following refuge-wide censuses, moose survey efforts consisted of intensive aerial surveys of standardized trend count areas (40-70 mi^2 in size) where hunting pressure was thought to be greatest, or where other conservation concerns dictated a need for the information. Our moose trend aerial survey work has emphasized use of consistent methods, equipment, and standardized identical survey areas, so that both composition and count or density data may be used to examine trends. Results of the moose trend

surveys were summarized by WB Orville Huntington and ROS/Pilot Spindler in Progress Report FY97-04 *Moose trend surveys on the Koyukuk and Nowitna National Wildlife Refuges, 1980-96*. The portion of the abstract pertinent to Koyukuk NWR and Kaiyuh Flats follows:

"Aerial trend surveys indicated that moose populations in most parts of Koyukuk National Wildlife Refuge (NWR) increased between the early 1980's and mid-1990's. In 1994, 1995 and 1996 moose at the Three-Day-Slough trend count area (TCA) showed signs of decreased productivity and increased mortality, and a decline in adult numbers, particularly bulls, was noted. On the Northern Unit of Innoko NWR, adult numbers at the Kaiyuh Slough TCA decreased between 1994 and 1996."

The highest recorded moose density on the Koyukuk NWR was observed at Three-Day-Slough but the population appeared to be headed for some changes. Density there peaked at 13.3 moose/mi^2 in 1993 but then declined to 11.1 moose/mi^2 in 1996 (but still above the 1985-96 average of 10.5 moose/mi^2, Figure G.8.1). In 1996 the sex ratio was 24 bulls/100 cows, which was the second lowest number ever observed and well below the average (33.1 bulls/100 cows) of all surveys conducted since 1985. The bull ratio suggested hunting pressure has had an effect on population structure. Calf production, at 23 calves/100 cows in 1996 was the second lowest level ever recorded. The yearling ratio in 1996 was below the long term average (8 compared to 9.4 yearling bulls/100 cows, respectively), and has been so since 1993. On the remainder of Koyukuk NWR, moose numbers and composition were healthy, but densities were about a third to half of the levels observed at Three Day Slough. In 1996, five other trend count areas were surveyed, with densities as follows: Dulbi Slough, 5.9 moose/mi^2; Dulbi River Mouth, 5.4 moose/mi^2; Koyukuk River Mouth, 5.1 moose/mi^2; Kateel River Mouth, 3.1 moose/mi^2; and Long Stretch, 1.3 moose/mi^2. Populations on these areas had apparently been stable or increased from the previous survey. On the Kaiyuh Flats composition ratios described a healthy population (67 calves/100 cows, 13 yearling bulls/100 cows, 60 bulls/100 cows), but adult numbers had declined from the previous 1994 survey (Fig G.8.2).

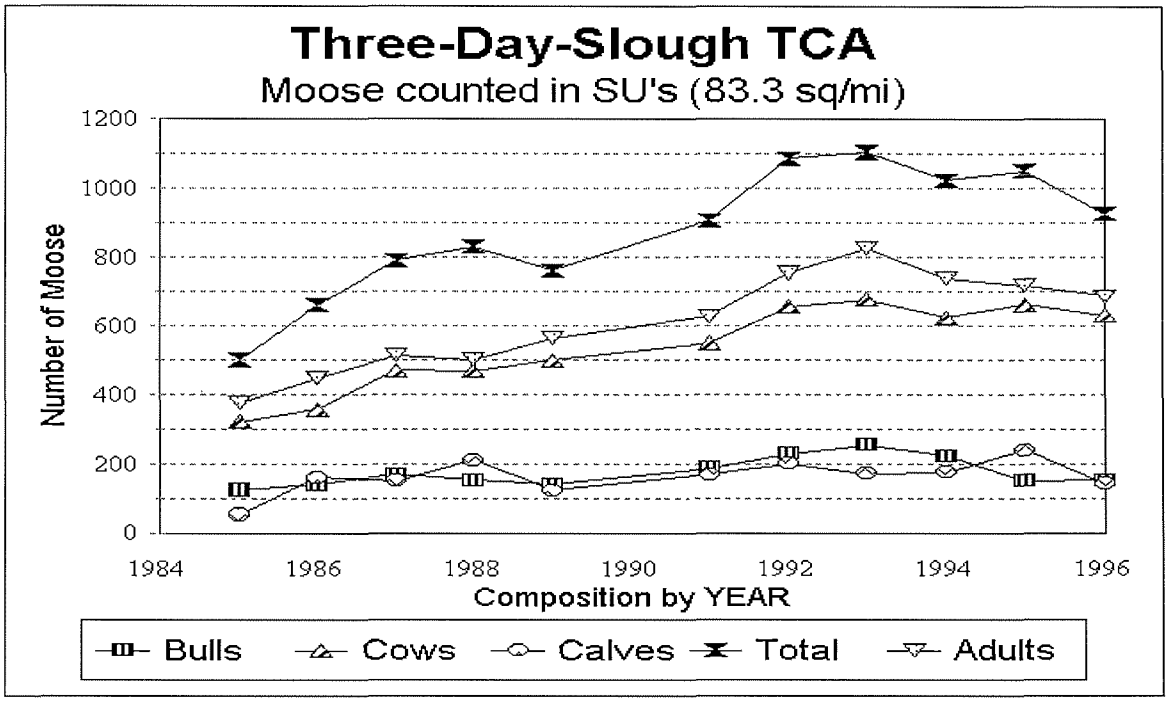

Figure G.8.1. Aerial moose trend counts at Three Day Slough, Koyukuk NWR, 1984-96.

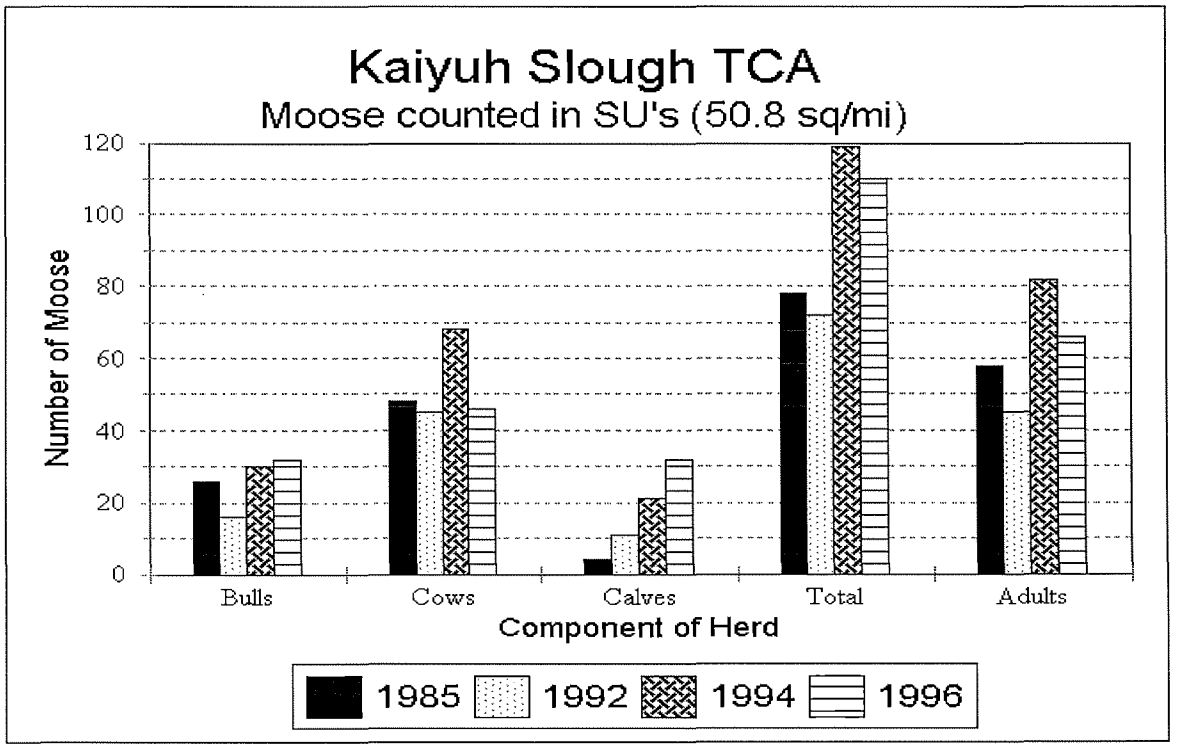

Figure G.8.2. Aerial moose counts at Kaiyuh Slough, N. Unit Innoko NWR, 1985-96.

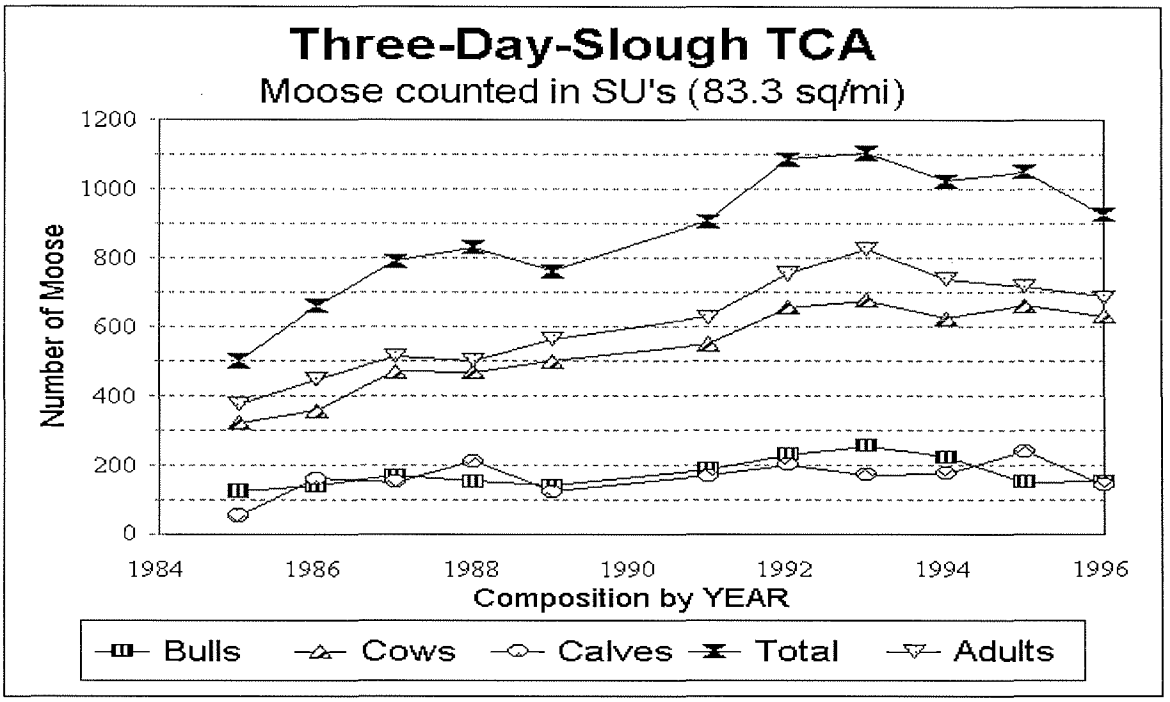

Figure G.8.1. Aerial moose trend counts at Three Day Slough, Koyukuk NWR, 1984-96.

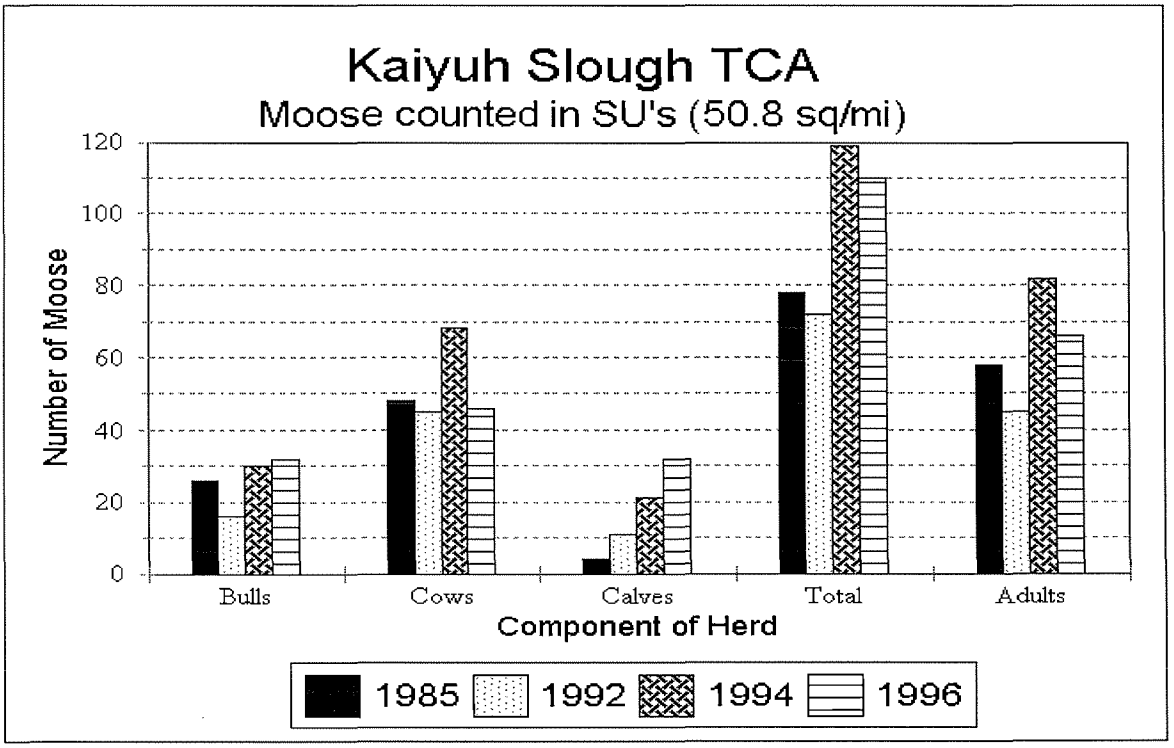

Figure G.8.2. Aerial moose counts at Kaiyuh Slough, N. Unit Innoko NWR, 1985-96.

Moose Browse Study. Dr. Knut Kielland, a senior research associate at the University of Alaska-Fairbanks, and the Alaska Department of Fish and Game initiated a study of moose browse at Three-Day Slough in 1995. Three-Day Slough was selected as the study site because of its sustained high density of moose and the concern that willows were overbrowsed. The refuge was able to contribute funds for analysis of samples in 1996. The following information is from Dr. Kielland's report *Browse Relations of Moose Along the Middle Koyukuk River*.

The purpose of the study was to determine the chemical composition of winter browse, primarily feltleaf willow (*Salix alaxensis*), and relate forage quality to observed browsing patterns by moose. Dr. Kielland also compared observed twig-size selection to predications of twig use based on optimal foraging theory to test the hypothesis that moose attempt to maximize daily energy/nutrient gain. The study was also designed to evaluate how chemical and morphological characteristics of browse controlled optimal browse diameter for moose.

Data were collected in March and April 1995. Field data indicated that the average diameter of twigs at the point of browsing (dpb) was 5.7 mm while the average diameter at the base of current annual growth was 8.4 mm. Gross energy and crude protein content decreased with increasing twig diameter. The observed dpb closely corresponded to peaks in model curves of twig energy and nitrogen, which suggests that moose were optimally foraging and may explain why current annual growth was not browsed at greater diameters. Models also indicated that at constant cropping rate and twig morphology, small differences in dpb may result in large differences in forage chemistry, which will affect the daily energy/nitrogen gain of moose. In conclusion, results indicated that diameter-specific digestibility and protein content of feltleaf willow in the study area was exceptionally high, particularly when compared to feltleaf willow from the Tanana River drainage where the moose population is small but growing. The high quality of browse in the study area may help explain the sustained high density of moose in Three-Day Slough, and Dr. Kielland determined that browse was not overexploited at the time of the study.

Caribou

Two caribou herds occur on the refuge: The Galena Mountain Herd (GMH) and the Western Arctic Herd (WAH). The GMH is a small resident herd of approximately 300 animals that winter north of Galena and calve outside the refuge in the western Kokrines Hills. The WAH is estimated at about 450,000 caribou. Portions of the WAH winter on northern and western sections of the refuge, but in the winters of 1989-1990, 1990-1991, and 1992-1993 WAH caribou wintered southeast of the Koyukuk River and south of the Dulbi River in areas usually occupied only by the GMH. Normally, caribou hunting is closed in Game Management Unit 21D in winter to protect the GMH, which is not large enough to sustain a significant harvest. When the WAH enters the Unit in sufficient numbers (so that GMH numbers are only 10% of total caribou), the Alaska Department of

Fish and Game (ADF&G) opens a hunting season by emergency order. Few WAH caribou have occurred on the refuge since 1993, however, and hunting has not been permitted during winter.

A cooperative study with ADF&G, the Bureau of Land Management (BLM), and the Alaska Fish and Wildlife Research Center was initiated in 1992 to monitor movements of the GMH and to determine population size and seasonal distribution. Blood samples were collected from GMH caribou to compare their genetic characteristics to caribou from other Alaskan herds and to caribou/reindeer hybrids. Eleven caribou of the neighboring Wolf Mountain Herd were also collared between 1994-1995 to determine their distribution. The range of the Wolf Mountain Herd is outside refuge boundaries, and these caribou were tracked primarily by BLM and ADF&G biologists.

Telemetry flights of the GMH were conducted in March, May, August, September, October, and November. One collared caribou died during the year as a result of wolf predation, and 14 collars remained active at the end of 1996. Calving began on 18 or 19 May and peaked around 23 May (Table G.8.1). Fewer caribou were observed during the calving season compared to previous years, but calves comprised a relatively high percentage of the observations. ADF&G biologists conducted a composition count on 11 October and observed a total of 232 caribou (Table G.8.2). The calf:cow ratio was the second lowest observed since 1992 (Table G.8.2), but more bulls were observed than in previous years despite the fact that no active collars remained on bulls. According to ADF&G biologists, the herd is currently stable although over-summer survival of calves was low. Although sample size of collared animals is too small to statistically determine mortality rates, ADF&G biologists believe that the annual mortality rate is above 10%, and any growth of the herd will be very slow.

Radio-collared GMH caribou. (MRB)

Table G.8.1. Observations of Galena Mountain Herd caribou around the peak calving period, 1993-1996.

Sex or Age	27 May 1993	23 May 1994	18-19 May 1995	20-22 May 1996
Calves	12	13	11	7
Cows and Yearlings	66	56	73	33
Bulls	15	40	25	2
Total Caribou	93	109	109	42
Percent Calves	12.9	11.9	10.1	16.7

Table G.8.2. Observations of Galena Mountain Herd caribou during October composition counts, 1992-1996. Data from ADF&G.

Year	Cows	Calves	Calves:100 cows	Bulls	Bulls:100 cows	Total
1992	123	9	7:100	49	40:100	181
1993	165	41	25:100	53	32:100	259
1994	115	46	40:100	25	22:100	186
1995	211	40	19:100	59	28:100	310
1996	151	19	13:100	62	41:100	232

10. Other Resident Wildlife

Beaver

Beaver populations are presently high in much of interior Alaska and beaver are frequently observed on the Complex in summer. Local hunters and trappers have noted a significant increase in the Koyukuk River drainage beaver population near the Hogatza River mouth, northeast of the village of Huslia. Beaver is an important subsistence species for local resource users, although current trapping levels are lower than they were historically. The fur is used for hats, mitts, and for trim on gloves and mukluks. Beaver meat is prized for its high fat content and is a welcome change from moose in the diet of local residents. From a biological perspective, beaver activity has an impact on wetland regimes and therefore on fish and waterfowl distribution. Native elders suspect that the increase in beaver activity due to lower trapping pressure has resulted in increased abundance of pike. Decreased subsistence use of pike combined with increased habitat created by beaver may have allowed pike to increase. Conversely, increased pike abundance may be related to decreased muskrat and duck numbers on the refuge. Beaver populations are not monitored annually on the Koyukuk NWR or the N. Unit of the Innoko NWR. However, baseline surveys of fall caches were conducted on the Complex in 1991.

Wolves

Wolves are common to abundant on the refuge and are sought after by local hunters and trappers. Wolf furs are prized for parka ruffs and a wolf pelt is a distinguished gift in local Athabascan potlatches. Wolves are the most significant predator to the refuge's major subsistence resources, moose and caribou, therefore population and predation rate information is important to ungulate management decisions. Recent population estimates for wolves on the Koyukuk NWR indicated healthy and stable populations, with a density estimated at 8.7 wolves/1000 km^2 in March 1994. Data from surveys conducted prior to these years, although less comprehensive, suggested that wolves were more abundant in the early 1990's compared to the 1980's. Total harvest ofwolves on the refuge in 1992 was estimated at 26% of the total population, a level thought to be sustainable over the long-term.

Wolf Study: Initiated in 1990, a study entitled *Seasonal movements and home range of three wolf packs on the Koyukuk National Wildlife Refuge* was inactive in 1996. Wolves were collared in 1990, 1992, and 1994 for home range and predation study. By 1995, a total of 50 wolves had been monitored an average of monthly during the course of the study. Analyses and report writing were planned for 1997.

A panel from the National Academy of Science was requested by the Governor of Alaska to conduct an independent assessment of the State's wolf management in Alaska. Members of the panel visited Galena to obtain public testimony in a meeting that followed the Federal Subsistence Western Interior Regional Advisory Council meeting on October 23-24, 1996. After public testimony, refuge staff provided the panel with requested oral and written information on baseline wolf and moose abundance.

11. Fisheries Resources

Of the 19 fish species with published ranges that include the Koyukuk NWR, 14 have been documented by field investigations in the last two decades. Major fish resources on the refuge include anadromous species such as salmon, dolly varden, and sheefish, and resident species such as pike, burbot, whitefish, blackfish, and suckers. Salmon are of particular importance to subsistence and commercial fisheries. For example, the Yukon River had a peak reported annual salmon catch of 1.2 million, of which an estimated 200,000 were from sections of the Yukon adjacent to or within the refuge (Koyukuk NWR Fisheries Management Plan). In addition to salmon, other important subsistence fisheries include pike, whitefish, and burbot.

Laura Pitka cleaning salmon in Galena.

Fisheries research on the Koyukuk and Kaiyuh Flats has been conducted by several organizations which had active projects in 1996:

1) USFWS Fishery Resources Office (FRO) in Fairbanks (baseline studies, Gisasa Weir salmon inventory, Kaiyuh pike study).
2) USGS Alaska Fish and Wildlife Research Center in Anchorage (salmon genetic stock identification study).
3) ADF&G, Sport and Commercial Fisheries Divisions in Fairbanks (Kaiyuh pike study).
4) Tanana Chiefs Conference in Fairbanks (Clear Creek Weir, pike contaminants on Kaiyuh).

Salmon

The mainstem of the Yukon River and other rivers within the drainage are subject to commercial and subsistence fishing. Part of the Yukon River drainage lies within the Koyukuk Refuge. The villages of Kaltag, Nulato, Koyukuk, Galena, Huslia, and Hughes depend upon the fish resources of the Koyukuk Refuge for subsistence. Annual aerial surveys to estimate escapement of chinook and chum salmon were conducted on the

Gisasa, Kateel, Hogatza, Indian, and Dakli Rivers by ADF&G in 1960 and 1961. No surveys were conducted again until 1974. Since then, ADF&G has surveyed selected index streams every year, although the same streams are not surveyed each year.

Escapement estimates for salmon stocks using the Koyukuk Refuge rivers are limited to five tributary streams with multi-year data; these are the Gisasa, Kateel, Hogatza, Indian, and Dakli Rivers. The distribution of chum and coho salmon within the Koyukuk River drainage has not been documented, and aerial escapement estimates over the years have been highly variable. Therefore the Service began a program to obtain such baseline information. In 1994 the Fairbanks FRO established a weir site on the Gisasa River, a major tributary of the lower Koyukuk River. Previous multi-year escapement estimates in conjunction with reliable boat access to its lower reaches, made the Gisasa a practical choice for the weir site of the five rivers considered (Gisasa, Kateel, Hogatza, Indian, and Dakli Rivers).

Logistics were also a major consideration, where all weir materials, tools, camping equipment, provisions, and personnel had to be transported by boat from Galena to the Gisasa River mouth, and by small jetboat from the mouth to the weir site. The Complex provided aerial support to the FRO Weir project through transport of food and personnel for crew changes. Storage space and bunkhouse lodging in Galena were also provided by the refuge. Larry Wholecheese Jr., a refuge RAPS employee, helped install and operate the weir in 1996. FRO also provided us with local-hire William Pilot. Daily escapement counts were radioed to the refuge office in Galena where refuge staff relayed counts to the ADF&G commercial fisheries biologist on a daily basis. Weir panels were disassembled after each season and stored on-site for the winter, while the rest of the equipment and camp gear was hauled back to Galena.

The 1996 weir data were summarized in a FRO progress report by J. Melegari: *Abundance and Run Timing of Adult Salmon in the Gisasa River, Koyukuk National Wildlife Refuge, Alaska, 1996.* U.S. Fish and Wildlife Service, Fishery Resources Office, Fishery Data Series Number 97-1. The abstract from the report follows:

"From June 19 to July 27, 1996, a resistance board weir was operated on the Gisasa River, a tributary to the Koyukuk River in west central Alaska. This was the third year of weir operation at this site. A total of 157,589 summer chum salmon *Onchorhynchus keta* and 1,952 chinook salmon *O. tshawytscha* were enumerated. The most abundant resident species were longnose sucker *Catostomus catostomus* (N=132) and Arctic grayling *Thymallus arcticus* (N=71). A total of 843 chum salmon and 407 chinook salmon were

sampled for sex, length and age from scale collection. Females comprised 51% of the chum salmon sampled. Average mid-eye to fork length (MEF) of chum salmon was 458 mm (N=428, SD =27) for females and 583 mm (N=415, SD=31) for males. Four age groups were identified for chum salmon, with 50% of the sample age 0.4 and 42% age 0.3. Females comprised 23% of the chinook salmon sampled. Average length was 829 mm MEF (N=80, SD=77) for females and 650 mm (N=327, SD=97) for males. Five age groups were identified for chinook salmon, with 60% of the sample age 1.3, 18% age 1.2, and 14% age 1.4."

In 1995 and 1996 a combination weir and counting tower were used to assess chum salmon run timing and escapement in Clear Creek, a tributary of the Hogatza River at the northern edge of the Koyukuk NWR. The project was operated by Tanana Chiefs Conference (TCC), Dept. of Fish, Wildlife, and Parks, in cooperation with the US Bureau of Land Management, ADF&G, and USFWS. This project was prompted by applications to BLM by Taiga Mining to expand gold mining operations at the Hog River Mine, which is located on a tributary of Caribou Creek, just downstream of Clear Creek. It was well documented that the area contained spawning chum salmon, but escapement estimates were unreliable. In a few prior years ADF&G had conducted aerial surveys at Clear Creek. They counted a minimum of 8,000 fish, and estimated 24,000 fish with their expansion factor of 3.0. Surprisingly, the 1995 weir/tower count indicated that 116,735 chum entered the creek between June 21 and July 21. In 1996 a total of 100,912 chum entered between June 21 and July 19. A progress report will be written by Kevin Van Hatten of TCC in Fairbanks.

The USGS Alaska Fish and Wildlife Research Center and USFWS Fisheries Resources Office in Anchorage wrote a report in 1992 entitled Genetic Stock Identification of Yukon River chum and chinook salmon, 1987-1990. The report contained preliminary data which showed that summer and fall chum salmon could be distinguished genetically, but within the summer and fall runs, U.S. and Canada-originating salmon could not be distinguished as easily. These organizations planned additional sampling, which included summer chum salmon on the Koyukuk during several years between 1990 and 1996. In 1996 additional genetic samples came from the South Fork Koyukuk Weir, and will eventually be incorporated in a final report.

Northern Unit of the Innoko NWR pike studies

In 1991 a small controversy arose when a commercial fishing guide began operating on Native lands within the Kaiyuh. Complaints of dead pike were received from local subsistence users; however, the guide insisted that his trophy catch and release fishing practices were low-impact and that fish were being handled carefully. The Complex in cooperation with the Fairbanks FRO felt that because very little was known about local pike biology it would be difficult to determine actual impacts or sustainable harvest. The ADF&G Division of Sport Fisheries was interested in pursuing a pike study in the area, so a cooperative project was proposed. Finally, late in 1993, funds in our budget coincided with ADF&G's funding for the study. The study was designed to determine: (1) summer and winter pike habitats; (2) habitat preference; (3) fidelity to seasonal habitats; (4) areas where fish are especially vulnerable to capture, especially overwintering areas; (5) the movement patterns between habitats; (6) the mechanics driving movements over large areas; and (7) the population structure in terms of length, weight, and age. All field work was completed in 1995.

A final ADF&G report (number 96-64) entitled *Seasonal migrations of northern pike in the Kaiyuh flats, Innoko National Wildlife Refuge, Alaska* was completed in 1996 by T.T. Taube and B.R. Lubinski. The abstract to the report follows:

"From July 1994 through July 1996, the Department of Fish and Game, Division of Sport Fish, and the US Fish and Wildlife Service (USFWS), conducted a joint study to identify overwintering areas and estimate length and age compositions of the Kaiyuh Flats northern pike population. During July 9-29, 1994, 50 large (>750 mm FL) northern pike were implanted with radiotelemetry transmitters and 962 northern pike were sampled for length and age. From June 12-22, 1995, the USFWS sampled an additional 840 northern pike for length and age. Northern pike were captured using trap nets, hook and line, and gill nets. Ages of northern pike sampled in 1994 ranged from 2-14 years. Mean length of all pike sampled in 1994 was 666 mm. Ages of northern pike sampled in 1995 ranged from 1-17 years. Mean length of all northern pike sampled in 1995 was 618 mm. During winter 1994-95, 45 (90%) of the 50 radio-tagged fish were found to have survived and retained their transmitters and were located within three distinct overwintering areas (2 lake channel habitats and 1 channel habitat). Sixteen (52%) of 31 fish tracked through winter of 1995-96 were found to have survived and retained their transmitters into summer 1996, with an additional 6 fish perishing or expelling their tags within their overwintering area. Of the 22 fish confirmed to have survived and retained their transmitters during winter 1995-96, 16 (73%) returned to their 1994-95 overwintering area, suggesting a strong fidelity to winter areas for those fish. Northern pike left the overwintering areas for spawning areas beginning in early May and did not concentrate in any specific spawning areas."

Contaminants

Some pike sampled on the Kaiyuh Flats in 1993 by Paul Headlee of TCC had elevated tissue mercury levels. The observed levels were below the human consumption guidelines set by the Minnesota Dept. of Health (no Alaska or national standards exist), however, Headlee recommended caution for consumption of large amounts of larger sized fish. There was a statistically significant relation between fish size and mercury level. According to Headlee, if the average size of a pike eaten is 32 inches long, the estimated mercury concentration would be 0.73 ppm (wet tissue weight). The Minnesota guidelines recommended that the amount of fish muscle tissue from fish of that size class "that could be consumed over a year long period without any adverse effect" would be approximately 23 pounds. ADF&G estimated annual per capita pike consumption in Galena and Huslia at 5.2 and 28.8 lbs., respectively. Details can be obtained in Headlee's final report entitled: *Mercury and selenium concentrations on fish tissue and surface waters of the northern unit of the Innoko National Wildlife Refuge (Kaiyuh Flats), west-central Alaska, 1993.* See also the *Nowitna* Annual Narrative, Section G.11.

14. Scientific Collections

Small Mammal Study - Small mammals were collected with snap-traps and conical pitfall traps during August and September as part of a long-term monitoring effort (see Nowitna Section G.10.). The primary species collected were red-backed vole, yellow-checked vole, and common shrew. Skulls of shrews and skulls and skeletons of other species were prepared and donated to the mammals collection at the University of Alaska Fairbanks Museum. Ectoparasites were collected and forwarded to Glens Haas and James Kjcera in Nevada for identification.

Passerine birds inadvertently killed during small mammal trapping or mist netting (Section G.7), were salvaged for study skins.

16. Marking and Banding

Total banding activities are summarized in Table G.16.1. Banding was divided into three main efforts: geese, ducks, and songbirds (MAPS project).

Geese. During July, 109 white-fronted geese were banded as part of a continuing study examining nesting and staging of Koyukuk River White-fronted geese (see Section G.3, Goose Study). Of the 109 total white-fronts banded, 69 also received neckbands. There were 58 juveniles, 51 adults, 65 females, and 44 males. There were a total of 12 recaptures, two of which were rebanded We banded at two locations on Koyukuk Refuge: Koyukuk Oxbow West, 52 captured, and Cloverleaf, 67 captured. For the first time in memory Willow Lake did not have enough birds to justify banding. As usual, Rod King of the Division of Migratory Bird Management assisted.

Ducks. We banded 336 ducks (182 northern pintail, 128 green-winged teal, 25 mallards, and 1 wigeon) between August 1-12, 1996. We were unable to band at Willow Lake due to extremely low water levels. Instead, a site was selected closer to Galena at an unnamed lake the workers named "Loafing Lake." It is also known as Tlatskokat by residents of Koyukuk Village, located 10 miles southeast of the banding site. Banding at the new site started off slow, but by the end of the two weeks, the total catch was considered a success. All birds were captured in medicine-hat traps located mainly along the southern shore of the lake. The only major problem was a black bear that learned to tip over a trap and ate seven pintails. A progress report entitled *1996 Duck Banding* was prepared by BT Jenny Lowe and is on file.

BT Fujikawa assisted in duck banding at Tlatskokat (Loafing) Lake.

We banded 192 passerines representing 18 species during mist netting operations on our MAPS project in 1996 (Table G.10.1, and see Section G.7).

Table G.10.1. Summary of bird banding at Koyukuk NWR during 1996.

White-fronted goose	109
Green winged teal	124
Mallard	24
N. Pintail	170
American wigeon	1
Sharp-shinned hawk	1
Alder flycatcher	15
Hammond's flycatcher	2
Gray jay	2
Black-capped chickadee	6
Ruby-crowned kinglet	6
Arctic warbler	1
Swainson's thrush	28
Orange-crowned warbler	18
Yellow warbler	7
Myrtle warbler	9
Blackpoll warbler	5
N. waterthrush	26
Wilson's warbler	3
Fox sparrow	5
Lincoln's sparrow	16
White-crowned sparrow	17
Slate-colored junco	25
Common redpoll	1
Total	621

H. PUBLIC USE

3. Outdoor Classrooms - Teachers

In September, at a Yukon-Koyukuk School District meeting of 14 principals and administrators, PR Johnson gave a slide program showing the refuge's involvement in school based camps, teacher workshops and classroom presentations. She also explained new teaching kits available from the refuge. Handouts on education resources available from the refuge library, contents of several teaching kits, and FWS curricula programs were distributed.

The refuge did another presentation on the new teaching kits at Project Wild Workshop in October at Galena School. Nine teachers explored the contents of teaching kits on mammals and songbirds. In the afternoon, the group enjoyed doing several Project Wild activities relating to kit materials which were presented by PR Johnson.

8. Hunting

The ADF&G Area Game Biologist has conducted a hunter check station on the Koyukuk River just south of the refuge boundary since 1983. The entire Koyukuk River within the refuge boundary is part of a controlled use area which prohibits aircraft access for moose hunting. The check station, therefore, provides a consistent source of harvest information for the majority of refuge hunters who gain access to the refuge from the Yukon River. This includes most residents on the Yukon and virtually all non-resident hunters. The check station has been a mandatory stop since 1990.

Temperatures during the September 1996 moose season were warm during the first part of the season, but then cooled off with little rain falling. Few hunters had problems caring for meat compared to last year. The refuge received few complaints from local villagers concerning meat spoilage.

Hunters checked 353 moose through the station during September 1996. This harvest was up from 1994 and also increased from the previous five year average of 189 (Tables H.2 & H.3). Numbers of hunters again rose to an all-time high exceeding the previous high. The number of non-residents hunting the area continues to increase as did the numbers of local residents for the season compared to 1995.

Table H.8.1. Number of moose hunters by residency class checked through the Koyukuk River Check Station[1]. Data courtesy ADF&G, Galena.

Year	Non-Local AK.	Non-Res.	Local Unit Res.	Total Hunters
1983	29	3	132[2]	164
1984	67	9	92[2]	168
1985	74	4	117[2]	195
1986	80	9	140[2]	229
1987	92	21	151	264
1988	121	20	158	299
1989	125	23	154	302
1990	133	36	137	306
1991	189	55	136	380
1992	173	39	145	357
1993	132	34	115	281
1994	194	56	106	356
1995	260	63	124	446
1996	306	89	213	608

[1] checking in and out was not mandatory until 1990 and compliance was lower during the first year, 1983.
[2] includes every trip made by hunter

Table H.8.2. Harvest by moose hunters and harvest rate by residency class checked through the Koyukuk River Check Station[1]. Data courtesy of ADF&G, Galena.

Year	Non-Local AK.	Non-Res.	Local Unit Res.	Total Harvest
1988	88 (73%)	20 (100%)	73 (46%)	181 (61%)
1989	89 (71%)	14 (61%)	55 (36%)	158 (52%)
1990	105 (79%)	30 (83%)	48 (35%)	183 (60%)
1991	121 (64%)	38 (69%)	49 (36%)	209 (55%)
1992	103 (60%)	19 (49%)	51 (31%)	167 (47%)
1993	109 (83%)	28 (82%)	48 (42%)	185 (66%)
1994	127 (65%)	41 (73%)	34 (32%)	202 (57%)
1995	188 (72%)	50 (79%)	49 (40%)	287 (64%)
1996	198 (65%)	66 (74%)	90 (42%)	353 (58%)

[1] checking in and out was not mandatory until 1990.

9. Fishing

Most fishing within the boundaries of the refuge takes place as part of commercial or subsistence activities which commonly use gill nets. The more traditional sport fishing (at least within the context of this section) is mainly limited to angling for northern pike in the summer and fall. Other species that receive some attention are grayling and sheefish. Two commercial use permits were issued for guided fishing during the year but neither guide made use of their permit. No air taxi operators transported clients with the main purpose of fishing.

Nancy Pitka and Albertha Sommer cleaning salmon at Galena.

Interest in the northern pike fishing on the Upper Innoko is drawing more attention each year. The quality of this fishery equals or exceeds that of any other place in the state. Fifteen pound or larger pike are not uncommon during the summer and winter in this area. The state record pike was taken just a short distance south of this area.

10. Trapping

Trapping provides an important source of supplemental income for many residents in the villages of Galena, Huslia, Kaltag, Koyukuk, Nulato and Hughes. Traplines are not registered, but are generally passed down from person to person or generation to generation. Thus, claims to certain areas for trapping are usually recognized and respected by local residents. Beaver trapping, however, is not always done within strictly controlled trapping territories. Areas are often shared by several people, perhaps because of the importance of this species as a food item. Snowmobiles are the primary means of transportation for trapping with some individuals traveling up to 200 miles round trip on the trapline. Most dog teams in Galena are used for recreation and we are not aware of any trappers using teams for transportation on their lines. Some trappers use airplanes for access and a few simply walk their traplines. Marten, the biggest catch, are generally taken using pole sets and/or cubby sets. Beavers are taken with snares through the ice while most wolves are shot or trapped with snares around kill sites.

The reported harvest of furbearers (sealing records) on the Koyukuk and the Northern Innoko is shown in Table H.10.1. These figures provide a conservative or "minimum" estimate of harvest because some skins, especially beaver and wolves, are kept by trappers for personal use. There are no sealing requirements for marten or mink. With the exception of lynx and wolverine, the number of furbearers trapped on the Koyukuk and sealed during the 95-96 trapping season, were above the 8-year mean the (Table H.10.2).

Table H.10.1. Furbearer harvest on the Koyukuk NWR and Northern Unit of the Innoko NWR (Kaiyuh Flats) during the 1995-96 trapping season.[1]

	Species				
Area	Beaver	Lynx	Otter	Wolverine	Wolf
Kaiyuh Flats[2]	42	0	6	1	6
Lower Dulbi	0	0	0	0	0
Koyukuk Mouth	0	0	0	0	0
3-Day Slough	0	0	2	1	4
Coffee Can	0	0	0	0	4
Gisasa-Kateel	0	0	0	0	0
Nikolai[2]	71	0	3	0	5
Bear Creek[2]	5	0	0	0	4
Huslia West[2]	52	0	3	2	10
Huslia East[2]	124	3	14	2	6
Total	294	3	28	6	39

[1]Based on sealing records obtained from ADF&G.
[2]This area contains several drainages and some fall outside refuge boundaries.

Table H.10.2. Minimum number of furbearers harvested on the Koyukuk NWR and Northern Unit of the Innoko NWR (Kaiyuh Flats) 1989-90 thru 1995-96.[1]

	Trapping Season							
Species	89-90	90-91	91-92	92-93	93-94	94-95	95-96	$\bar{x}$
Beaver	258	272	215	106	353	254	294	250
Lynx	7	5	17	7	22	8	3	10
Otter	2	9	11	8	24	11	28	13
Wolverine	2	12	4	3	8	4	6	6
Wolf	13	1	14	54	34	31	39	27
Total	282	299	261	178	441	308	370	306

[1]Minimum number harvested based on sealing records obtained from ADF&G.

17. Law Enforcement

More attention was devoted to conducting LE patrols during the September moose season than in previous years. Because of the high number of hunters now traveling to the refuge - 608 this year - two trips were made to the Three Day Slough area to conduct patrols. Refuge Officers Good and Liedberg, who returned to assist during the early part of the season on the Koyukuk Refuge, from September 5 - 8 and by RO Harvey Heffernan from the Arctic NWR, who worked with RO Johnson from the 22nd through 25th. Over 150 hunters were contacted during the patrols. No cases were made, but many contacts for making sure camps were left clean were made.

Koyukuk NWR law enforcement camp. (JG)

20. Subsistence Management

The Koyukuk and Nowitna Refuges support uses which occur on a checkerboard of Federal, State, Native corporation, and privately owned lands within refuge boundaries. Subsistence activities conducted on State and Native corporation lands, navigable waters, and on certificated Native allotments within the Complex, are managed by the ADF&G. Subsistence activities occurring on Federal lands and waters are administered by the various agencies depending upon ownership. As a result, user group conflicts between subsistence and non-subsistence moose hunters on the Koyukuk River continued this year. Since 1990 the present arrangement of dual Federal-State subsistence management has presented residents of the area and refuge management with many new challenges.

ROS Pete DeMatteo continued to serve as subsistence coordinator for the Complex. In fiscal year 1996 the Complex received $58K in subsistence funds, of which $50K was for salary and $8K was for travel.

Federal Advisory Council

The Western Interior Subsistence Advisory Council (Council 6) represents the residents of the western Interior region with nine seats. The function of the Council is to convey the needs and opinions of its constituency to the Federal Subsistence Board and to submit regulation proposals and comments. Included on the Council in 1996 were Chairman Raymond Collins, McGrath; Vice-chairman Harold Huntington, Koyukuk; Secretary Angela Demientieff, Holy Cross; Henry Deacon, Grayling; Jack Reakoff, Wiseman; Herman Morgan, Aniak; Gail Vanderpool, Red Devil; William Derendoff, Huslia; and Ronald Sam, Allakaket. Vince Mathews of USFWS, who is stationed in Fairbanks, served as Regional Council Coordinator for the Western Council. He is an employee of the Regional Office's Office of Subsistence Management. Vince also attended the moose co-management meetings in the region. The Council held two meetings in 1996; the first was to be in Holy Cross in March, but two weather delays caused it to be rescheduled to Anchorage. The second meeting of 1996 was held in Galena, on October 23 and 24.

Federal Subsistence Board

The Federal Board met April 1-5, 1996 to make rulings on 67 proposals concerning changes to Subpart D of the Federal subsistence regulations on seasons and bag limits. Proposal Number 44 was submitted by Harold Huntington of the Western Interior Federal Subsistence Advisory Council to close lands along the lower Koyukuk River to non-local moose hunters. The proposal read: "During the Sept. 5-Sept. 25 season, Federal lands within one half mile of the Koyukuk River from 40 miles above its mouth to the lower end of the Three Day Slough are closed to the taking of moose except by residents of Unit 21(D) and residents of Huslia and Ruby." The reasons given in the proposal for changing the regulation were: "Because of the high hunting activities during the fall moose season in this portion of the Koyukuk River, these measures would ensure a healthy moose population and would provide more opportunity for local subsistence hunters. Too many hunters travel through this area on their way to the Three Day Slough area and subsequently the moose in this area are steadily declining due to too many hunters passing through this portion of the Koyukuk River. Closing this stretch of Federal Public Lands along the Koyukuk River to non-local hunters would ultimately improve the moose herd and would increase subsistence hunting opportunities for the local hunters."

The Federal Subsistence Board approved Proposal 44 during their April 1996 meeting. The originator's objective was to decrease the competition between local and non-local user groups during September on the lower Koyukuk River; however, realization of the objective was complicated by the fact that the majority of the moose harvest occurs below

ordinary high water, in areas of State jurisdiction. ADF&G believed that Proposal 44 complicated management and enforcement and that it was not biologically necessary, so they submitted a formal request for reconsideration to the Federal Board. A teleconference was held in August 1996 to obtain further testimony, which was divided. Several Koyukuk and Huslia residents, and a few Galena residents, supported the original proposal and were against the reconsideration. Several Galena residents and the ADF&G area biologist opposed the original proposal and were in favor of the reconsideration. The Federal Board reconsidered Proposal 44 and reversed their April decision. The State and Federal moose seasons would remain aligned, but there were many hard feelings left in the villages, especially after a record-high number of non-local moose hunters were observed in September 1996 (see Section H.8).

Shortly after the 1996 moose season, an initiative for moose co-management was born in Koyukuk village, and Harold Huntington resigned his post on the Western Interior Federal Subsistence Advisory Committee. He became active in Koyukuk Tribal Council's moose co-management efforts, and a public meeting was held in November 1996 at Koyukuk village. It was mainly an informational meeting in which agencies detailed the status of the moose population and harvest, and villagers expressed their frustration with a system which they perceive favors non-local hunters and hampers their subsistence opportunities. A series of similar meetings was scheduled in other area villages in 1997. Stay tuned...

The Federal Board also continued the arduous task of prioritizing the many customary and traditional use (C&T) proposals it has received since 1990. A 1993 analysis by the Office of Subsistence Management (OSM) staff concluded that the process could take five to ten years to complete.

State proposals

In recognition of the growing conflict between local and non-local moose hunters (see Section H.8), ADF&G Area Biologist Tim Osborne presented the Middle Yukon Advisory Committee with a proposal to decrease competition on the Koyukuk River in September by establishing a registration permit hunt. He believed that a registration hunt could possibly discourage participation by some non-local and non-resident hunters. The proposal was considered by the State Board of Game March 14-23, 1996, and established a registration permit hunt for GMU 21D and 24 within the Koyukuk Controlled Use Area during the September moose season. Under the subsistence registration permit hunt, resident hunters could harvest a cow or bull without antler size restrictions during 1-25 September; however, antlers would be devalued by Department personnel at the Koyukuk check station. Under the general hunt, residents and non-residents seeking trophy bulls (50 inches or wider) or cows could obtain a "trophy" registration permit eliminating the antler devaluation requirement. The season dates for non-resident hunters for GMU 21D and 24 within the Koyukuk Controlled Use Area were maintained at September 5-25.

Initial feedback from hunters passing through the Koyukuk check station was mixed, many non-local hunters and some local hunters did not like the trophy devaluing part of the regulation, nor the uncertainty of knowing whether a permit would be available. In its first year, the registration hunt did not seem to have much of an effect on curtailing the growth of harvest and non-local hunters (See Section H.8), and this created informal calls for additional changes. ADF&G area biologist Osborne and his supervisors decided to keep the regulation the same for a few years to better analyze the effect.

State Fish and Game Local Advisory Committees

The Middle Yukon, Ruby, and Koyukuk River local Fish and Game Advisory Committees continued to function under minimal funding by the State Boards of Game and Fish. The Complex continued to work with the Committees and attempted to attend meetings whenever possible. In February, 1996, Paul Liedberg attended the Middle Yukon Advisory Committee meeting in Galena. Pete DeMatteo attended the October meeting of the Koyukuk River Advisory Committee in Hughes. Finally, on November 30, Pete DeMatteo and Jim Good attended the middle Yukon Advisory Committee meeting in Kaltag.

I. EQUIPMENT AND FACILITIES

3. Major Maintenance

Support pilings under quarters no. 2 were reconditioned and sealed. Arctic windows were installed in two quarters to replace old, mildewed window frames.

4. Equipment Utilization and Replacement

A new 1,000 gallon vaulted fuel tank received in 1995 was wired for electricity and made operational for gasoline storage and dispensing in the wareyard.

Two new vehicles ordered in FY95 arrived this year. They were a Ford Ranger pickup and a Dodge Ram pickup which serves as our fuel truck.

5. Communications Systems

Reliable radio communications are essential to conducting safe and efficient field work in the remote parts of the refuges. Due to the size of the complex, a fairly complicated radio system has evolved. The first remote facilities were installed in 1988, but reliable communications were not attained until 1992, when several required improvements in mountain-top equipment became a reality. The system has since worked well, but it has taken considerable coordination between FMO Rebarchik and the BLM AFS radio communications maintenance staff to keep it that way.

The Complex is serviced by a network of mountain-top VHF-FM radio repeaters that provide coverage to most of the areas in which we work. The main hub of the radio network is located on Totson Mt., 35 miles south-southwest of Galena. The Totson site receives VHF signals from the field directly on local channel 1, or indirectly through two repeaters on the Koyukuk (Roundabout Mt., channel 2 and Purcell Mt., channel 3) and two repeaters on the Nowitna (Peak 2321, channel 5, and VABM Kokrines, channel 7). In addition, the Totson site has a repeater (channel 4) that allows portable-to-portable communication without relaying through the office. Communications between the office and the field, and repeater control, are established through a UHF link from the base console in the office to Totson Mt. A telephone interconnect is available for emergency communications after office hours.

6. Computer Systems

Every permanent, professional, administrative, and technical staff member has an individual computer workstation protected by an Uninterrupted Power Supply. All workstations and peripheral equipment are linked together via a peer-to-peer network using Windows for Workgroups. A peer-to-peer network does not require a server and generally requires less administration than a server-based network. The network allows easy access to printers and other peripheral equipment and enables staff to readily share files and other information. The refuge network is also tied to an adjacent office building that houses ADF&G, Louden Village council, and Gana-A'Yoo, Ltd.

A number of peripherals were added to the network in 1996 including a Cannon Bubble Jet Color printer, HP Scanner, and Iomega Jazz drive. Three new Pentium Desk Top Computers and one Pentium Laptop were purchased to replace older 486 workstations. An assortment of software was upgraded and several workstations received memory upgrades. One GIS-capable Pentium Desktop, 21" monitor, and PC Arc Info software was purchased for the FMO.

The refuge shares a geographic information system (GIS) with the lands department of Gana-A'Yoo, Ltd. (GYL), a cooperator on land bank and previous challenge cost share agreements. The GIS, in combination with the network, has proved to be valuable for producing and sharing maps used for management of wildlife, fish, and land resources, as well as fire management. The GIS uses ArcView and PC-ARC software, and includes a Summagraphics E-size digitizer and an HP DesignJet 650C color plotter.

8. Other (Aircraft)

The complex uses three aircraft, one Cessna 185 (N714KH) and two Piper Super Cubs (N4343 and N13833), to conduct most field operations. All three aircraft are on floats during the summer and on skis during the winter. Wheels are used only for a few weeks during transitions between seasons. The three airplanes and three refuge pilots flew a total

of 552 hours in 1996. This was done without incident, and represents this station's thirteenth year without an aviation accident or incident. Our annual flying hours have declined steadily since 1992, when we peaked at 1024 hours. We flew 67 hours in 1995. Flying activities have declined due to completion of several large aerial radio-telemetry studies and wildlife census projects.

The three aircraft are essential to accomplish field operations over the entire Complex because most of the flying occurs in two seasonal peaks: (1) summer (waterfowl inventory, and banding, small mammal and furbearer inventories); and (2) winter (moose, wolf and caribou surveys). Most of these inventories have surveys with narrow phenological and weather windows in which we can accomplish the work. Three pilots worked on the staff in 1996, two dual-function GS-485 Refuge Operations Specialists (Liedberg and Spindler) and one full time GS-2181 pilot (Brown). The three pilots on staff and three aircraft provide the flexibility to schedule several types of work, or similar comparative work in several areas of the complex, and accomplish it despite the unpredictable weather and limited daylight of the subarctic winter.

Aircraft are "owned" and maintained by the Office of Aircraft Services who bill the Service for hourly flight time and monthly availability rates. In calendar 1996, the hourly flying bill for our three aircraft was about $48,000. Monthly availability charges are incurred for each aircraft, whether it is flown or not, and that amounted to an estimated $29,000. The hourly and monthly charges, plus aviation fuel, and mechanics and pilot travel for field maintenance and ferry flights, respectively, put the annual flying bill at about $100,000. Maintenance for our remotely-located aircraft was made easier by our use of Northland Aviation, an OAS-approved maintenance facility in Fairbanks. During the year there were no private mechanics in Galena who could assist with emergency breakdowns.

J. OTHER ITEMS

1. Cooperative Programs

In 1992, Gana-A'Yoo, Ltd. (GYL) requested cooperation and technical assistance to guide land use decisions on Corporation Land Bank holdings within and around the Koyukuk and Northern Unit of Innoko NWR. It is of mutual interest to both the Service and GYL to cooperate so that their adjacent lands are managed in a way that is compatible and complementary and that minimizes conflict and degradation of habitat. The corporation's goal is to provide shareholders with a land base that continues to meet their subsistence needs and optimally can provide commercial uses at a profit while maintaining the land's biodiversity and productivity. GYL would like to develop some land-based economic activities to improve local employment opportunities. Possible economic developments include commercial timber harvesting, guided recreational wildlife observation tours, guided and outfitted hunting, fishing, and dog sled trips, and

cabin/camp site permits. Additionally, the corporation would like to conduct habitat enhancements, particularly prescribed burning, to improve moose populations and berry production for subsistence and commercial leasing opportunities.

For the fourth consecutive year, the Service signed a challenge cost-share agreement with GYL. The agreement recognized that the Service and GYL share a great need for efficient access to land status, natural resource, and public use data. The agreement was the vehicle for continued funding of the Geographic Information System (GIS). Both land-managing organizations now share easy access to the same high quality information upon which land use planning and management decisions can be based.

Benefits to the refuge and Gana-A'Yoo include:

1) Ability to cooperatively manage Land Bank and adjoining federal, state, and private lands as one ecosystem.
2) Ability to produce a cooperative land use plan that will have as a goal the maintenance of existing biodiversity in the nearly pristine ecosystem, protect subsistence and endangered wildlife species, but allow wise beneficial uses of these resources.
3) Guidance of economic development activities so that wildlife and fish habitats are protected and enhanced rather than degraded.

Several major projects were continued as part of the agreement in 1996.

1) BT Marlene Marshall continued to be employed to make additions to the GIS database. During the year she generated maps on land status, wolf, swan, moose, and caribou distribution, wildfire history, and vegetation. She also assisted with numerous other tasks that could take advantage of the GIS capabilities. BT Jean Fujikawa arrived in July and assumed full time GIS work while Marlene changed to part time. Jean spent considerable time organizing the system to function more efficiently.
2) Development of a vegetation map.

The Challenge Cost Share program has been an excellent way for us to cooperate with an adjacent landowner to achieve many common goals. The funding source and project goals will be pursued in future years.

In 1995 the refuge began a long-term cooperative project with the local public radio station, KIYU. *Raven's Story* began as part of a wildlife study to determine why geese declined in the Koyukon Region. Elders were asked to recall and describe abundance and habitat conditions. This information was not available from other sources because no formal waterfowl studies occurred in the area before the 1950's. We therefore tape-recorded these valuable observations, and other information about wildlife and fish species that elders were willing to share. *Raven's Story* was started in 1995 because Catherine and Steven Attla of Huslia wanted to share their stories with youth in their village; and the

Galena public radio station, KIYU, was interested in airing local Athabascan programming. The goal of *Raven's Story* is to record elder's stories, observations, and experiences relating to wildlife, fish and subsistence in the Koyukon Region. We hope to find at least four elders from each of eight villages in the region who are willing to share their stories with public radio listeners. For radio, each interview is produced into several 3-10 minute segments about a particular topic with a music and narrative introduction and a music outro with credits. The series airs weekly throughout Interior Alaska over KUAC and it's affiliated public radio stations and translators as part of Community Radio of Alaska. It also airs in Anchorage on the Native public radio station KNBA.

In 1996 Spindler completed interviews with Galena elder Sidney Huntington and a month's worth of production work with the material. Interviews with Joe and Celia Beatus of Hughes were also completed in 1996. After radio production is complete, the original tapes are deposited in the University of Alaska Fairbanks oral history collection. Collectively these interviews are a valuable source of information about subsistence practices, wildlife and fish relative abundance, and even habitat conditions during a time period for which little other baseline information is available. The project has received great support from local tribal councils, radio stations KIYU and KUAC, and the public radio network.

KIYU, Catherine and Steven Attla, and Mike Spindler were jointly presented a "Goldie Award" for *Raven's Story* by the Alaska Broadcaster's Association at their 1996 convention. The award was for *Best radio entertainment series for small stations*. KIYU radio station manager Bob Sommer accepted the award, which was an honor for a small bush radio station.

4. Credits

WB/Pilot Mike Spindler, B, D5; G1, 2, 3-part, 4, 5, 6, 7-part, 8-part, 10-part, 11, 16; H8, 20; I5 ,6 ,8; J1; Highlight-part
WB Orville Huntington, G3-part, 8-part; Highlight-part
WB/LE Buddy Johnson, G7-part, 10-part, 14; H10
WB Lisa Saperstein, G8-part; C3; E1; Highlight-part
PR Heather Johnson, E1; Highlight-part
FMO Bob Rebarchik, F9; Highlight-part
ROS Pete DeMatteo, E6; D4, 5
DRM Jim Good, Highlight, E1, 5, 6; F12; H8, 9, 17; I2, 4; J1, 4; Feedback; Editing
AT Rosie Cassou, Editing
RC Sharon Tunnell, Word processing and formatting
Photo credits: JG(Good)

K. FEEDBACK

We continue to have concerns about not receiving service for our OAS aircraft after trying many times to reach the appropriate individuals in the Anchorage Office. This is an on-going saga. OAS needs to improve their customer service. Hopefully someone with the authority can get OAS to be more responsive.

ANNUAL NARRATIVE REPORT

1996

NOWITNA NWR

KOYUKUK/NOWITNA NATIONAL WILDLIFE REFUGE COMPLEX

Galena, Alaska

REVIEW AND APPROVALS

Complex Manager	Date	~~GARDNER~~ Acting Refuge Supervisor	05/30/2004 Date
Regional Office Approval		10/27/06	Date

INTRODUCTION

The Nowitna National Wildlife Refuge was created on December 2, 1980, with the passage of the Alaska National Interest Lands Conservation Act. Purposes for which the refuge was established are:

1. To conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, trumpeter swans, white-fronted geese, canvasbacks and other waterfowl and migratory birds, moose, caribou, marten, wolverine and other furbearers, salmon, sheefish, and northern pike;

2. To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitats;

3. To provide the opportunity for continued subsistence uses by local residents;

4. To ensure water quality and necessary quantity within the refuge.

The refuge lies approximately 200 miles west of Fairbanks in the Central Yukon River Valley. It comprises 2.1 million acres of forested lowlands, hills, lakes, marshes, ponds, and streams. The Nowitna River, a nationally designated Wild River, drains the refuge from south to north. The lowlands along this river are prime waterfowl production and migration habitat. The river and its tributaries support king and chum salmon runs, a large pike population, and one of only three resident sheefish populations in the state. The Yukon River, which forms the northern boundary of the refuge, has a salmon fishery of international significance and is an important transportation corridor. The refuge's very productive marten habitat prompted specific reference in ANILCA to its outstanding furbearer value. Other species of interest common on the Nowitna are moose, wolves, black and grizzly bears, beaver, wolverine, lynx and several species of raptors including nesting bald eagles.

Access to the refuge is possible by airplane, boat, snowmachine, foot, or dog sled. The Complex's aircraft, two Super Cubs and a Cessna 185, as well as three river boats and several snowmobiles provide transportation. The refuge headquarters is located in Galena, a village of approximately 500 people. See the Koyukuk report for a description of Galena. In 1989, the Nowitna Refuge was fused into a complex with the Koyukuk NWR and the Northern Unit of the Innoko NWR. Items common to all refuges are presented in detail under the Koyukuk report.

Fall colors, Nowitna River scenery looking toward the Yukon River with Kokrine Hills in the background. (JG)

INTRODUCTION

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H. PUBLIC USE

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K. FEEDBACK

A. HIGHLIGHTS

G.3. Reports were completed on duck production surveys (1983-1992) and goose production surveys (1983-1995) for the Refuge.

G.10. Small mammal studies started in 1991 to determine use of three stages of post-fire succession resulted in over 518 animals being live-trapped this year. Primarily red-backed and yellow-cheeked voles were captured.

G.11. The baseline water contaminants report for the refuge was finished.

I.2. The lower Nowitna administrative cabin received some needed repairs.

I.5. A much-needed permanent radio repeater was installed in the Kokrine Hills.

B. CLIMATIC CONDITIONS

Refer to the Koyukuk section of this report.

D. PLANNING

5. Research and Investigations

The following approved refuge wildlife studies were active during 1995. Progress reports are available from the Complex office or the Regional Office Library. Brief reports from the studies are included in the appropriate section of this narrative.

The relationship of wildland fire to lynx and marten populations and habitat in interior Alaska (Project No. 75620-90-01).

The purpose of this project was to examine the response of marten, lynx, and small mammals to differing stages of habitat succession following wildland fire. This four-year field project was initiated in August 1990. The overall project has developed into three subprojects specifically addressing 1) marten, 2) lynx and 3) small mammal prey species. Although the furbearer field research has focused on the Nowitna NWR, major consideration has been given to larger regional databases, e.g. small mammals, fire history, fur sales records, and interviews with trappers. A final project report was completed at the end of 1995. Two publications in scientific journals resulted from the study: *Marten selection of postfire seres in the Alaskan taiga, Can Journal of Zoology* 74:2225-2237; and *Selection of post-fire seres by lynx and snowshoe hares in the*

Alaskan Taiga. Northwestern Naturalist 78: 77-86. WB Buddy Johnson, WB Paragi, and BT Don Katnik were all instrumental in seeing this project through to publication of results. With publication of these two papers, the furbearer part of the study was officially over, but small mammal work has continued because it focuses on relation of wildland fire and long-term population cycles (See Section G.10).

Contaminants

A technical report entitled *Contaminant baseline data for water, sediments, and fish of the Nowitna National Wildlife Refuge, 1985-1988,* was completed in August 1992 by Northern Alaska Ecological Services (NAES) in Fairbanks, with cooperation of refuge staff. This study was initiated on the Complex in 1985. Periodic sampling was conducted on the Koyukuk, Nowitna, and Northern Unit of the Innoko Refuges. The objectives of the study were to quantify the level and distribution of elevated mercury concentrations, compare heavy metal concentrations between watersheds with placer mining and those known to be free of previous mining activity, and determine the level of contaminants in wildlife resources that use known contaminated watersheds. A final report summarizing sampling efforts in the 1980's was completed in 1992. A final report of 1991 field sampling was completed by USFWS Northern Alaska Ecological Services during 1996. A summary of the study results is presented in Section G.11.

E. ADMINISTRATION

1. Personnel

Refer to the Koyukuk section of this report.

2. Youth Programs

Refer to the Koyukuk section of this report.

4. Volunteer Program

Refer to the Koyukuk section of this report.

5. Funding

Refer to the Koyukuk section of this report.

6. Safety

Refer to the Koyukuk section of this report.

7. Technical Assistance

Refer to the Koyukuk section of this report

8. Other

Refer to the Koyukuk section of this report

F. HABITAT MANAGEMENT

1. General

Habitat types on the Nowitna NWR are characteristic of interior Alaska but an unusual feature of the refuge, compared to most other Alaska refuges, is that 88% of its lands are forested. The lower Nowitna drainage has some especially high quality white spruce measuring over 18 inches in diameter and over 100 feet high. Approximately 36% of the refuge is dominated by black spruce, whereas, an estimated 2% is dominated by white spruce. The primary use of spruce by local residents is for house logs and firewood, although small commercial sawmills have operated in Tanana, Ruby and Galena. The majority of the highest quality timber on the refuge grows along the Nowitna River. The Comprehensive Conservation Plan for the refuge precludes commercial timbering. Local interest in commercial logging operations on islands of the Yukon River has been expressed.

Fall colors along the Nowitna River just north of the lower administrative cabin. (JG)

2. Wetlands

The Nowitna's many river watersheds and thousands of lakes provide the basis for the refuge's abundant aquatic resource. The principal rivers on or adjacent to the refuge include the Yukon, Nowitna, Sulatna, Big Mud, Little Mud and Grand Creek. With the exception of the Nowitna, all of these rivers carry a heavy sediment load.

The Nowitna River is the heart of the refuge. This meandering river is constantly creating a diversity of new habitats for fish and wildlife. The river's main channel is 283 miles long, of which 223 miles are within the refuge. The river width ranges from 150 to 450 feet wide and has a mild gradient with all Class I water. The main channel in the lower river is typically 20-30 feet deep in early summer. Limestone in the Kuskokwim Mountains near the headwaters of the Nowitna, contributes carbonates which buffer the acidic qualities of the river and make it more productive than many of its interior Alaskan counterparts. The river flows into the Yukon River which is the fifth largest river system in North America.

Placer mining for gold and other minerals, which was stimulated by the lifting of federal restrictions on gold prices in the early 1970s, has gone through a resurgence since that time. A number of placer mines operate within the Nowitna River drainage on mostly State land west of the refuge. This mining technique is a source of aquatic and riparian habitat destruction and potential downstream impacts are a concern.

Lowlands of the Nowitna Refuge are dominated by ponds and marshes, most of them smaller than ten acres. There are approximately 14,000 lakes and ponds on the refuge, and wetland acreage is estimated at about 30,000. No active manipulation of the wetland habitats takes place on the Nowitna Refuge.

3. Forests

The Nowitna's vegetation forms part of the circumpolar northern coniferous forest. On the Refuge, forests dominate at elevations below treeline. Open stands of black spruce are common in low-relief terrain. White spruce, occasionally growing with white birch and aspen, can be found in the better-drained and warmer sites. White birch and aspen may dominate following a disturbance such as fire; however, some stands are considered to be mature or climax in certain habitats.

Seven major vegetation classes were distinguished in a mapping process conducted by Talbot and Markon in 1985 using Landsat images (Talbot, S. S., and Carl J. Markon. 1986. *Vegetation Mapping of Nowitna NWR, Alaska Using Landsat MSS Digital Data. Photogrammetric and Remote Sensing.* Vol 52, No. 6. June 1986, pp 791-799). They defined the forest class site as one with trees at least 16 feet tall. Included in this category are intermediate successional stages, or secondary tree growth temporarily less than 16 feet. Forests are the most widespread vegetation type, covering 88% of the refuge. Of the five recognized subclasses, open needleleaf forest and broadleaf forest are the most extensive, comprising almost 1.5 million acres or 72% of the surface area of the Refuge.

The five forest subclasses are described as follows:

Closed needleleaf forest - This subclass has 60 to 100% cover, occurs on moist to well drained sites from the lowlands to mountain slopes and is particularly well developed on

alluvial sites along the Nowitna River and on some islands in the Yukon River. The dominant tree species is white spruce, which may grow in excess of 100 feet tall along the Nowitna River. White birch and balsam poplar are secondary species. This subclass comprises 2% of the Refuge surface area.

Open needleleaf forest - This subclass has 25 to 60% tree cover and is found on moderately to poorly-drained soils. It is usually dominated by black spruce or larch. This subclass comprises 42% of the Refuge surface area. This subclass comprises 42% of the Refuge surface area.

Needleleaf woodland - This subclass which is sometimes called "muskeg" has 10 to 25% tree cover and is found on moderately to poorly-drained soils. Black spruce is the most common tree and dwarf shrubs such as Labrador tea, bog blueberry, lingonberry, and small cranberry are important in the understory. Sphagnum moss covers much of the ground, insulating the permafrost layer beneath. This subclass comprises 10% of the Refuge surface area.

Broadleaf - This subclass has 25 to 100% cover and occurs in well to imperfectly-drained sites. White birch, aspen, and balsam poplar dominate the overstory. Other types of broadleaf deciduous forests occur on hills where strips of birch forest line many hillside streams, and aspen is present on south-facing sandy hillsides. This subclass comprises 30% of the Refuge surface area.

Mixed forest -This subclass has 25 to 100% cover. It consists of deciduous broadleaf and evergreen needleleaf trees over large areas of moderately to well-drained soils on the lower mountains. It grows tallest in lowlands along rivers and on islands in the Yukon River. Principal species are white birch, aspen, and white spruce. This subclass comprises 4% of the Refuge surface area.

6. Other Habitats

In addition to the forest vegetation classes described in F. 3, Talbot and Markon went on to describe several other classes that occur on the Nowitna Refuge. With the exception of the water classes, the others are described here.

A vegetation class of scrub was described in the mapping process which includes over 4% of the refuge surface area. Sites in this vegetation class are composed predominantly of deciduous shrubs ranging from 1.5 to 16 feet in height. Three subclasses occur within the scrub type and include lowland broadleaf, alluvial broadleaf, and subalpine broadleaf. Dominant species within these subclasses include *Alnus crispa, A. incana, Salix planifolia, and S. alaxensis.* Chief understory species include *Vaccinium vitis-idaea, Linnaea borealis, Calamagrostis canadensis, and Equisetum arvense.*

The dwarf scrub class is also called tundra and contains slow-growing dwarf shrubs less than 1.5 feet tall, chiefly in the heath and crowberry families. One subclass includes dwarf scrub-graminoid tussock peatland which is located on poorly-drained organic soils. Mosses and lichens cover the surface. Dominant species include *Ledum decumbens, Vaccinium uliginosum, V. vitis-idaea, Betula glandulosa, Eriophorum vaginatum, Carex bigelowii, Rubus chamaemorus, Sphagnum* spp., *Dicranium* spp., *Cladina* spp. and *Cetraria* spp. The second subclass is prostrate dwarf shrub tundra which characterizes relatively bare alpine communities. It is dominated by matted dwarf shrubs and is also rich in lichens. Dominant species include *Dryas octopetala, Salix phlebophylla, Vaccinium uliginosum, V. vitis-idaea, Empetrum nigrum, Diapensia lapponica, Salix arctica, Arctostaphylos alpina, Sphaerophorus globosus, Cetraria nivalis, C. cucullata, Alectoria ochroleuca, Thamnolia subuliformis,* and *Stereocaulon* spp. The dwarf scrub class accounts for 1.9% of the Refuge surface area.

A herbaceous vegetation class is dominated by herbaceous plants and includes grasses, sedges, and flowering plants. The primary subclass is graminoid bog, marsh, and meadow. Graminoid bog has a mossy surface underlain by peat which is often saturated with water. Typical graminoids in this subclass are *Eriophorum russeolum, Carex limosa,* and *Carex chordorrhiza.* Graminoid meadow is relatively dry and dominated by *Calamagrostis canadensis.* It is often associated with old river meander scars. Graminoid marsh primarily occurs at the margins of lakes and ponds. The most important graminoids in this subclass are *Carex aquatilis* and *Carex rostrata.* This class occurs along the margins of most wetlands on the refuge. Approximately 1.8% of the Refuge is comprised of this class.

A scarcely vegetated areas class includes subclasses of scarcely vegetated floodplain and scarcely vegetated scree. In this class, plants are scattered or absent and bare mineral soil or rock dominates. The scarcely vegetated floodplain subclass includes river alluvium areas recently colonized by *Populus balsamifera, Salix alaxensis, Epilobium angustifolium, E. latifolium, Artemisia tilesii, Achillea sibirica, Equisetum arvense, Arenaria physodes* and several grasses. Less than 0.2% of the Refuge is comprised of this class.

9. Fire Management

This was a moderate to mild fire year in Alaska. The Nowitna refuge had only two wildfires in 1996. Lightning started both fires in limited suppression zones. Fire number 7619 burned in mid June, for a total of 1.0 acre. Fire number 7608 started July 7, and burned 813.0 acres until it was called out on July 31, 1996.

12. Wilderness and Special Areas

The Nowitna River within the Nowitna NWR was designated a Wild River by ANILCA per provisions of the Wild and Scenic Rivers Act. The main river channel is 283 miles long, of which 223 miles are within the refuge. The watershed of the Nowitna is 7,244 square miles, of which only 31% lie within the boundaries of the Refuge. Except for nine trapper cabins and two refuge administrative cabins along the river, there are no improvements within the corridor. Two State of Alaska R.S. 2447 Rights-of-Way (ROW) are recorded within the boundaries of the Nowitna Refuge. One of these (No. 219) encroaches on the Wild River corridor in several places and could present management problems should the state choose to exercise use of the ROW.

G. WILDLIFE

1. Wildlife Diversity

The Nowitna Refuge supports a diverse group of wildlife representing most of the species found in interior Alaska. Thirty-seven species of mammals, 147 birds, 20 fishes, and 1 amphibian are known to occur on or near the refuge. A draft bird list for the refuge was completed in 1992. It will not be published until adequate field and literature review can be accomplished. Particularly lacking are observations and documentation of upland and alpine-breeding species.

2. Endangered and/or Threatened Species

The American peregrine falcon is the only endangered animal species known to breed on the Nowitna refuge. Delisting has been proposed for the American peregrine; Region 1 is responsible for acting upon the proposal and is gathering information. There is also a proposal to delist the threatened arctic peregrine falcon, which migrates across the refuge. ADF&G has recommended that the American and arctic peregrine falcons be removed from the state's endangered species list but should be considered "species of special concern."

3. Waterfowl

Wetlands in the Nowitna River floodplain support large waterfowl populations. Principle duck species breeding on the refuge include American wigeon, northern pintail, mallard, green-winged teal, surf scoter, white-winged scoter, common and Barrow's goldeneye, bufflehead, and lesser scaup. Less abundant breeding ducks include northern shoveler, red-breasted merganser, greater scaup, canvasback, ring-necked duck, redhead, black scoter, and oldsquaw. Arctic, red-throated, and common loons also nest on the refuge, as do horned and red-necked grebes. Canada geese, white-fronted geese, trumpeter swans, and tundra swans are found on the refuge in moderate to high numbers. The greatest

concentrations of waterfowl occur during spring and fall migrations on large, shallow floodplain waterbodies, especially connected oxbow lakes that are partially drained.

Weather Conditions and Waterfowl Migration Chronology

In 1996, spring breakup on the Yukon was about normal in timing (May 14 at Galena, two days later than average), but there was some local ice-jam flooding. During a flight over the Nowitna on May 10 the following phenological observations were made by WB Huntington and Pilot Brown: (1) the upper Sulatna River was open and flowing; (2) valley floors had 0-5% snow cover, while north hillsides had 20-30% snow cover and south hillsides had 10-20 % snow cover; (3) the upper Nowitna was open but ice was jammed in places, there was some flooding over the banks; (4) the Titna River was open and flowing bank to bank; (5) the Big Mud River had ice jammed at the mouth; (6) the Little Mud river was open and flowing; (7) the mouth of the Sulatna river was open with small ice jams; (8) very high water occurred on the lower Nowitna River due to an ice jam three miles below the lower administrative cabin--water was at the bottom of the storage shed. Observers counted 917 swans during this flight, along with many cranes and geese. It appeared as though the flight occurred just as the wetland habitats were opening up and breeding birds were arriving while migrating birds were passing through. Habitat conditions were estimated to be about average for waterfowl nesting and brood production. This was in contrast to the excellent conditions observed in 1995 and the poor conditions that occurred in 1989, 1992, and 1994. Significant widespread flooding occurred along the lower Nowitna River during 1989, 1992, and 1994. In 1994, an ice-jam flood on the Yukon just above Ruby caused record water levels and flooded much of the available waterfowl habitat in the Nowitna floodplain as far up as the Loop.

Ducks

Duck production surveys were conducted on the refuge from 1983 to 1992. Duck production survey methods continuously improved as they evolved, but data sets were small and staff turnover caused inconsistencies in methodology. In 1990, surveys were standardized to produce refuge & statewide estimates, but these methods were too costly to continue annually. WB Saperstein was tasked with preparing a summary of the results of all duck production surveys. In 1996 she completed a report entitled *A summary of ten years of duck production surveys, Nowitna National Wildlife Refuge, Alaska, 1983-1992.* An abstract of that report follows:

"Individual lakes were surveyed from 1983-1989, but after standardization in 1990, all waterbodies within 2.6 km^2 plots were surveyed. Methods of stratifying the refuge to obtain better production estimates also varied until 1990 when the refuge was divided into three strata of expected production based on the quantity of water contained in 2.6 km^2 plots. Refuge-wide production estimates reported between 1987-1992 ranged between 4,209 ducklings (90% CI=14.5%) in 1989 and 17,140 ducklings (90% CI=15.9%) in

1988. Confidence intervals around production estimates were much wider following standardization of techniques and refinement of statistical procedures in 1990." [Production estimates between 1990-1992 ranged from 4,855 (90% CI=63.4%) in 1991 to 14,270 (90% CI=57.4%) in 1990. Standardization and stratification methods that worked for other Alaska refuges to improve precision of estimates clearly did not improve the quality of estimates for Nowitna.]

"Twenty-six lakes surveyed for at least five years during the ten year period were used as a subset for statistical analyses. Duckling density observed in these lakes was highly variable among years. Kruskall-Wallis tests were conducted to compare duckling density within years among strata defined by geography and type of lake (bog, non-bog, or connected oxbow). Significant differences among strata were detected only for dabblers in 1986 and 1987. Mann-Whitney U tests were also performed on a simplified data set to compare density between bog and non-bog lakes in each year. Significant differences were detected for dabblers in 1987 and 1989."

The only other indication of trends in duck numbers available for the refuge is the aerial duck breeding pair survey conducted by the Service's Division of Migratory Birds in Juneau. A summary of key duck species estimates for the Tanana-Kuskokwim stratum is presented in an unpublished report entitled "*Alaska-Yukon waterfowl breeding pair survey, May 14-June 15, 1996.*" The Nowitna NWR comprises <10% of the Tanana-Kuskokwim Stratum, and therefore, these data will not be presented here. For 1996 trends by species, in a nearby area, see the *Koyukuk* annual narrative, Section G.3.

Geese

Production. Results of river float-trips to assess goose production were summarized by BT Lowe and ROS/Pilot Spindler in Progress Report FY96-01 entitled: *Goose production surveys on Koyukuk and Nowitna National Wildlife Refuges, Alaska, 1983-1995.* A brief summary of the Nowitna portion of the report follows:

"River float-trip surveys have been conducted annually on the Nowitna NWR to assess goose production and record observations of other wildlife. Surveys were initiated on the Nowitna in 1985. During the period from 1985 to 1993, a trend of declining goose abundance was observed. This trend partially reversed in much of the Koyukuk/Nowitna Refuge Complex in 1994 and 1995. Surveys in most areas of the Complex showed small increases over 1994 goose numbers. The 1995 survey showed a sharp increase in greater-white-fronted goose numbers on the Nowitna. Observations of Canada geese continued to decline on the upper Nowitna River, and the 1995 totals were the lowest ever observed. The Nowitna River was the only river surveyed that experienced a sharp decline in 1995."

Between 1995 and 1996 the Nowitna River goose production survey showed a 23% decline in adult and an 18% decline in young white-fronted geese, but both values were

above the long-term mean. Age ratio, at a healthy 73% young, was similar to 1995 and the long term mean. A 9% decrease in adult an 11% decrease in adult and young Canada geese was observed between 1995 and 1996. Percent young, 64, was similar to the previous year, but was above the long-term average.

Swans

Both Trumpeter and Tundra Swans nest on the refuge but species composition has differed by area and year; therefore, late summer aerial production surveys have necessarily grouped the two species simply as"swans." Swans are considered a key indicator species because their production trends tend to correlate well with that of other waterfowl species, swan sightability is high during aerial surveys, and they are sensitive to nest disturbance. Swan surveys have been conducted on the Nowitna NWR by refuge staff since 1985 to determine trends and locate nesting and staging areas. The staff selected eight 1:63,360 trend maps to monitor swan population and production, according to the wildlife inventory plan.

Complete statewide censuses of Trumpeter Swan summer populations in Alaska were conducted by USFWS in 1968, 1975, 1980, 1985, 1990, and most recently in 1995. The survey covers 51,364 statute miles of aerial survey transects in the known range of Trumpeter Swans. All maps with swan habitat within the entire Nowitna NWR were surveyed in 1990 and 1995. The purpose of this survey was to accurately detect any long term population changes in Alaska. This effort was coordinated and funded by the Migratory Bird Management Field Office in Juneau.

Results of refuge aerial swan surveys were summarized by BT Lowe and WB/Pilot Spindler in Progress Report FY96-02 entitled: *Aerial Swan production surveys on Koyukuk and Nowitna NWRS, Alaska, 1985-1995.* A brief summary follows:

"Aerial surveys of a sample of eight trend maps indicated that adult swan populations on the Nowitna NWR increased from 1985 to 1995. Slight declines in percent young were noted on the Nowitna NWR in the years between 1990-93. The declines were partially reversed in 1995, when percent young increased. Censuses of all swan habitat on all units of the Nowitna NWR in 1990 and 1995 also indicated that the total population has increased. In the five years between these two most recent censuses, swan estimates on

the Nowitna NWR increased 68% from a total of 292 to a total of 492. The estimated annual growth rate of the adult component was 12%."

No swan surveys were completed on the Nowitna during 1996.

4. Marsh and Water Birds

A number of marsh and water birds are commonly observed on the refuge, including: common, Pacific, and red-throated loons, red-necked and horned grebes, and sandhill cranes. Yellow-billed loons are occasionally observed.

5. Shorebirds, Gulls, Terns, and Allied Species

Some of the shorebird species commonly seen on the refuge include the following: common snipe, whimbrel, semipalmated, least, spotted, solitary, and upland sandpipers, lesser yellowlegs, golden and semipalmated plovers, long-billed dowitcher, and northern phalaropes. Mew gulls and arctic terns are common breeders and Bonaparte's and Herring gulls are regular nesters. No trend surveys are conducted to determine the status and distribution of these species, but observers on goose production surveys were encouraged to record sightings of any *Charadriiform* birds they identified.

6. Raptors

The Complex has nesting populations of rough-legged hawks, merlin, sharp-shinned hawks, ospreys, northern harriers, red-tailed hawks, goshawks, great horned owls, great gray owls, boreal owls, northern hawk owls, American peregrine falcons, and bald eagles. Snowy owl, Swainson's hawk, and gyrfalcon are occasional visitors. Northern hawk owls were seen on a regular basis during the Fire/Furbearer study in the 1985 burn. This burn is in the tall shrub-sapling stage and supports a diverse microtine community. Peregrine falcons and rough-legged hawks nest on river bluffs along the upper Nowitna River and along the Yukon River within the refuge, while the other species tend to be forest nesters.

7. Other Migratory Birds

A Breeding Bird Survey (BBS) route, established in 1994 on the Ruby Road, was completed on 12 June 1996. The BBS route follows the Ruby Road, a 50-mile long gravel road that provides access to several mining areas south of Ruby. The route was designed to be run from south to north (toward Ruby) so that the observer could become familiar with the route while on the way to the start, remain overnight, and then run the survey the next day on the way back to Ruby. The survey was conducted following procedures established by the BBS and began approximately ½ hour before sunrise at 03:17 and was completed at 07:42, an elapsed time of four hours, 25 minutes.

Observations were recorded for 257 individuals of 20 species. The most frequently encountered species were Swainson's thrush (68 individuals recorded at 40 stops), alder flycatcher (31 individuals recorded at 21 stops), and slate-colored junco (29 individuals at 25 stops). This is a substantial decrease from last year when 354 individuals of 22 species were recorded (Table G.7.1).

Table G.7.1. Total individuals recorded and the number of stops, out of 50, at which each species was detected during Breeding Bird Survey, Ruby, Alaska 1994-96.

	1994		1995		1996	
Species	Total	Stops	Total	Stops	Total	Stops
Common Snipe	1	1	0	0	0	0
Ruffed Grouse	0	0	1	1	0	0
Olive-sided Flycatcher	0	0	1	1	0	0
Alder Flycatcher	50	32	37	25	31	21
Hammond's Flycatcher	3	3	1	1	2	2
Gray Jay	1	1	2	2	1	1
Common Raven	2	2	1	1	7	7
Ruby-crowned Kinglet	25	24	37	29	21	20
Grey-Cheeked Thrush	1	1	4	3	4	3
Swainson's Thrush	92	42	113	46	68	40
Varied Thrush	10	9	17	14	9	9
American Robin	0	0	2	2	5	5
Orange-crowned Warbler	17	16	10	10	15	15
Yellow Warbler	19	17	10	10	13	11
Myrtle Warbler	19	19	27	21	22	21
Blackpoll Warbler	0	0	4	3	4	4
Northern Waterthrush	0	0	7	7	4	4
Wilson's Warbler	1	1	4	4	4	4
Savannah Sparrow	1	1	0	0	0	0
American Tree Sparrow	0	0	1	1	0	0
Fox Sparrow	4	4	7	6	2	2
White-crowned Sparrow	5	4	13	8	11	10
Slate-colored Junco	30	23	45	28	29	25
Common Redpoll	0	0	10	9	2	2
Lincoln's Sparrow	0	0	0	0	3	2
Total Species	17		22		20	

8. Game Mammals

Moose

A moose census was conducted on the Nowitna NWR during the fall of 1995. The final report for the census was completed by WB Huntington, ROS/Pilot Spindler, and WB M. Bertram (Yukon Flats NWR) in 1996 as Progress Report FY96-04 entitled: *1995 Moose Census: Lower Nowitna River and Sulatna River Drainages*. A brief summary follows:

"An aerial moose population survey was conducted on 1,338 mi^2 of the lower Nowitna and Sulatna River drainages from November 6-10, 1995. The 1995 census area was within areas previously surveyed in 1980, 1986, and 1990. The sightability-corrected total regression estimate for the 1995 census area was 908 ± 19% moose at the 90% confidence level. Although this estimate represents a 34% population decline from the estimated 1990 population total, it was not statistically significant. Trends in regression estimates over a fifteen year period included a 3.3% average annual decline from 1980-86, a 14% average annual increase from 1986-90, and a 6.9% average annual decline from 1990-95. The 1995 sex and age composition in the subunit indicated a population with moderately low productivity and recruitment, and high exploitation."

In 1996, annual moose trend count area (TCA) surveys were completed in four areas. A report entitled *Moose trend surveys on Koyukuk/Nowitna National Wildlife Refuge Complex, 1980-96* was written by WB Huntington. Pertinent sections of the abstract appear below:

"Moose declined at the Nowitna River Mouth and Sulatna/Nowitna Confluence TCAs in 1993 and 1995, but both TCAs showed an increase between 1995 and 1996 (Figures G.8.1 and 2). Moose increased at the Deep Creek TCA between 1993 and 1995, but stabilized in 1996 (Figure G.8.3). Elsewhere on the Nowitna NWR, a dramatic decrease in moose abundance was observed in the upper Nowitna River at Our Creek TCA (Figure G.8.4). The bull/cow ratios showed decreases in all Nowitna NWR areas in the past decade." The Our Creek decline was very likely related to the nearby GMU 19 moose population crash that ADF&G attributed to unusually high wolf numbers. In that situation the wolves appeared to have outstripped the prey source and then collapsed a year later. We plan to continue biannual moose monitoring according to the Wildlife Inventory Plan.

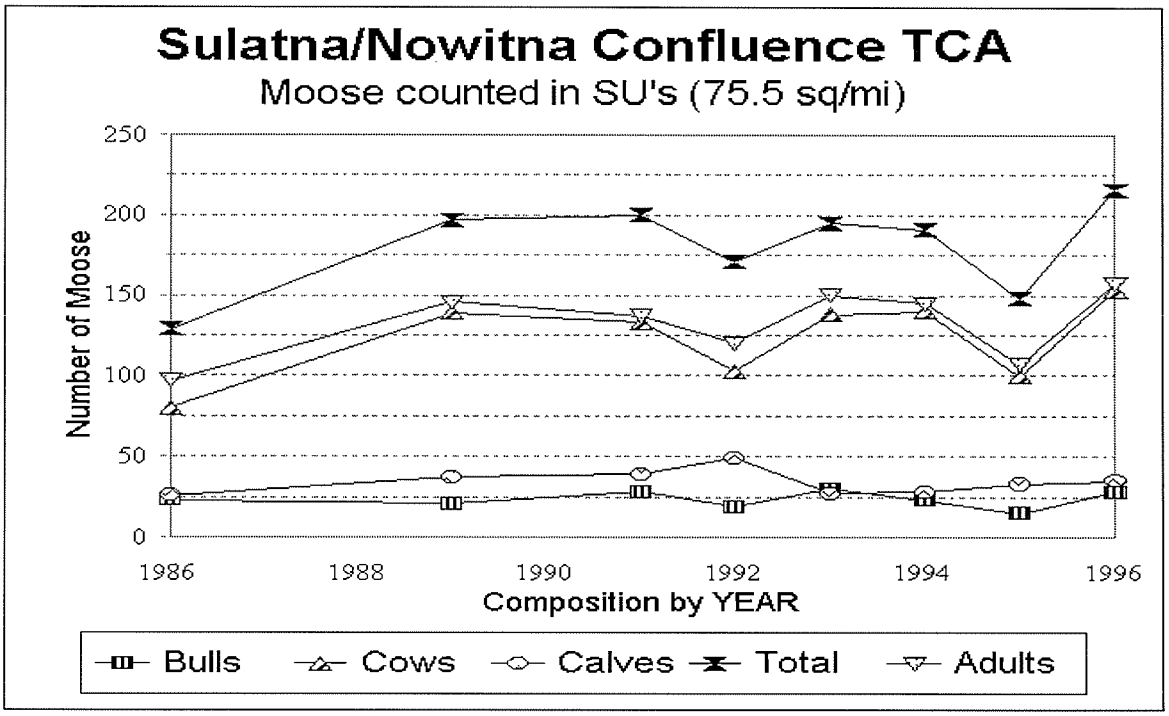


Figure G.8.1. Aerial moose trend counts at the Sulatna/Nowitna Confluence, Nowitna NWR, 1985-96.

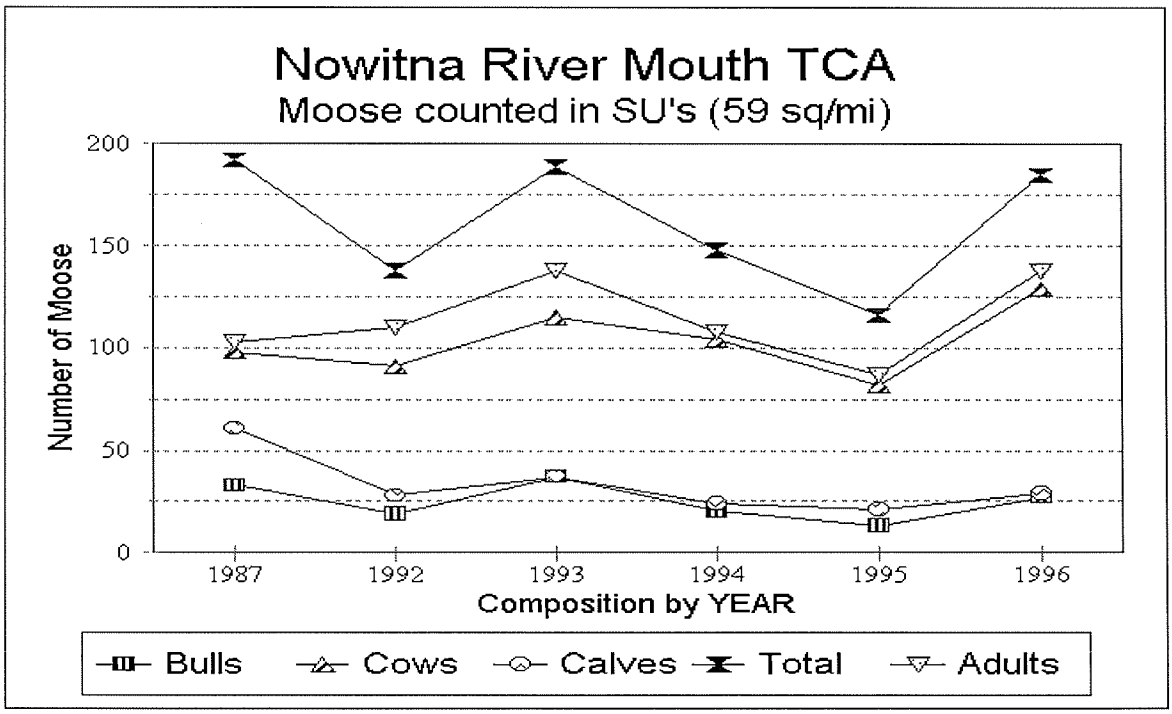


Figure G.8.2. Aerial moose trend counts at Nowitna River Mouth, Nowitna NWR.

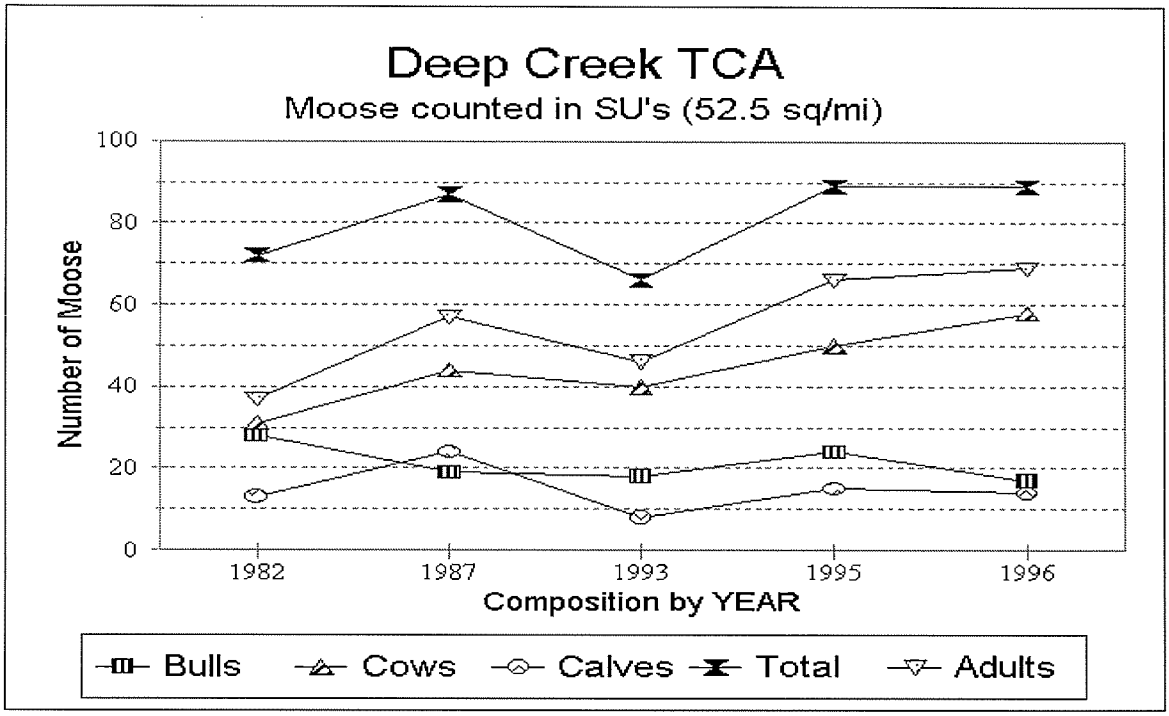


Figure G.8.3. Aerial moose trend counts at Deep Creek, Nowitna NWR, 1982-96.

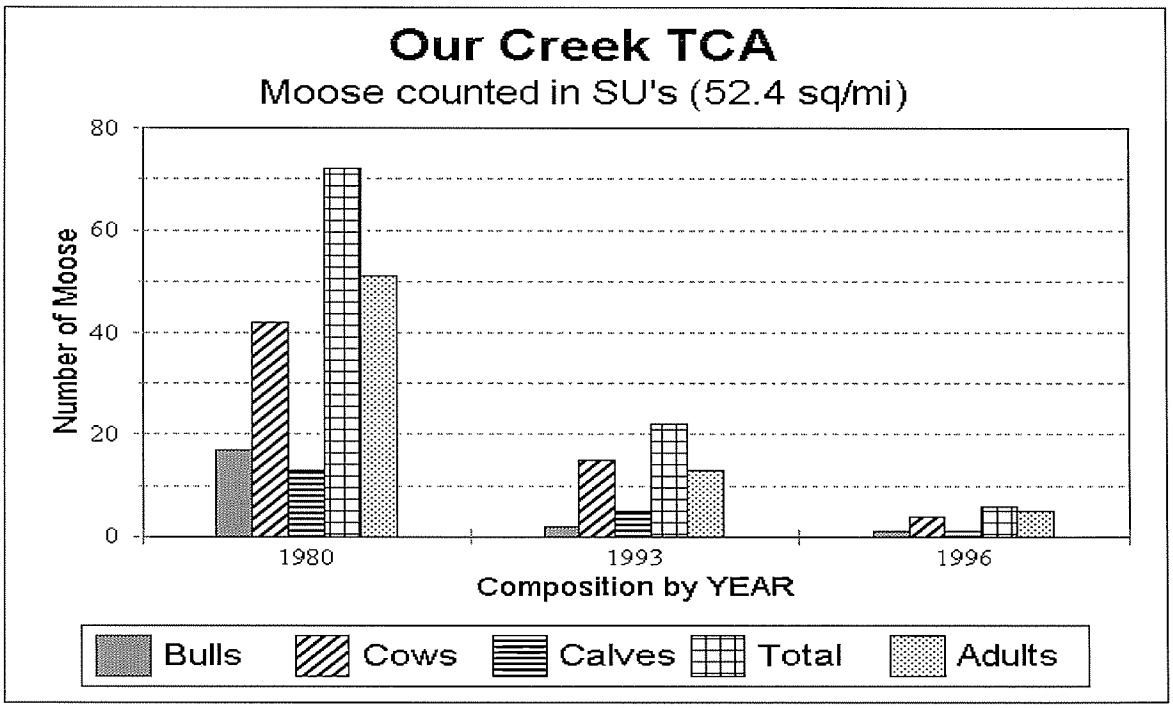


Figure G.8.4. Aerial moose trend counts at Our Ck., Nowitna NWR, 1980-96.

Caribou

Caribou occur in small numbers in the hills both north and south of the Nowitna NWR. The late John Honea of Ruby reported to ROS Spindler in a *Ravens's Story* interview that he saw large numbers wintering on the Nowitna in the 40's. These were likely from the Western Arctic Herd when it formerly migrated in large numbers through Anaktuvuk Pass and wintered in the Kanuti and Melozitna areas.

10. Other Resident Wildlife

Wolves

Wolves are common to abundant on the Nowitna NWR, and are sought after by local hunters and trappers. Wolf furs are prized for parka ruffs and a wolf pelt is a distinguished gift and part of the ceremony in local Athabascan potlatches. Significant predation by wolves on moose within the refuge is a point of concern to the hunting public; therefore, population and predation rate information is important to ungulate management decisions.

On March 16 and 17, 1996, refuge staff, in cooperation with ADF&G, conducted a wolf census on Nowitna NWR. A final report (FY97-05) entitled *1996 Nowitna NWR wolf census, Koyukuk/Nowitna National Wildlife Refuge Complex, Alaska, Game Management Unit 21B* was written by Orville Huntington and Earl Becker. The abstract to that report appears below:

"An aerial wolf (*Canis lupus*) population survey of Game Management Unit (GMU) 21B was conducted on approximately 12,616 km^2 (~ 4871 mi^2) of the lower Nowitna and Sulatna River drainages and east of the Yukon/Nowitna River confluence on March 16 and 17, 1996. The 1996 wolf census area also encompassed the northern portion (73%) of the Nowitna National Wildlife Refuge (6,050 km^2; ~ 2,336 mi^2), and most (96%) of the 1995 standardized moose (*Alces alces*) census area (3,315 km^2; ~ 1,280 mi^2). Sample design and analysis followed the Sample Unit Probability Estimator procedure developed by the Alaska Department of Fish and Game. Wolf populations were estimated at 68 wolves in GMU 21B, 55 wolves in the northern portion of the refuge, and 49 wolves in the moose census area. Estimated densities within these three areas were 5.4 wolves/1,000 km^2 (SE = 0.8), 9.1 wolves/1,000 km^2 (SE = 1.1), and 14.9 wolves/1,000 km^2 (SE = 2.9), respectively. The moose:wolf ratio was estimated at 18.5 moose:1 wolf within the standardized moose census area. Comparisons with previous estimates suggest that the refuge wolf population was stable or increased."

The moose-wolf ratio was judged to be at a level where wolf predation could be limiting the moose population.

Marten

To obtain long-term information on the demographics of the marten population and harvest intensity on the Nowitna Refuge, we began purchasing marten skulls from refuge trappers in 1987. Tooth sectioning and analysis of cementum annuli and radiographs are used to age animals, and trapper questionnaires provide estimates of annual trapping effort. This information has been used to develop a better understanding of the relationship between harvest characteristics (total harvest, sex and age composition) and the status of the Nowitna marten population.

Ageing and sexing marten skull samples purchased from trappers. (BR)

The number of individuals trapping on the refuge continues to be low. Two trappers operating on or near the Nowitna National Wildlife Refuge provided 224 marten carcasses from the 1995-96 harvest. Juvenile martens comprised 75% of the harvest sample. The overall ratio of males to females was 1.5:1 and the ratio of juveniles to adult females was 16.9:1.

When looking at age-sex ratios for individual traplines, a large sample of harvested martens is more meaningful than a few animals for judging whether overharvest may have occurred. During the 1995-96 trapping season, all ratios were indicative of a healthy and productive marten population and well within Alaska Department of Fish and Game (ADF&G) management objectives of maintaining >50% males and a ratio of young:adult females of ≥2:1 in the annual harvest (Figure G.10.1). In recent years, a large portion of the refuge has been essentially untrapped and likely serves as a reservoir for dispersal that enhances the health of the population. A detailed analysis of the 1995-96 Marten Harvest is available in: W. N. Johnson. 1998. *Analysis of the 1995-96 marten harvest on the Nowitna National Wildlife Refuge.* U.S. Fish and Wildl. Serv., Koyukuk/Nowitna Refuge Complex, Ann. Rep. 98-01 Galena, AK.

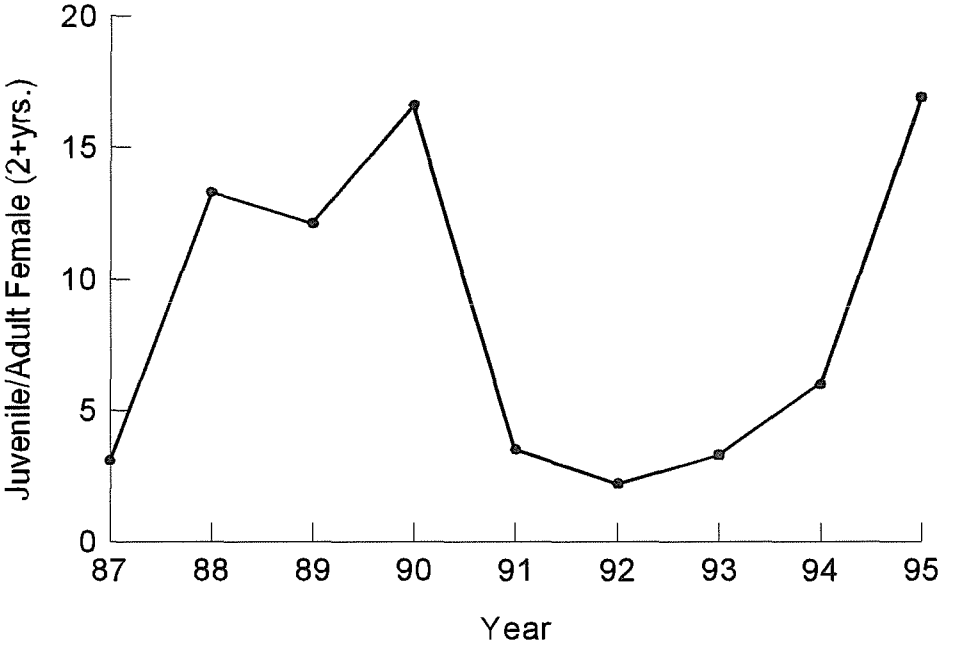


Figure G.10.1. Ratios of juvenile marten to adult females ($\geq$ 2 years old) harvested on the Nowitna NWR, Alaska. 1987-95.

Small Mammals

Since 1991 we have studied the abundance, biomass, and species diversity of small mammals among three stages of post-fire succession on the Nowitna NWR. This effort was initiated as part of a larger project examining the relationship of wildland fire to furbearers, primarily marten and lynx. The larger effort was completed in 1995 but we have continued to trap at these sites to document the response of microtines to fire over time. In addition, we hope to learn more about population cycling in rodents and this requires a sampling effort encompassing at least two cycles (6 - 10 years).

We used two snaptraps and a pitfall trap, set for three 24-hour periods at each of 100 stations in 100 x 100 m grids. Three grids (replicates) were located in a 1985 burn in the tall shrub-sapling stage, three in a 1966 burn in the dense tree stage, and three were in mature black spruce forest >100 yrs old (Figure G.10.2). Trapping occurred in late August-early September when most rodents are at peak abundance.

In 1996, we captured 518 animals representing 5 genera and 9 species over 8,000 trapnights (TN). Red-backed voles (*Clethrionomys rutilus)* were the most ubiquitous microtine, occurring on all grids at all sites. *Microtus* species were most prevalent in the early post-fire seres.

Red-backed voles erupted in all three seres in 1992 following extemely low densities the previous year (Figure G.10.3). They subsequently declined to very low densities on the mature forest and 1966 burn in 1994 and we anticipated another eruption in 1995 in these seres. However, numbers have remained very low in the 1966 burn and although rebounding in the mature forest, they never reached the levels seen in 1992. Interestingly, red-backed vole abundance has remained very stable in the more recent 1985 burn with very little deviation relative to the other seres. We suspect that the more productive and contiguous tall-shrub habitat provides a more stable environment. Moreover, vole diversity is much higher here and the abundance of alternate prey such as yellow-cheeked vole (*Microtus xanthognathus*) may dampen the annual effects of predation.

We plan to begin work with a graduate student in 1997 as part of a cooperative effort with UAF (Eric Rexstad) and the UAF museum (Joe Cook). This effort would focus on rodent cycling and post-fire micro-habitat relationships emphasizing yellow-cheeked voles and the rare tiny shrew.

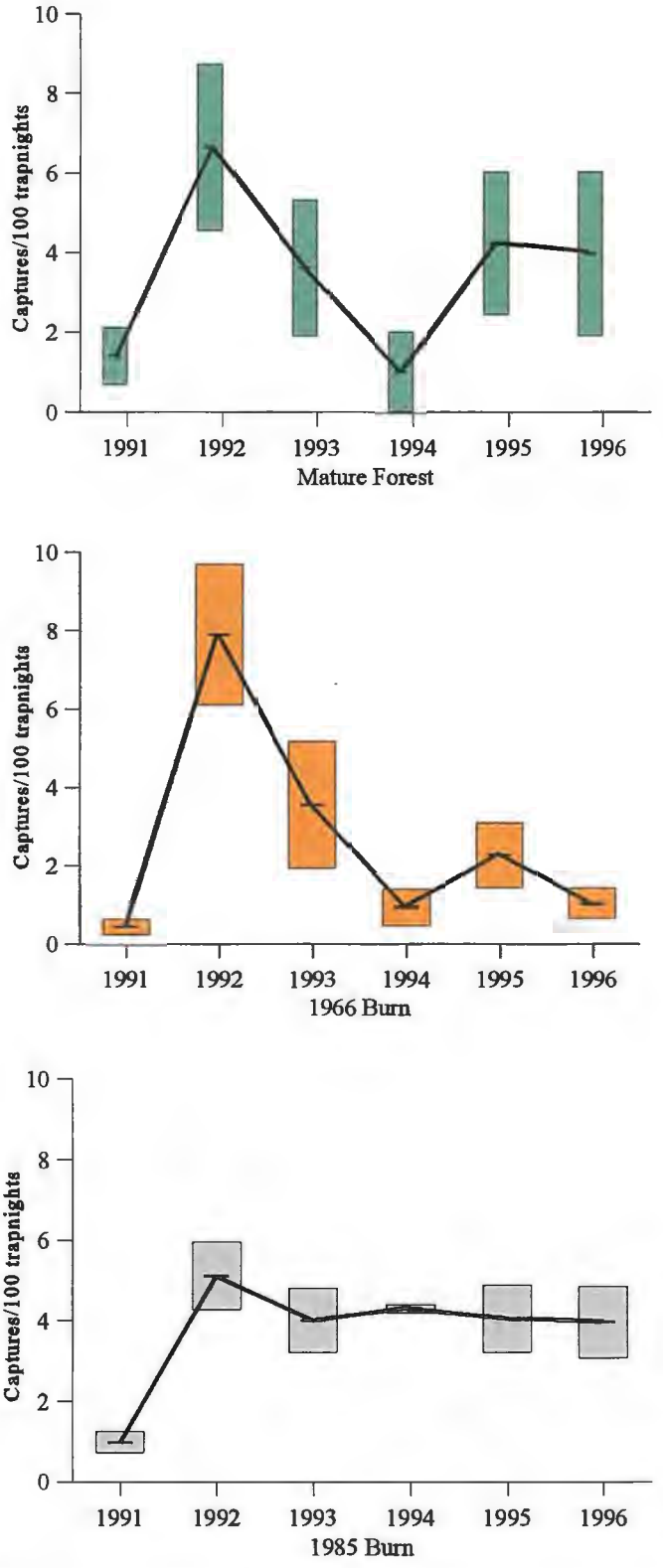


Figure G10.3 Mean ± SD captures/100 trapnights for red-backed voles (*Clethrionomys rutilus*) in three post-fire seres on the Nowitna NWR, Alaska, 1991-96.

11. Fisheries Resources

The published ranges of 20 fish species fall within the Nowitna drainage, and 14 species have been documented in previous field work. Of these, chinook, chum, and coho salmon, whitefish, burbot, and northern pike are the most important species in subsistence fisheries near the refuge. Additionally, pike and sheefish are important in the area sport fishery. Because the refuge is not staffed with a fisheries biologist, field work on the refuge has mostly been accomplished by the Service's Fisheries Resources Office and the Northern Alaska Ecological Services offices in Fairbanks.

Salmon

Estimates of salmon escapement in the Nowitna Refuge have never been made. The relative strength of each species run is also unknown. It is known that escapement estimates of salmon in the Yukon River drainage have been declining since the early 1980's. This decline has been most evident in summer chum salmon. People from the villages of Ruby and Tanana depend, in part, upon the fishery resources of the Nowitna Refuge for subsistence. In 1993 the Fairbanks Fishery Resource Office conducted a preliminary salmon stock assessment on the Nowitna Refuge, and a progress report was completed in 1994 by D.W. Wiswar: *Salmon surveys on the Koyukuk and Nowitna NWR's, Alaska, 1993* (Fisheries Resources Office, USFWS, Fairbanks, AK.). The brief one-season study concluded that further investigations are necessary to determine spawning areas and make escapement estimates. Salmon migrating up the Nowitna River could be inserted with radio telemetry transmitters to aid in identifying spawning areas. Escapement estimates could be made using enumeration techniques, such as a weir, counting tower, or carcass counts.

Pike

In response to increased guided sport fishing, the Alaska Dept. of Fish and Game, Sport Fisheries Division (Fairbanks), began in 1996 a baseline study on pike abundance and age structure along the lower Nowitna River. According to John Burr, the Principle Investigator, preliminary findings of the study showed that pike were abundant and that age structure had not yet been affected by the sport harvest. He said that the Division would return to the Nowitna in about five years to assess any changes if sport fishing continues to increase. A final report will be written in 1997 or 1998.

Contaminants

A technical report entitled *Contaminant baseline data for water, sediments, and fish of the Nowitna National Wildlife Refuge, 1985-1988* was completed in August 1992 by Northern Alaska Ecological Services (NAES) in Fairbanks, with cooperation of refuge staff. Further study based on sampling in 1991 was analyzed in a 1996 report by K.

Mueller, E. Snyder-Conn, and M. Bertram entitled *Water quality and metal and metalloid contaminants in sediments and fish of Koyukuk, Nowitna, and the Northern Unit of Innoko National Wildlife Refuges, Alaska, 1991.* Portions of the executive summary from that report appear below:

"Stream sediment, water, and fish samples were collected from 12 sites: four sites on Northen Unit Innoko NWR, two south of the Northern Unit, two north of Koyukuk NWR, and four on the Nowitna NWR. Streams sampled had soft water and were calcium and magnesium carbonate-dominated. Hardness values were extremely low at Clear Creek and the Hogatza River, and high at the Sulukna River and Sulukna adjacent pond. Hardness values at other sites were moderate. All pH values were 7.0-7.3 except the Sulukna River and Sulukna adjacent pond which were 8.3 and 7.6, respectively. Alkalinity values closely corresponded to hardness values. Sulfates, if present, were in low concentrations. Sulukna adjacent pond had high values of conductivity, hardness, and alkalinity likely due to evaporative concentration. Clear Creek was slightly turbid due to bank erosion, while the Hogatza River was turbid due to bank erosion and placer mining activity upstream of the site."

In general, concentrations of beryllium, cadmium, lead and mercury in sediment samples were characteristic of uncontaminated sediments. Mercury concentrations in sediments were all <0.14 mg/kg. Mean concentrations of cadmium and lead in sediment samples were greatest on Koyukuk NWR, and mean concentrations of copper, manganese, nickel, and zinc were greatest on Northern Innoko. Concentrations of beryllium, cadmium, copper, lead, manganese, and nickel were lowest in sediment samples from the Nowitna."

Several investigators list copper concentrations <20-25 mg/kg as background conditions for sediment. Copper concentrations exceeded 25 mg/kg at all Northern Innoko and Koyukuk sites, and at two of four sites on Nowitna. Concentrations of nickel <20-31 mg/kg have been reported as background conditions. Nickel concentrations exceeded 31 mg/kg at all sites except Sulukna River and Sulukna adjacent pond, which exceeded 28 mg/kg. Reported background concentration estimates of zinc range from 50-100 mg/kg; the mean zinc concentration for all sites was 91 mg/kg."

Mean concentrations of beryllium, boron, cadmium, copper, lead, manganese, nickel, and strontium in sediment were not significantly different above and below the Camp Creek mine. Zinc concentrations were significantly greater above the mine than below. In general, samples from mined streams did not have higher concentrations of metals in sediments than those from unmined streams. Although greater than in other studies, copper and zinc concentrations from our study seemed to be within the normal range for Northern Innoko, Nowitna, and Koyukuk NWR's."

Arctic grayling, northern pike, and sheefish are highly migratory species and, thus, assigning origin of contaminants found in these species is difficult, if not impossible.

Cadmium, iron, magnesium, manganese, mercury, selenium, and zinc accumulated differentially in tissues of northern pike and sheefish. The pattern of accumulation for cadmium, magnesium, selenium, and zinc in northern pike was kidney>liver>muscle. In northern pike, kidney and muscle concentrations of mercury were significantly greater than in liver.'

Arsenic, cadmium, and zinc concentrations in fish tissue were low. Mercury was detected in each fish regardless of location, except for the one Alaska blackfish collected. Mean concentrations of mercury in muscle samples were from 3.3 to 8.6 times greater than the mean background concentrations reported by other investigators. Eight northern pike and four sheefish had at least one tissue with mercury concentrations greater than 4.0 mg/kg, the approximate dry weight equivalent of the Food and Drug Administration 1.0 mg/kg wet weight action concentration for mercury. Selenium has been shown to strongly bind with methylmercury, a highly bioavailable and toxic form of mercury, providing an antagonistic effect. Selenium concentrations exceeded mercury concentrations in all kidney and liver samples of northern pike; however, mercury concentrations exceeded selenium concentrations in all northern pike muscle samples."

The report demonstrated that considerably more baseline work needs to be done to identify the sources of contamination and to have a solid baseline should any threats occur in waters upstream from the refuges.

14. Scientific Collections

See Section G.14 in Koyukuk report.

16. Marking and Banding

See Section G.16 in Koyukuk report.

H. PUBLIC USE

1. General

A special use permit was issued for the removal of a B-17 bomber, pictured at right, which crashed September 10, 1951. The following summary of the incident was obtained from the refuge Special Use Permit file:

"On 10 September 1951, Capt. Fred Grindle, Jr., and his crew took off from their home station, Elmendorf AFB, Alaska, to fly a navigation and photo mission in TB-17G, SN 44-85505A. The aircraft climbed uneventfully to 11,000 feet in VFR weather. The aircraft commander was highly qualified, the pilot and co-pilot had little or no experience in the B-17. The pilot had approximately 9 hours, and the co-pilot was on his first flight. Approximately 30 minutes after takeoff the crew reported high fuel pressure on the number 3 engine. Then fire broke out, the engine was shut down, and feathered. The fire extinguisher system was activated without effect. The fire increased in intensity and was burning the main gear tire so the gear was extended into the slip stream. A rapid descent was made to about 5,000 feet, but the fire continued. The number 3 engine exploded and fell from the aircraft. The aircraft continued to descend while the crew prepared for bailout, but the aircraft struck the tops of a dense woods before anyone bailed out. The cabin remained relatively intact as the aircraft struck trees 12 to 20 inches in diameter. Everyone but the radio operator escaped. The aircraft was destroyed."

The salvaged plane is to be restored.

6. <u>Interpretive Exhibits/Demonstrations</u>

A newly constructed kiosk was placed in front of the refuge office. The interpretive display changes seasonally. The kiosk has the unique advantage of portability. It can be moved to the boat launch during the fall hunting season where it is highly visible to hunters passing the area.

A visitor studies the map at the new information kiosk. (HJ)

8. <u>Hunting</u>

Moose hunting continues to be a popular activity on the refuge. This year a permit check station was maintained at the mouth of the Nowitna River by Alaska Department of Fish and Game (ADFG) during the moose season. Biologist Jim Woolington, ADFG, worked at the check station, as did ROS Pete DeMatteo, during the entire season. The refuge provided logistical support by aircraft and boat.

Hunters checking through the station totaled 129, and they took 37 moose. One group of 3 hunters has been coming to the Nowitna Refuge in pursuit of moose for over 15 years. They travel by vehicle and boat from Haines, a distance of over 800 miles!

Big game hunters shot both spruce and ruffed grouse, along with ducks incidental to their moose hunting.

In 1996, total hunting effort, harvest, and success, as measured at the Nowitna River Moose Hunter Check Station, was slightly lower than 1995, and considerably below the long-term average (Table H.8.1). Fairbanks and other non-local hunters accounted for the greatest share of harvest and success (Figures H.8.1 and 2). Success of non-local hunters has been more consistent than success of local hunters (Figure H.8.2). The recent decline in success of local hunters from 1994 to 1995 prompted complaints to both USFWS and ADF&G in 1995 and was the reason the Tanana Tribal Council proposed changes to the regulations (See Section H.20). Despite a slight decline in number of non-local hunters from 1995 to 1996 (perhaps due to the registration permit hunt requirements), success of the local hunters continued to decline from 1995 to 1996, while it was stable for the non-local hunters (Figures H.8.1 and 2).

The check station was operational on September 2nd and was dismantled on the 28th. This year USFWS requested the presence of an ADF&G employee at the check station to administer the State registration hunt. Jim Woolington (then Assistant Area Biologist based in Fairbanks) spent the whole season at the check station.

Looking north from the Nowitna Check Station, Kokrine Hills in the background, September. (JG)

Table H.8.1. Residency (N), harvest (n), and success (r%) of moose hunters stopping at the Nowitna River mouth hunter check station.

YEAR	LOCAL VILLAGES			FAIRBANKS			OTHER AK. RES			NON-AK. RES.			UNKNOWN			TOTAL			TOT. NON-LOCAL		
	N	n	r%	N	n	r%	N	n	r%	N	n	r%	N	n	r%	N	n	r%	N	n	r%
1988	33	9	27%	103	35	34%	25	7	28%	8	5	62%	9	0	0%	170	56	31%	145	47	32.4%
1989	31	6	19%	94	29	31%	23	9	39%	12	6	50%	6	0	0%	166	50	29%	135	44	32.6%
1990	23	7	30%	67	32	38%	26	12	46%	14	4	29%	0	0	0%	130	54	42%	107	48	44.9%
1991	21	9	43%	72	24	33%	44	11	25%	17	2	12%	0	0	0%	154	46	30%	133	37	27.8%
1992	24	3	12%	38	19	50%	53	10	19%	10	2	20%	0	0	0%	125	34	27%	101	31	30.7%
1993	19	7	37%	58	26	45%	35	19	54%	21	1	5%	0	0	0%	133	53	40%	114	46	40.4%
1994	16	6	37%	63	27	43%	41	16	39%	13	5	38%	0	0	0%	134	54	40%	117	48	41.0%
1995	16	3	19%	63	24	38%	44	9	20%	9	2	22%	0	0	0%	132	38	29%	116	35	30.2%
1996	19	2	11%	54	21	39%	36	12	33%	20	2	10%	0	0	0%	129	36	28%	110	35	31.8%
Mean	22	6	26%	68	26	39%	36	12	34%	14	3	28%	2	0	0%	141	47	33%	120	41	34.6%

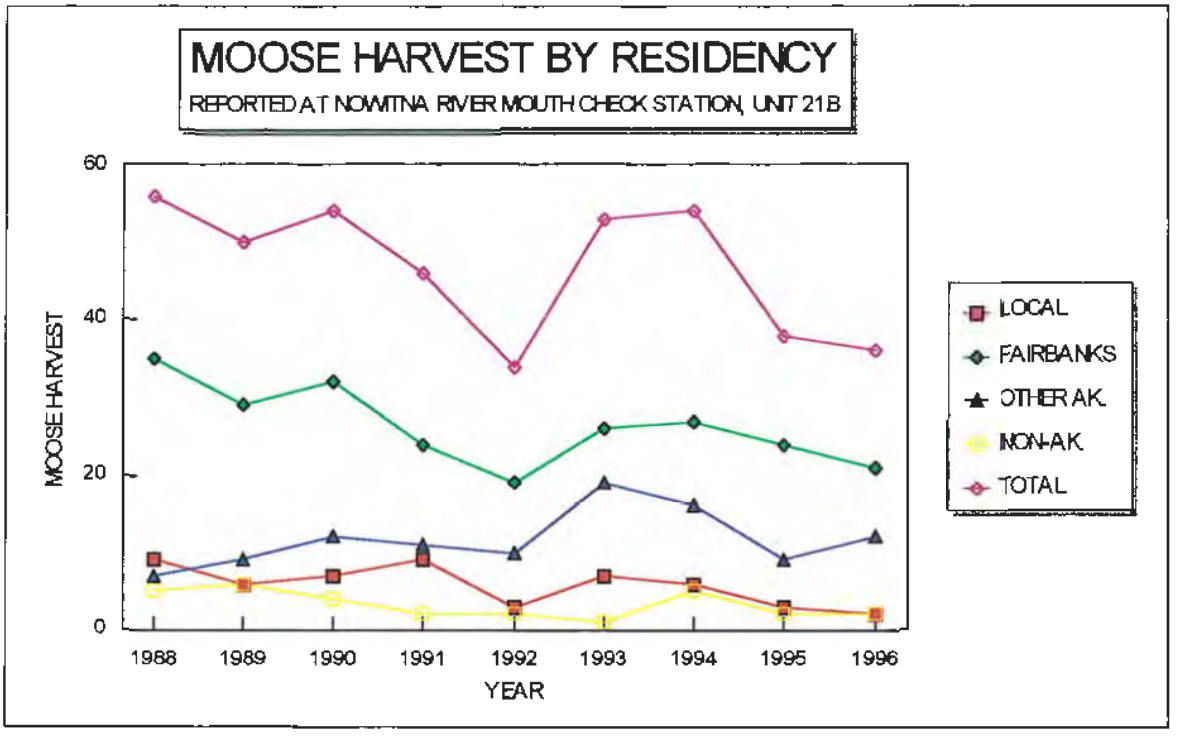


Figure H.8.1. Trends in moose harvest according to residency, based on reports to the Nowitna River mouth hunter check station, Nowitna NWR, AK. 1988-96.

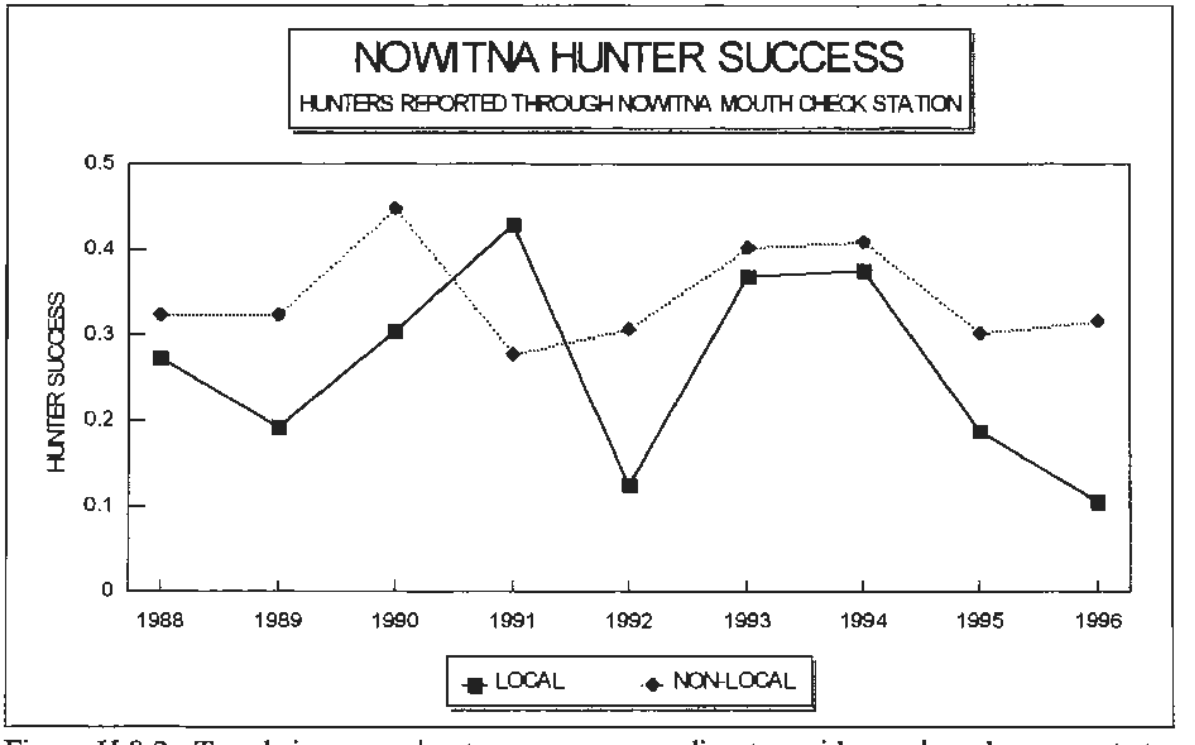


Figure H.8.2. Trends in moose hunter success according to residency, based on reports to the Nowitna River mouth hunter check station, Nowitna NWR, AK. 1988-96.

9. Fishing

Sport fishing provides many hours of challenge on the Nowitna River and its tributaries. Successful fishers catch northern pike, sheefish, and in clearer waters, grayling. Summer pike fishing is popular, but many big sheefish are taken in the fall.

Northern pike and sheefish are the most popular resident fish species for recreational fishing on the refuge. Fishing pressure in prior years has been light from June through August, and is done primarily by floaters and guided fly-in anglers who arrived by float-equipped aircraft. Harvest pressure has increased in recent years due to commercial guide/outfitter services operating on the Nowitna under special use permit. These guiding services reported 7 clients in 1996.

A survey began in 1996 to assess biological effects of fishing pressure on the refuge (see Section G.11). Use of the Nowitna River by floaters is very light. Put-in and take-out points are not conducive for refuge contact with floaters so they go undetected. There is concern that the number of boats traveling down the Yukon and fishing the lower Nowitna has increased. Pike fishing that occurs in September in conjunction with moose hunting probably equals the total harvest for June through August.

10. Trapping

Trapping has been an important public use activity on the refuge in the past providing a source of supplemental income for several residents in the villages of Ruby and Tanana. Traplines in Alaska are not registered but are generally passed down from generation to generation within a family and are usually associated with a cabin or camp of some sort. Occasionally traplines and accompanying cabins and equipment are sold to outsiders or newcomers. At least one trapper has used an airplane to reach remote lakes and then traps their periphery. Most trappers use snowmobiles for transportation; however, some use dog teams, and at least one hardy trapper walks (snowshoes) his entire line. Martens are generally taken using pole sets and/or cubby sets. Beavers are taken with snares through the ice and most wolves are shot or trapped with snares placed around moose or caribou kills.

The reported harvest of those furbearers required to be sealed is shown in Table H.10.1. These figures may be slightly inflated because they include some areas adjacent to the refuge. Sealing records are generally considered conservative estimates of harvest as some fur, especially beaver, is often kept for personal use and not sealed. Regardless, the reported harvest from the 1995-96 season is strikingly lower than the previous year and the 10-year average (Table H.10.2). This decline is likely due to reduced trapper effort and not furbearer decline. In recent years, lower pelt prices, higher operating costs, and the deaths of a few long-time trappers have combined to greatly reduced the annual harvest of some furbearers on the refuge.

Marten is the most economically important species in the Nowitna region and most trappers focus their efforts on this species. There are no sealing requirements for marten or mink in interior Alaska.

Subsistence cabin along the Nowitna River among the spruce trees. (JG)

Table H10.1. Furbearer harvest on the Nowitna NWR during the 1995-96 trapping season.[1]

Area	Beaver	Lynx	Otter	Wolverine	Wolf
Deep Creek[2]	3	0	1	0	1
Lower Nowitna	0	0	0	0	0
Grand Creek	0	0	0	0	0
Pilot Creek	0	0	0	0	0
Lost R.-Sulukna	0	0	0	0	0
Sulatna/ Monzonite	0	0	0	0	0
Sulatna-Poorman	2	2	3	0	0
Lost River	0	0	0	0	0
Titna[2]	0	0	0	0	0
Susulatna[2]	0	0	0	0	0
Palisades[2]	1	0	0	0	0
Big Mud	0	0	0	0	0
Big Creek	0	0	0	0	1
Little Mud	0	0	0	0	0
Boney Creek	0	0	0	0	0
Total	5	2	4	0	2

[1]Based on sealing records obtained from Tim Osborne, Area Biologist, ADF&G.
[2]Part of this area falls outside the refuge boundary.

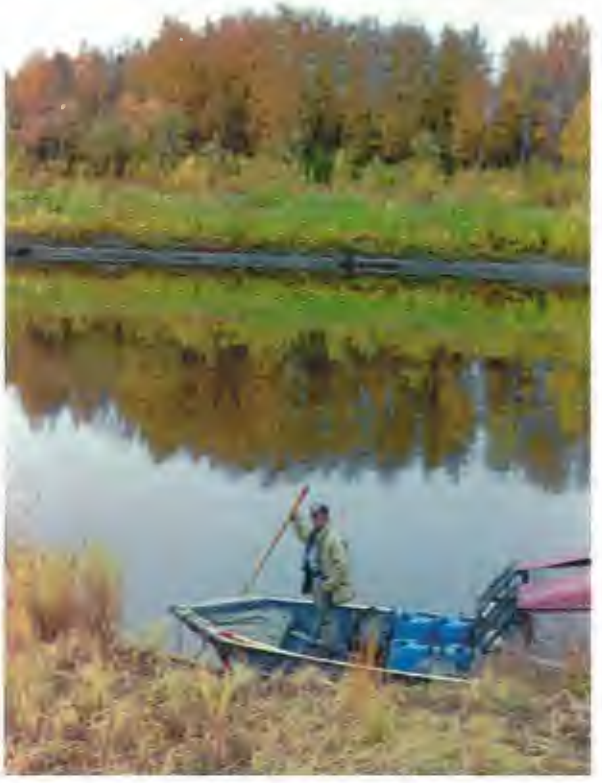
Table H.10.2. Minimum number of furbearers harvested on the Nowitna NWR during trapping seasons 1986-87 to 1995-96.[1]

	Trapping Season										
Species	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	$\bar{x}$
Beaver	176	141	45	36	57	5	43	76	77	5	66
Lynx	4	6	25	6	6	27	10	13	3	2	10
Otter	4	12	7	0	2	1	2	1	3	4	4
Wolf	14	15	0	1	19	15	2	13	8	2	9
Wolverine	2	1	0	1	5	7	1	15	2	0	3
Total	200	175	77	44	89	55	58	118	93	13	92

[1]Minimum number harvested based on sealing records obtained from ADF&G.

17. Law Enforcement

Refuge Officer Good and RO Liedberg (who returned from Yukon Delta NWR to assist during the moose season) patrolled the Nowitna upstream about 60 miles south of the mouth of the Nowitna River between September 10th and 13th. Over 30 hunter camps were checked. All hunters and associated campers were asked to maintain clean camps. No violations were found, and most camps were very clean.



Paul Liedberg on refuge patrol boat during moose hunting law enforcement. (JG)

20. Subsistence Management

As an attempt to decrease user-group conflicts and competition with non-local hunters during the fall moose season on the Nowitna River, the Tanana IRA Council submitted Proposal 43 to the Federal Subsistence Board. The proposal would have closed Federal land on the Nowitna to non-local hunters. Further analysis indicated that Federal Proposal 43 would not reduce competition between local and non-local hunters because Federal jurisdiction begins at the ordinary high water line, while most moose and moose hunting occur below ordinary high water, which is State jurisdiction. To avoid confusing

dual regulations the ADF&G area biologist proposed a solution that he hoped would decrease competition in both Federal and State jurisdictions on the Nowitna. In turn, the Tanana Tribal Council withdrew Federal Proposal 43, and supported the new ADF&G proposal.

ADFG Proposal 53, which was adopted by the State Board of Game during their March 23-29, 1996 meeting, established a registration permit hunt for GMU 21B that began during the September 1996 moose season. Resident hunters could harvest one bull by registration permit without antler size restrictions during the September 5-25 season; however, antlers would be devalued by Department personnel at the Nowitna check station. Residents and non-residents seeking trophy bulls (50 inches or wider) could hunt under the general registration permit hunt, which eliminated the antler devaluation requirement. The general hunt required that bulls have an antler spread of 50 inches or larger, or a minimum of 4 brow tines. The season for non-resident hunters for GMU 21B is September 5-20.

I. EQUIPMENT AND FACILITIES

2. Rehabilitation

Maintenance Worker Attla made repairs to the lower Nowitna cabin. Some work was needed on doors of the cabin and storage shed, as well as protecting siding from porcupine damage.

5. Communications Systems

After several months of coordination with the Alaska Fire Service (AFS), the Bureau of Land Management (BLM), and the Doyon Regional Corporation (Doyon) the refuge was able to install a permanent repeater site on the Kokrines Hills north east of the village of Ruby. The repeater site is located on native selected lands that allow for excellent radio coverage of nearly the entire Nowitna refuge. Doyon permitted the site and John Cook (BLM

Kokrines repeater installation crew: FMO Rebarchik, BT Lowe, BT Lane, BT Fujikawa, Pilot Miller. *(BR)*

Archeologist) from Fairbanks conducted the archeological inspection on August 7, 1996. The repeater structure was secured on site on August 14th with the final repeater installation occurring on August 16th. The repeater installation crew was composed of Biotechnicians Jean Fujikawa, Jenny Lowe and John Lane, FMO Bob Rebarchik, Pilot A.I. Miller, and AFS Radio Technicians Chuck Chase and Vern Williams. This was definitely an interagency project involving AFS, BLM, Doyon, and the U.S. Fish and Wildlife Service. Hopefully, the repeater will give us many years of uninterrupted radio service.

J. OTHER ITEMS

4. Credits

Mike Spindler prepared sections B, D5; G1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 16; H8, 20; I5, 8; J1; and edited sections...F, G, H.
Orville Huntington prepared sections G3-part, 8-part,.
Buddy Johnson wrote sections G7, 10-part, 14; and H10.
Bob Rebarchik wrote sections F9 and I5.
Jim Good, editing, sections H8, 9, 17; I2; and J4.
Sharon Tunnel, Word processing & formatting.
Rosie Cassou, editing.
Photo credits, JG (Jim Good), HJ (Heather Johnson), BR (Bob Rebarchik).

K. FEEDBACK