

KOYUKUK NATIONAL WILDLIFE REFUGE

Galena, Alaska



Merged With ARLIS ANCHORAGE, ALAS Thracy

U.S. Fin'; & Wildlife Service ANNUAL NARRATIVE REPORTION E. Tudor Road Anchorage, Alaska 99503 Calendar Year 1988

Michael Musin 3/30/89 ALL. Matin Refuge Manager Date Refuge Supervisor Review

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Atul Megus Regional Office Approval

5-10-59 Date

TABLE OF CONTENTS

INTRODUCTION Øl

A. HIGHLIGHTS 07

1.	Fee Title	•	•	•	•	•	•	•	•	•	•			•	•	Nothing	to	Report
2.	Easements		•	•	•	•	•	•	•	•	•	•	•	•	•	Nothing	to	Report
3.	Other	•	•	•	•	•	٠	•	•	•	•	•	•	•	•	• • • •	•	ø9

D. PLANNING

1.	Master Planning Nothing to Report
2.	Management Planning
3.	Public Participation Nothing to Report
4.	Compliance with Environmental Mand Nothing to Report
5.	Research and Investigation

E. ADMINISTRATION

1.	Personnel
2.	Youth Programs Nothing to Report
3.	Other Manpower Programs Nothing to Report
4.	Volunteer Programs
5.	Funding
6.	Safety
7.	Technical Assistance
8.	Other Items

F. HABITAT MANAGEMENT

1.	General
2.	Wetlands
З.	Forests
4.	Croplands Nothing to Report
5.	Grasslands Nothing to Report
6.	Other Habitats Nothing to Report
7.	Grazing Nothing to Report
8.	Haying Nothing to Report
9.	Fire Management
10.	Pest Control Nothing to Report
11.	Water Rights Nothing to Report
12.	Wilderness and Special Areas

G. WILDLIFE

1.	Wildlife Diversity	33
2.	Endangered and/or Threatened Species	33
3.	Waterfowl	35
4.	Marsh and Water Birds	56
5.	Shorebirds, Gulls, Terns and Allied Species .	58
6.	Raptors	58
7.	Other Migratory Birds	60
8.	Game Mammals	 6Ø
9.	Marine Mammals Nothing	to Report
10.	Other Resident Wildlife	72
11.	Fishery Resources	74
12.	Wildlife Propagation and Stocking Nothing	to Report
13.	Surplus Animal Disposal Nothing	to Report
14.	Scientific Collections Nothing	to Report
15.	Animal Control	to Report
16.	Marking and Banding	••••.74
17.	Disease Prevention and Control Nothing	to Report

H. PUBLIC USE

1.	General	76
2.	Outdoor Classroom) Students Nothing	to Report
3.	Outdoor Classrooms) Teacher Nothing	to Report
4.	Interpretive Foot Trails Nothing	to Report
5.	Interpretive Tour Routes Nothing	to Report
6.	Interpretive Exhibits/Demonstrations .Nothing	to Report
7.	Other Interpretive Programs Nothing	to Report
8.	Hunting	76
9.	Fishing	78
10.	Trapping	79
11.	Wildlife Observations Nothing	to Report
12.	Other Subsistence Activities	80
13.	Camping Nothing	to Report
14.	Picnicking	to Report
15.	Off)Road Vehicles Nothing	to Report
16.	Other Non)Wildlife Oriented Rec Nothing	to Report
17.	Law Enforcement	80
18.	Cooperating Association Nothing	to Report
19.	Concessions Nothing	to Report

I. EQUIPMENT AND FACILITIES

1.	New Construction		• •		•	•	•			81
2.	Rehabilitation		• •		•	•	•	.Nothing	to Repo	rt
3.	Major Maintenance		•	•	•		•			81
4.	Equipment Utilization	and	a Re	epl	ace	eme	nt			82
5.	Communications System		•	•	-		•			82
6.	Energy Conservation .		•	•	•		•	Nothing	to Repo	rt
7.	Other	• •	•	•	•		•	Nothing	to Repo	rt

J. OTHER ITEMS

1. 2. 3.	Cooperative Programs Nothing to Report Items of Interest Nothing to Report Credits
	K. FEEDBACK
1.	Feedback

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INTRODUCTION

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

- To conserve the 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;
- To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitat;
- To provide the opportunity for continued subsistence uses by local residents; and
- To ensure water quality and necessary water quantity within the refuge.

Koyukuk National Wildlife Refuge 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. After the conveyance of native allotments, village and native regional corporation (Doyon,Inc.) lands, the refuge will contain 3.69 million acres.



The Koyukuk River flood plain provides outstanding habitat for waterfowl, moose and furbearers MLN The refuge is situated in a roughly circular floodplain basin of the Koyukuk River just north of its confluence with the Yukon River. The extensive forested flood plain is surrounded by the Nulato Hills, elevation 1500' - 3000' on the west; the Purcell Mountains and Zane Hills, elevation 3100' - 4000' on the north; the Galena Mountains, elevation 1500' - 3000' on the east and the Yukon River on the south.

Koyukuk has also been delegated responsibility for managing the upper unit of the Innoko NWR (Kaiyuh Flats). This unit consists of 750,800 acres located south of the Yukon River with its eastern upper boundary starting directly across the river from Galena. This unit was also established by ANILCA. The majority of the flatland is dominated by a maze of sloughs, creeks, and lakes. The foothills of the Kaiyuh Mountains run along the southeastern border of the unit.

Vegetation types are typical of the boreal forest or taiga of interior Alaska. White spruce occurs in large pure stands along rivers where soils are better drained. Numerous fires have set vast areas back to earlier seral stages consisting of aspen, birch and willow. Black spruce muskegs or bogs are a dominate feature and develop on the poorly drained soils. Dense willow and alder stands are common along the rivers and sloughs. The most conspicuous characteristic of the vegetation is the complex interspersion of types.



The refuge's diverse terrestrial habitats help support a healthy moose population. MRB

The refuge achieves national and international significance through its contribution to waterfowl populations using all four 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.



Productive wetlands abound on the refuge and support a variety of waterfowl. MLN

Fish abound in refuge streams and lakes supporting subsistence and sport fisheries.

Refuge headquarters is located in Galena, on the Yukon River approximately 6 miles south of the southernmost portion of the refuge and 110 miles south of the northernmost point. Galena, Alaska was established about 1919 as a supply point for the galena (lead sulphite ore) deposits south of the Yukon River.

Galena's population of approximately 1,000 is bolstered by the approximately 330 military personnel stationed at the Galena Air Base where two F-15 Eagle intercept aircraft are kept on 24 hour alert.

Galena is not a typical Alaskan village. It has advantages of regular air service, modern communications, river access, and such amenities as two general stores, a lumber yard/hardware store, cafe, hotel, health clinic, and a retail outlet for boats, motors, snowmachines and generators. Management of the refuge for the next several years will continue to consist primarily of field investigations to quantify significant bird and mammal resources by habitat type on a seasonal basis. The goal of this effort will beto learn as much as possible in order to maintain refuge habitats in their present pristine condition in the face ofdevelopment of lands within adjacent to the refuge.



Figure 1. Location of Koyukuk Refuge and the Northern Unit of Innoko Refuge.



- New wildlife bilogist position and fire management officer positions filled.
- 2. Station airplane recovered.
- 3. Wildlife Biologist/Pilot Rost receives Special Achievement Award.
- 4. Busy fire season.
- 5. Moose harvest rises sharply.
- 6. Successful moose census thanks to timely snowfall.



Dabblers account for over 60% of waterfowl production on the refuge.

B. CLIMATIC CONDITIONS

The climate of the Koyukuk basin is similar to Fairbanks. The summer sun provides almost continuous radiation and heats valleys which are protected from coastal winds and clouds by surrounding hills. During the winter the sun stays above the horizon for less than four hours. The valleys become cold sinks and temperatures are among the coldest on the continent. Galena, located approximately 125 miles south of the Arctic Circle, has a mean of 60.1 degrees Fahrenheit and a January mean of -9 degrees Fahrenheit. The frost-free period is normally about 100 days. Temperature extremes range from near 70 below to the high 90's. Ice is present in the lakes from early October to late May. Precipitation averages 14.6 inches, the bulk being in the form of rain in June, July, August and September. Monthly weather data is included in Table 1.

The year started out with a regular arctic heat wave! Galena airport recorded +39 F for highs on both January 1 and 2. However, this rare thaw didn't last long and sub zero temperatures were the norm for the rest of the month. February and March were moderately warm with highs above zero. April brought thawing daytime temperatures which melted most of the snowcover. Along with the warm temperatures came sunny blue skies which set a precedent for the next three months. Weather from April through July was truly phenomenal for this area. The lack of precipitation allowed us an almost "mosquito free" summer (well, compared to most years). The hot dry weather, however, did make for

			Tempera	ture (F)
Month	Precipitation	Snow	Maximum	Minimum
January	.21	3.1	39	-33
February	.58	9.1	32	-41
March	.43	6.3	4 Ø	-28
April	.30	.1	55	-24
May	.98	.1	7Ø	-28
June	.81	Ø	77	37
July	.34	Ø	81	5Ø
August	2.24	Ø	74	4 Ø
September	.45	.5	63	24
October	.33	7.6	44	-1Ø
November	.54	13.3	20	-28
December	.99	19.3	31	-39

Table 1. Precipitation amounts and temperatures at Galena, Alaska, 1988. an interesting fire season in interior Alaska. Rains finally came in August and precipitation was recorded on 26 days during the month. Fortunately, September rebounded with beautiful sunny weather for most of the month until snow hit on the 20th. Winter arrived guickly in October and the last thawing temperature of the year was on October 3.

C. LAND ACQUISITION

3. Other

The Galena public hearing, concerning acquisition of selected inholdings in Alaska National Wildlife Refuges, was held on September 30 in the Gana-A 'Yoo, Limited conference room. Koyukuk NWR was specifically interested in acquiring lands on the Kaiyuh Flats which are being considered in the trade. The hearing was attended by 18 persons, 17 of whom provided oral testimony. A total of six individuals, one representative of a local Native council, ten individuals representing Gana-A 'Yoo, Ltd., and the Mayor of Galena provided testimony. One person read a written statement from the Mayor of the village of Nulato who was unable to attend the hearing.

Except for the testimony of two private individuals, all persons testified in favor of the proposed exchanges. The individuals opposing the exchange were concerned about the short term benefits of the exchange and the essentially permanent loss of Native control over a portion of Native lands in the region.

All commenter expressed concerns over loss of access to subsistence resources which they feared could result from the trade of Native lands to the federal government. Many commenters gualified their support of the proposed exchanges under the condition that access to subsistence resources not be restricted on lands conveyed to the government.

D. Planning

2. Management Planning

Dave Patterson, Public Use Specialist (Regional Office), conducted a station public use review during August 23-25 and is currently drafting a public use plan for the refuge.

Comments on the Draft Fisheries Management Plan were sent in on June 13.

5. Research and Investigation

The fire study, initiated in 1987, was continued this year.

The Placer Mining Impact (Water Quality) Study, initiated in 1987, was also continued in 1988.

The following study proposals were submitted to the regional office for approval in 1988.

- Pintail Nesting Ecology on the Koyukuk NWR.
- Wetland Ecology as it relates to Waterfowl Production on the Koyukuk NWR.
- Sightability Correction for Duck Productivity Surveys on the Koyukuk NWR.
- Population Status, Seasonal Distribution, and Population Limiting Factors of the Galena Mountain Caribou Herd.

It was suggested by the Biological Study Review Panel that the first three preliminary study proposals be combined into one proposal. The final study proposal entitled, "Wetland Ecology and Sightability Correction for Waterfowl Production Surveys on the Koyukuk NWR", will be submitted in early 1989. The caribou study will be incorporated (funded) into our yearly big game inventories.

E. Administration

1. Personnel



Michael L. Nunn, Refuge Manager, PFT, GS-12/04, EOD 5/26/84.



Daryle R. Lons, Assistant Refuge Manager, Permanent Full Time, GS-11-05, EOD 8/14/84



Gregory R. Rost, Wildlife Biologist/Pilot, Permanent Full Time, GS-12/03, EOD 9/28/86.



Mark R. Bertram, Refuge Biologist, Permanent Full Time, GS-05/03, EOD 04/10/88.



Mike N. Granger, Fire Management Officer, Permanent Full Time, GS-09-01, EOD 04/10/88.



Dianna R. White, Refuge Secretary, Permanent Full Time, GS-05-03, EOD 02/07/86.

Two additional personnel were added to the refuge staff in 1988. Mark Bertram was selected for the refuge's GS-5/7/9 Wildlife Biologist position in February and came on board in early April. Mark came to us from the Anchorage Regional Office.

Mike Granger, formerly with the Department of Defense in Arizona, was selected as GS-9/ll Fire Management Officer in early March. Mike, with us since late April, was accompanied by his wife and two children on their trek north. His family has since expanded to three with the birth of a healthy baby boy in June.

A history of manpower at the Koyukuk NWR is given in Table 2.

				Shared		
		Permanent	Permanent	Permanen	it	
		Full	Part	Full		
		Time	Time	Time	Temporary	FΤΕ
FΥ	83	2	1	Ø	Ø	3
FΥ	84	3	Ø	2	l-Local Hire	3
FΥ	85	3	Ø	2	l-Local Hire	5
FΥ	86	5	Ø	Ø	l-NTE 4 yrs.	6
FΥ	87	6	Ø	Ø	Ø	6
FΥ	88	6	Ø	Ø	Ø	6

Table 2. Six Year Summary of Manpower

4. Volunteer Programs

The refuge had several volunteers in 1988. Volunteer Bill Summerour, Professor of Ornithology at Jacksonville University in Alabama, participated in brood surveys for part of July. Volunteer Summerour also assisted State Game Biologist Tim Osborne with peregrine falcon banding on the lower Koyukuk River.

Biologist/Pilot Greg Rost's father, George Rost and brother-in-law Mike Collins signed on as volunteers in late June. Volunteers Rost and Collins took their carpentry expertise to the refuge administrative cabin and built an exceptional set of cabinets, a table, and bench. Volunteers Rost and Collins also assisted in collecting data for the water quality study.

Volunteer Jason Nunn assisted refuge staff with the interagency moose census in late November. Jason kept camp operational and assisted in preparing meals for 15 people. He also assisted in breaking camp the following week.

5. Funding

Station funding for the last five fiscal years is shown in Table 3.

Table 3.	Koyukuk	National Wi	ldlife Refu	ge Funding	
Programs	FY84	FY85	FY86	FY87	FY88
1210	-Ø-	- Ø -	-Ø-		- Ø -
1220	-Ø-	-Ø-	-Ø-	-Ø-	-Ø-
1260	\$275,000	\$336,000	\$375,000	\$430,000	\$440,000
1994(861)	0) 6,000	13,000	22,000	40,000	\$39,100
Totals	\$281,000	\$349,000	\$397,000	\$470,000	\$479,100

6. Safety

We were fortunate to have another accident free year. Informal safety meetings were conducted throughout the year. A CPR and First Aid course were also taken by most of the staff. All safety material received from the Regional Office safety officer was reviewed by all employees. Field safety crew plans were prepared and submitted to the Regional Office prior to the field season.

The staff was painfully reminded of the importance of Nomex clothing while flying when Galena resident Roger Huntington crashed his supercub on October 23. Roger and his passenger were unhurt in the initial crash but the plane immediately caught fire after impact. Both men were badly burned and Roger, with burns over 50% of his body, has a long road to recovery. Although much of the outer clothing did not catch on fire, the intense heat caused underlying man-made synthetics such as nylon and polypropylene to melt onto his skin. Nomex underwear, socks, and gloves were ordered for all staff to complement our Nomex flight suits. Other safety gear received during the year included 2 custom flight helmets.

The refuge 1986 Suburban was wrecked by a private contracter in October. Galena does not have a car rental agency and it had been refuge policy to lend private contracters a refuge vehicle. Private contracters are no longer allowed to operate refuge vehicles unless its written into the contract.

The biggest in our safety program is still the lack of an adequate radio system. Hand held King FM radios, which we have used for the past three years have added a measure of safety to our field season. However, their range is extremely limited. New VHF FM radio equipment, which includes two mountain top repeaters, was finally installed

in 1988. However, after three trips to the refuge by Revel Communication and Regional Communication Specialist Tim Miller, our radio system is still not fully functional. We do have limited communication from the air back to Galena base in the southern half of the refuge but we still do not have ground to Galena base communication. Long range communication is non existant (over 30 miles). It seems the proper microwave interface equipment was not selected when the radio system was designed several years ago. It's hard to believe, after pumping over \$160,000 into this radio system, that a project of such high priority could not be completed in three years. Until these communication problems are solved refuge staff will continue to spend extended periods in isolated areas of the refuge without field to Galena base communication. Our fingers will remain crossed again this year in the hope that no emergency situations develop in the field.

7. Technical Assistance

Biological data pertinent to resident and migratory game was routinely supplied to the Alaska Department of Fish and Game biologist in Galena. It should be noted here that this is a two-way street and the local area biologist is freely providing his data to us. We carry this same relationship with the Area Game Biologist for the Bureau of Land Management in Fairbanks.

8. Other Items

Refuge staff members received the following training and attended the following workshops and meetings during 1988:

Refuge Manager Nunn:

Waterfowl Workshop, January 11-13. Middle Yukon Advisory Committee Meeting, February 20. LE Refresher Course, February 22-26. Fire Training, February 29-March 11. Project Leaders Mtg., April 1-8. Service Semi-Annual Firearms Qualification, August 22. ANWR Land Exchange Public Mtg., September 30. Fire Management Program Review, Oct. 7,Nov.9.

Assistant Refuge Manager Lons: Waterfowl Workshop, January 11-13. LE Refresher Course, February 22-26. Citizen Participation Workshop, March 29-April 1. Contaminant Workshop, April 21-22. North American Waterfowl Management Meeting, August 17. Service Semi-Annual Firearms Qualification,Aug.22. ANWR Land Exchange Public Meeting, September 30. Wildlife Biologist/Pilot Rost: Waterfowl Workshop, January 11-13. Middle Yukon Advisory Committee Meeting, Feb. 20. Moss Computer Training, February 29-March 4. Wildlife Disease Workshop, April 12-14. Basic Refuge Manager Academy Training, April 18-May 13. ANWR Land Exchange Public Meeting, September 30. Annual OAS Ground School, December 5-9.Wildlife Biologist Bertram:

Moss Computer Training, March 7-11. Citizen Participation Workshop, March 29-April 4. Basic Refuge Manager Training Academp, April 18-May 13. ANWR Land Exchange Public Meeting, September 30.

Fire Management Officer Granger: Fire Training, May 16-20. Fire Management Program Review, Oct.7, Nov.9. ANWR Land Exchange Public Meeting, September 30. HP 71-B Training, December 14-16.

Secretary White: Lotus and Administrative Workshop, November 14-18.

"Official" visitors to the refuge during 1988 which are not mentioned elsewhere in this report were:

- Steve Calvo and Silvio Proano from the General Accounting Office were here January 26-28. They met with refuge staff to discuss priorities concerning the Kaiyuh Flats lands which are included in the ANWR land exchange.
- Engineer George Ziots, Architect Steve Bettis, and Tom Hettich met with refuge staff on March 21 to define future needs concerning the initial plans for the Koyukuk/Nowitna headquarters.
- Special Agent Dan Mayer stopped by Galena May 27 to discuss the Victor Williams case with Assistant Manager Lons.
- Biostatistician Lyman McDonald, University of Wyoming, assisted and reviewed our waterfowl brood survey work in the field on July 9-10. He indicated he was pleased with our program; we are anxiously awaiting his final recommendations.

- Central Office Division of Refuge folks Dave Heffernan and Tom Follrath, Refuge Supervisors Kurtz and Schmidt, and Kenai Assistant Manager/Pilot Richey stopped in Galena on July 14. They overflew the refuge while enroute from Bethel and stopped in to visit, have lunch, and refuel.
- Dave Patterson, Public Use Specialist, conducted a public use review August 23-25. He is currently drafting a refuge public use plan.
- Pat Sweetsir, Max Hundorf, and Louis Nelson met with refuge staff on September 27 to discuss an upcoming ANWR land exchange public hearing.
- John Kurtz and Paul Schmidt conducted a station review/inspection October 24-28.

<u>Permit #</u>	Permittee	Activity
-KUK-88-4-50017	John Gaudet Jake's Alaska Wilderness Outfitters	Commercia] Guiding
-KUK-88-2-50013	Rudee Scott Galena Air Service	Air taxi Operations
-KUK-88-5-50056	Gary Guy Frienship Air	Air taxi Operations
KUK-88-3-50016	Robert Brown Sea World Charters	Commercial Outfitting
KUK-88-1-50012	Fred Maestas Bureau of Land Mangmt.	Native Allottment Survey

The following Special Use Permits were issued during 1988:

Koyukuk Refuge received State and Federal Scientific Collecting Permits for migratory birds in May.

Slides were sent to Dick Kuehner, Region 1, for incorporation into a laser video disk program about all national wildlife refuges.

1. General

Located 270 miles northwest of Fairbanks in west central Alaska, the Koyukuk Refuge lies within a roughly circular basin and connects the floodplain and the Koyukuk River just north of its confluence with the Yukon River. The extensive floodplain is a forested basin surrounded by high hills and characterized by many lakes. The terrestrial vegetation is typical of the boreal forest or taiga of interior Alaska and northwestern Canada.

The most conspicuous characteristic of vegetation on the refuge is the complex interspersion of types. Differences in vegetation cover are caused by soil types, erosion by streams and rivers, permafrost exposure, flooding and fire. There are four broad vegetation types 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 absent. This type consists of tall to moderately tall stands of white and black spruce, paper birch, aspen and balsam poplar.



Meandering rivers create a succession of oxbox lakes, young scrub vegetation, and forest types which provide a rich mosaic of habitats. DRL



Lowlands along the Koyukuk River support dense stands of white spruce. DRL

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

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

LANDSAT maps of the refuge were developed in 1987. However, these maps were generalized and aerial maps have since been ordered for waterfowl brood survey plots and potential prescribed burn areas. Photo's of a potential burn in the Three-Day-Slough vicinity will help determine fuel load data in this unique area of the refuge.

Wetlands

The rivers in the refuge lowlands are characterized by a low gradient, tortuously meandering course and heavy spring flooding. Flooding during spring is typical and subsidence

of the waters frequently continues through much of the summer. The rivers, in particular the Koyukuk, carry a heavy silt load at flood stage.

Creeks are typically shallow, slow, and meandering with steep banks. Narrow bands of white spruce line the higher banks, while willow and alder thickets predominate in the lower areas.

Some off refuge placer mining occurs on several streams that flow into the refuge. Initial investigations were undertaken in 1986 to determine the extent of detrimental effects placer mining has on the water guality of these rivers and to establish baseline data for all refuge rivers.

The investigation was continued in 1988 with special emphasis on Aloha, Bishop, Camp, and Caribou creeks, and Hogatza and Koyukuk rivers. Twenty-eight fish, eighteen sediment samples, and thirty-six water samples were collected. All samples were analyzed for the presence of arsenic and mercury by atomic absorption spectrophotometry, and for other metals (aluminum, zinc, cadmium, copper, iron, nickel, and manganese) by Inductively Coupled Plasma Emission Spectrometry, using preconcentration technique B. All water samples were analyzed for both the total and dissolved form of each metal. Muscle, liver, and kidney tissues were analyzed in the fish samples.



Water samples were collected at six sites on the refuge to determine the abundance of heavy metals from off-refuge placer mining operations. GRR



Bog lakes are abundant on the refuge. A smoke column from the Bear Creek Fire is in the background. MRB

It was extremely difficult to solicit volunteers for this project since most fish samples were collected with sampling sticks (spinning rods). Areas of low fish concentrations were sampled with gill nets. We have yet to receive results from samples sent in in 1987-88.

Lake and pond types include upland basin, ice-formed lakes on the flats, river flooded lowlands, oxbows and bog lakes. Spring runoff, rain and river flooding charge lakes resulting in variable water depth and shorelines from year to year. Depths seldom exceed 15 feet and are usually much shallower. Water temperatures in shallow lakes reach 70 f and above in midsummer, creating ideal conditions for heavy growth of aquatic plants and invertebrates. Among the aquatic plants, duck weeds are common. Water milfoil, coontail, and smartweed are abundant in some lakes and one or more of 12 species of pondweed occur in almost all lakes. Bog lakes usually contain water lilies. Several species of sedge, bluejoint grass, foxtail, and fleabane provide cover on receding shoreline and dry basins. After flooding, sedges and occasionally bluejoint grass survive as emergent vegetation to water depths exceeding four feet. Shorelines of bog lakes vary in character but nearly always contain buckbean, wild calla, and various species of sedge. Cattails and burreeds are found in only a few lakes.

Waterfowl use is related to both type and density of aquatic and shoreline vegetation. Preference is given to lakes with abundant submerged pondweeds, water milfoil, and coontail and having shoreline vegetation that is moderately dense and interspersed with openings. These are either closed basin type lakes maintained by infrequent flooding and long periods of gradually receding water levels, or lakes connected to river systems that are more frequently flooded but also experience gradually receding water levels.



Shoreline vegetation varies with stability of water levels. Lakes which fluctuate with rivers and streams usually are surrounded by dense stands of horsetail. MRB



Buckbean is a common emergent on bog lakes.

MRB

3. Forests

A general description of forest types is given in Section F-1.

No commercial harvest of timber has taken place in the area since the gold rush days at the turn of the century. However, forest products are extremely important to subsistence users for house logs, firewood, fish wheels, and fish drying racks.

9. Fire Management

The fire season was an extemely busy period for the Koyukuk Refuge in 1988. Fire Management Officer Granger was greeted with the most severe fire season in Alaska in 10 years. More than 2.1 million acres burned statewide. Eighteen fires on the Koyukuk Refuge contributed 31,885.6 acres to the statewide total. These fires ranged from .1 to about 18,000 acres with a total expenditure of over 4 1/2 million dollars, or \$147.00/acre. The cost of fighting fires in Alaska isn't cheap!



The Cottonwood Creek Fire, which burned over 2,500 acres, was the first substantial fire on the refuge in 1988. MRB

This was more than enough for one fire management officer except Mike was also responsible for fire management activities on the Innoko, Nowitna, and Selawik refuges as well. The combined fire totals for these refuges were 15 additional fires totaling 373,577 acres at a cost over 5 million dollars. These fires ranged from .l acres to 207,800 acres. The latter was the Waring Mountain Fire which started June 15 and was finally declared out on September 7. This fire occurred in the wilderness area of the Selawik NWR. The fire was initially allowed to burn but later manned because of smoke accumulations in the Kobuk Valley and surrounding villages. When the final tally is made this fire alone could cost in excess of 5 million dollars. Access made this fire a difficult one to overcome. The lack of roads made transportation of equipment and personnel extremely difficult. More than a million pounds of supplies and gear were para-dropped to crews fighting the fire.

The extreme fire season proved to be very beneficial for fire fighters in several local villages. For example, Shungnak crews made on the average \$11,222 fighting fires in Alaska and the lower 48 this summer. Not bad for a couple months work! Fire suppression on the refuge is provided by B.L.M.'s Alaska Fire Service. Initial attack is achieved with smoke jumpers and retardant bombers such as C-119's, DC-6's, and 7's, Catalina PBY's and a Navy version of the B-24, the PB4Y. Helicopters are used to pick up smoke jumpers and to ferry in Emergency Fire Fighter crews as needed.

Fire suppression activities on the refuge are guided by the Alaska Interagency Fire Management Plan. The Seward/Koyukuk Planning Area encompasses the entire refuge. Under this plan, refuge land is put into one of four management options; critical protection, full protection, modified action, and limited action.

The critical protection option is for those areas where fire presents a real and immediate threat to human and physical developments. These areas or sites are occupied areas such as villages and fish camps. The highest priority in the allocation of suppression forces is given to sites in this option.

The <u>full protection</u> option is for those areas designated to receive initial attack and suppression efforts until the fire is declared out. This option is designed for the protection of cultural and historical sites, high resource value areas which require fire protection, but do not involve the protection of human life and habitation. Only fires in the critical protection area receive a higher priority for suppression resources.



Supplies and gear were para-dropped to firefighters on a daily basis during the Waring Mountain Fire on the Selawik NWR. MNG

A synopsis of the 1988 fire season on the Koyukuk Refuge is given in Table 4.

BLM Fire	Date	Date	Size	Cost
Number	Started	Out	(acres)	
AØ19	5/29	5/30	4.5	\$3,250.00
AØ2Ø	5/29	5/30	2.0	90.61
AØ21	5/29	6/11	2,550.0	1,000.00
All4	6/15	6/16	.3	3,250.00
A128*	6/16	6/17	.1	1,000.00
A129	6/16	6/24	83 . Ø	355.00
A2Ø5	7/6	8/30	8,080.0	1.2 million
A211	7/9	7/9	3.0	0.00
A224	7/12	7/14	.5	15,000.00
A229	7/12	7/12	.1	1,000.00
A231*	7/12	7/15	20.0	15,000.00
A236	7/12	8/1	3,120.0	1.6 million
A239*	7/12	7/14	.1	0.00
A245	7/13	7/17	1.5	15,000.00
A247	7/13	7/18	10.0	15,000.00
A263	7/15	8/31	18,000.0	1.8 million
A269	7/16	7/18	10.0	15,000.00
A277*	7/19	7/2Ø	.5	3,250.00

Table 4. Fires on the Koyukuk NWR in the 1988 fire season.

* Fires occurring on the Kaiyuh Flats (Northern Unit of the Innoko Refuge).

The modified action option is designed for those areas that require a relatively high level of protection during critical burning periods, but a lower level of protection during the non-critical burning periods when a risk of large, damaging fires is diminished. During the critical burning periods, fires in "modified action" areas receive aggressive initial attack. If a fire escapes initial attack and requires more than a modest committment to contain it, an Escaped Fire Analysis is conducted to determine the level of suppression needed in relation to the values at risk. Lands in this category are suited to indirect attack, the intent being to balence the acres burned with suppression costs. During the non-critical burning period, "modified action" areas do not receive initial attack of suppression; the intent being to reduce suppression cost and achieve resource management objectives through limited fire activity.

The limited action option recognizes areas where a natural fire program is desirable, or the values at risk do not warrent the expenditures of funds. Suppression actions are only to the extent necessary to keep a fire within the management unit or to protect higher classified sites within the area. The careful monitoring of fire behavior and fire weather conditions is essential on all fires in limited action areas.

These plans are designed on the premise that fire has been the major habitat improvement force in this area for thousands of years. It is a key environmental factor in this cold dominated system.

We as land managers want as natural fire regimes as possible without endangering human life and property. Fire seasons such as this year stress these plans to the limit. Land managers have received much public outcry from the Governor, Senators, and Native Corporations over burning traplines.

Prior to man's interruption the fire cycle in Interior Alaska ranged from 40 to 120 years. Our forests are adapted to this type of burning cycle and the wildlife depend on it. Without periodic fires the forest will grow old and unproductive and the soil will become increasingly iceladen.



Fire removes organic matter, resulting in the warming of the soil and lowers the permafrost layer which increases organic matter decomposition rates. The bottom line is improved habitat quality. MNG



Figure 3. Fire Management Options on the Koyukuk NWR and the Northern-Unit of the Innoko Refuge.



Fireweed is an early invader following fire.

MRB

Several public meetings and numerous newspaper articles have addressed the pros and cons of the Alaska Interagency Fire Management Plans, commonly known as the "let burn policy." Presently the future of these plans in Alaska have yet to be decided.

Two post fire season meetings were held by the Regional Office to discuss recommendations to improve fire management on Alaskan refuges. Major emphasis was placed on implementing a rigorous prescribed burning program. The Region 7 Fire Management Policy and Position Paper was also drafted and given to the National Fire Management Policy Review Team to assist them in making decisions concerning refuge lands in Alaska.

Several prescribed burn locations were flown and plotted on maps. Primary considerations for the burns are fuel loading and adequate barriers as there are no man-made fire breaks on the refuge. Plans are to burn at least one of the proposed locations in June 1989. The Effects of Fire on Wildlife Populations study was continued in 1988. The objectives of this study are to:

- Determine vegetation changes and successional sequences caused by fire.
- Determine small mammal, furbearer, avian, and moose population changes caused by fire.

The study area consists of three sites. Two are in an area burned during the summer of 1986. One is in the middle of the fire area and the other is along the perimeter of the burn area. The third site is an unburned control site. Each site consists of a three mile long transect.

Small mammal trap lines were set, and bird counts and vegetative transects were conducted during June 21-23 and again during August 23-26. Data collected during the last two years indicates, as expected, the rodent population is increasing in the burn sites, especially along the perimeter.



Here, FMO Granger inspects a funnel trap, part of a small mammal trapline for the Fire Study. GRR


Yellow-cheeked and meadow voles are common trapline victoms. MRB

12. Wilderness and Special Areas

The 400,000 acre 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). The Koyukuk Wilderness surrounds the geologically unique Nogahabara Sand Dunes and also includes the Three Day Slough area. Since the Koyukuk area is unglaciated it is theorized that the dunes are wind-blown deposits of sand that originated in glaciated areas to the northwest.



Nogabahara Sand Dunes MRB

1. Wildlife Diversity

Baseline data continues to be collected to determine which of the numerous species listed as common and casual to interior Alaska are present on the Koyukuk National Wildlife Refuge. Over 145 bird and 30 mammal species are thought to occur, as well as, three salmon species and numerous fresh water species.

2. Endangered and/or Threatened Species

Peregrine falcons nest on the refuge. Area Biologist Osborne and Volunteer Bill Summerour conducted a raptor survey on July 3. The survey covered the lower 35 miles of the Koyukuk River and some areas of Nikolai Slough. A total of six eyases were banded at two eyeries. Four other pererines, three identified as adults, were observed around the eyeries. Refuge staff observed an adult pair of peregrines in June which were defensive. A search was made for the scrape in August but it wasn't located.



Although peregrine falcon nesting habitat is scarce on the refuge several nest sites are active each year. MRB



Figure 4. Peregrine falcon nest sites in 1988.

3. Waterfowl

Waterfowl Pair Count

For the third consecutive year, a duck pair count was conducted in five trend areas on May 25, 26, and 31 in the Koyukuk National Wildlife Refuge. Fifty-four pairs from eight species of ducks were observed. In addition, 11 key waterfowl brood plots were surveyed and 196 pairs representing 12 species of ducks were observed.

The five trend areas and ll key waterfowl brood plots were surveyed by a pilot and an observer in a Piper Super Cub, flying 60 to 80 mph approximately 150 feet above ground level. The species, number of individuals, and number of pairs of ducks observed were recorded.

A total of 161 ducks representing nine species were observed during the flight of five trend areas (Table 5). This represents a very slight increase over the number seen in the 1987 survey. The 54 pairs seen during the 1988 survey is a five percent decrease compared to the 1987 survey. Again in 1988, due to time constraints, the five trend areas were not surveyed during the brood count as had been done in the past. In anticipation of this, 11 key waterfowl brood plots were also sampled during the breeding pair count.

		# P	airs obse	erved	Total	birds	observed
		1986	1987	1988	1986	198	7 1988
Mal	llard	4	4	1	9	21	14
Wig	geon	7	14	8	28	38	21
N.	Shoveler	Ø	7	12	10	22	28
N.	Pintail	5	20	4	10	47	26
Dab Tot	bler al	16	45	25	57	128	89
Sca	up	1	10	2Ø	37	27	52
Can	vasback	3	Ø	1	6	Ø	2
Buf	flehead	Ø	Ø	4	2	Ø	9
Sur	f Scoter	Ø	1	Ø	Ø	2	Ø
Bla	ck Scoter	Ø	Ø	4	Ø	1	8
W.W	. Scoter	Ø	1	Ø	10	2	1
Div	er Total	4	12	29	55	32	72
Gra	nd Total	2.0	57	54	112	160	161

Table 5. Number of ducks observed on five trend areas, 1986-88.

Species seen in the trend survey in 1988 were similar to those seen in the 1987 survey. However, divers took exception to this, and bufflehead and black scoter pairs were observed for the first time in 1988. Surf scoter and white-winged scoter pairs, which were observed in 1987, were not present in 1988. Mallard, wigeon, and northern pintail combined showed a 66% decrease in 1988. The only dabbler pair which increased in 1988 was northern shoveler (+42%). As in past years, no green-winged teal were observed in 1988 during the breeding pair count, however, they did comprise 14% of total production on the refuge in 1988.

A total of 592 ducks representing 12 species and including 200 breeding pairs were observed on 11 waterfowl brood plots during the breeding pair count (Table 6). In comparison to the five trend areas, similar dabbler species were also observed on this count of 11 waterfowl brood plots. One noticeable exception between the pair count and brood survey was the high number of northern pintail broods found in the brood survey. Only one northern pintail pairs were observed in the pair count but 26 broods were later present in the brood survey. On a positive note, 81% of mallard, wigeon, and shoveler pairs observed in the pair count were later accounted for with observed broods in the brood survey. Although green-winged teal were not observed within the brood survey plot several pair were sighted adjacent to the plot. Twenty-two broods were later observed in the brood survey. Diver pairs were common, especially on large lakes, and although 173 pairs were observed during the pair count only 29 diver broods were later seen in brood surveys.



Although not as numerous as other dabblers, shovelers are common on the refuge. MRB

	1988 Pair	count	1988 Brood survey
נ	otal Birds observed	# pairs observed	<pre># broods observed*</pre>
Mallard	16	3	2
Wigeon	43	18	24
G.W. Teal	3	1	22
N. Shoveler	8	4	5
N. Pintail	32	1	26
Dabbler Tota	1 102	27	79
Redhead	Ø	Ø	1
Canvasback	3 9	15	Ø
Scaup	241	56	8
Goldeneye	Ø	Ø	2
Bufflehead	7	1	4
Oldsquaw	2	1	3
Black Scoter	146	72	4
W.W. Scoter	4	2	1
Surf Scoter	56	26	6
Diver Total	49Ø	173	29
Grand Total	592	200	10/8

Table 6. Number of ducks observed on 11 waterfowl plots during breeding pair count - 1988.

* broods observed during July 6 - 28 brood surveys

Waterfowl Brood Survey

For the fourth consecutive year, a duck brood survey was conducted between 6 July and 15 August, 1988, within the Koyukuk National Wildlife Refuge, and on the Kaiyuh Flats Unit. Thirty one-square-mile plots on the Koyukuk National Wildlife Refuge and fifteen one-square-mile plots on the Kaiyuh Flats Unit were surveyed. Duck production estimates were 116,102 on the Koyukuk National Wildlife Refuge, and 38,684 on the Kaiyuh Flats Unit (Table 7). These estimates show a slight decrease in duck productivity compared to 1987. A stratified random sample of one-square-mile plots was surveyed to determine duck brood density and distribution on the refuge. Plots were delineated by section lines on 1:63,350 scale USGS topographical maps. Based on water bodies marked on these maps, there are 3,135 square miles of waterfowl habitat on the Koyukuk National Wildlife Refuge. Waterfowl habitat is defined as any section with more than 15 acres of water in lakes, sloughs with water flowing less than three miles per hour, or streams meandering through marsh areas. It specifically excludes large rivers, or sloughs on the main rivers.



Wigeon are the top waterfowl producing species on the refuge. MRB

Waterfowl habitat on the refuge is divided into three strata. Poor habitat is any section with numerous small bog lakes (less than 15 acres each); or with no single bog lake over 60 acres either partially or wholly within the plot; or with a non-bog lake greater than 15 acres but less than 60 acres. Bog lakes are defined as lakes not connected to flowing streams that would provide regular nutrient exchange. There were 2,059 square miles of poor habitat in the 1988 survey.

Moderate habitat is any section with a total of at least 60 acres, but not more than 100 acres, of water in non-bog lakes, sloughs, or marsh areas; or with at least 60 acres of an adjacent 200 acre or larger bog lake in the plot. In the 1988 survey, 675 square miles were classed as moderate habitat.

Key habitat is defined as sections containing more than 100 acres of non-bog lakes, sloughs, and marsh lands; or containing more than 120 acres of an adjacent 200 acre or larger bog lake. The 1988 survey included 401 square miles of key habitat.

Based on the variance observed in a similar 1986 survey, sampling was optimally allocated between the three strata after Caughly, 1977. Six plots were surveyed in the poor strata, seven in the moderate habitat, and 17 in the key habitat on the Koyukuk unit.

Plots were selected using a random numbers table. The first number drawn was an assigned number representing the township; the second number drawn was the range; and the third number drawn was the section. Each section drawn was identified as poor, moderate, or key habitat. The first six poor, the first seven moderate, and the first 17 key plots were considered the sample. Alternates in each stratum were drawn from the list to be used if some of the plots were inaccessible. A plot was deemed inaccessible if a PA-18 Super Cub on floats could not be landed within one mile of the plot. Of the 30 plots, only two key plots were deemed inaccessible, and alternates surveyed.

Order of examination of plots was based on convenience, including ferry time and anticipated completion time. Except for helicopter surveys, each plot was surveyed by the most appropriate non-motorized method. When possible, observers paddled around the edge of each water body in the plot in either 12 foot lightweight canoes, or 12 foot inflatable kayaks. Where portages of any distance were required (usually more than 200 yards), observers walked around the water bodies as closely as possible to the water's edge. Birds were observed with the aid of binoculars, and recorded by species, age class, and number of young. Broody hens without observed young were recorded by species.

When the Super Cub was landed in the plot, that water body was surveyed last, when possible, to allow time for waterfowl behavior to return to normal.

All thirty of the plots were surveyed twice, once early (July 6-21, 1988) to coincide with peak dabbler production, and once late (July 29-August 15, 1988) to coincide with peak diver production. Two of the moderate plots, M4 and M6, were dry this year and were not surveyed. Ten key plots (K2, K3, K5, K8, K9, K10, K13, K15, K16, and K17), two moderate (M1 and M2), and three poor plots (P2, P5, and P6) were also surveyed, July 22-23, during the second count with helicopter due to helicopter availability. Bertram (1988), in comparing ground and helicopter counts on twenty plots, found that while the total number of broods seen was similar with both techniques, ground surveys favored diving ducks and helicopter surveys favored dabblers.

A simple random sample of one-square-mile plots was surveyed on the Kaiyuh Flats Unit. Fifteen plots were surveyed in 1988, selected from 997 square miles of waterfowl habitat. Five of the plots (KF1-5) were surveyed twice, once early (July 18-28) and once late (August 12-15). In addition to ground counts, the helicopter was also used to survey the first five plots (KF1-5, 7/12-13) and was used for the only count done on ten additional plots (KF6-15).

After the data were collected, an effort was made to reconcile the number of young seen. If a brood was seen on a plot during the second count that was too young to match any of the broods seen the first count, it was counted as a new brood. If all broods seen during the first count were accounted for, and extra broods of the same age or older were seen on the second count, they were counted as new broods. Total young seen is the sum of all young seen on the first and any new young seen on the second count.



Lightweight canoes are ferried down to waterfowl brood survey plots via Piper Supercub. MRB

An average number of young (all species) per plot was calculated in each stratum, and on the Kaiyuh Flats Unit. The product of the average young per square mile and the size of the stratum estimates total young produced in each stratum. The sum of these estimates for each stratum is the estimate of total production for the refuge. The product of the average young per square mile and the size of the waterfowl habitat on the Kaiyuh Flats Unit is the estimate of total production for the Kaiyuh Flats Unit.

In each stratum on the Koyukuk National Wildlife Refuge, and on the Kaiyuh Flats Unit, the average number of young per square mile was calculated for each species. These averages were used to compute weighted species totals for the Koyukuk National Wildlife Refuge and simple species totals for the Kaiyuh Flats Unit.

For calculations, broody hens without observed young were assigned broods equal to the average brood size (rounded to the nearest whole bird) for the stratum.

During the 1988 duck brood survey, 2,055 young (496 broods) from 15 species were classified. Due to the difficulty in distinguishing between female lesser and greater scaup, and between common and Barrow's goldeneye, young were classified as scaup species and goldeneye species, respectively.

Estimated production on the Koyukuk National Wildlife Refuge between July 6 and August 15, 1988, was 116,102 birds (se=17%); and on the Kaiyuh Flats Unit, 38,684 birds (se=48%) (Table 7). On the Koyukuk National Wildlife Refuge, wigeon (29%), green-winged teal (14%), and pintail (13%) accounted for over half the total production (Table 8). Overall, dabblers accounted for 63% of the production, and divers and sea ducks the remainder. On the Kaiyuh Flats Unit (Table 9), dabblers accounted for 65% of the total production, with green-winged teal (12%), wigeon (38%), and mallards and northern pintails (6% each) the top producers. Divers and sea ducks produced 35% of the estimated total.

Estimated production for most species appears to have decreased from 1987 (Table 10) although increases were noted in wigeon and northern pintail. However, bias from several sources enters into the estimates, and direct comparisons should be made cautiously. On any given plot, an unknown number of broods go unobserved. This percentage of broods missed probably varies with such factors as species, age of brood, weather conditions, type of water body, and observer experience, among others. Unfortunately, these biases are probably not the same from year to year. And although every effort was made to reconcile broods between first and second counts, double counting was still a possibility.



This late summer brood is just a week or two away from earning their wings. MRB

It should be noted that when comparing yearly totals in Table 10 another important source of bias is the manner in which broody hens were handled. In 1986, and earlier surveys, broody hens were evaluated as having a brood equal to the overall average brood size for the species. In the 1987-88 estimates of total production, broody hens for each species were evaluated in each stratum as having a brood equal to the average brood size for that species in that stratum (columns 87a and 88a). Brood sizes tended to be significantly smaller than the overall average in the poor stratum, which makes up 66% of the total area. When broody hens from the poor stratum are evaluated with a brood size equal to the overall average, a higher than actual estimate results (columns 87b and 88b), thus the difference between columns a and b for 1987 and 1988 totals in Table 10.

A hatching date was estimated (based on stage of development) for each observed brood. Mean hatching dates were calculated for each species (Tables 11 and 12). Mean hatching dates appear to be slightly later (averaging about 5 days) on the Kaiyuh Flats Unit than on the Koyukuk NWR (Figure 5). The 1988 survey coincided nicely with peak production.



Koyukuk Unit	Ave Young per mi2	Total Young All Species	se of Estimate	Ave Broods
Poor	27.2	55,943	28%	6.7
Moderate	39.4	26,615	33%	8.9
Кеу	83.7	33,544	21%	18.0
TOTAL	37.0	116,102	17%	8.4
Kaiyuh Flats	38.8	38,684	48%	11.2

Table 7. Estimated total duck production - Koyukuk National Wildlife Refuge and Kaiyuh Flats Unit.

Table 8. Estimated total young produced - by species - Koyukuk National Wildlife Refuge.

Species	Total Young (a)	% of Total Production
Mallard	5,209	4
Wigeon	33,328	29
Green-winged Teal	16,537	14
Northern Shoveler	1,759	2
Northern Pintail	14,960	13
Redhead	116	<1
Scaup spp	17,825	15
Ringneck	4,926	4
Canvasback	1,030	<1
Bufflehead	1,289	1
Goldeneye spp	1,631	1
Oldsqua w	1,398	1
Black Scoter	3,291	3
Surf Scoter	8,114	7
White-winged Scoter	4,281	4
Unidentified	877	<1

TOTAL

116,571

100

(a) Total Young = Tp + Tm + Tk (poor, moderate, and key), where, Ti = {[total observed young + (broody hens X stratum average brood size)] / square miles observed in stratum} X total square miles in stratum

Species	Total Young (a)	% of Total Production
Mallard Wigeon Green-winged Teal Northern Shoveler Northern Pintail Scaup spp Goldeneye spp Ringneck Bufflehead	2,193 14,756 4,586 1,196 2,393 5,384 997 1,196 3,789	6 38 12 3 6 14 3 3
Black Scoter Surf Scoter	1,396 798	3

TOTAL

38,684

100

(a) Total Young = {[total observed young + (broody hens X average brood size)] / square miles observed } X total square miles of habitat

As mentioned earlier, helicopter surveys also were conducted on 15 plots on the Koyukuk NWR and all 15 plots in the Kaiyuh Flats Unit. However, only five of 15 plots were used for production estimates in the Kaiyuh Flats Unit. Each of the surveys used pilots with different flying techniques. The success of the helicopter survey depended heavily on an experienced observer with sharp waterfowl identification skills. Often identification was made by shape rather than color, especially on overcast days with flat light. Counts were made as quickly as possible due to the obvious helicopter disturbance. When pushed, dabblers would often run into the grass or up the bank to hide. Although there was little difficulty with species identification it can be difficult to get an accurate number and age class of young. Divers were much more diffucult to accurately count because they dove for extended periods and broods tend to bunch up when pushed (common on large lakes). Diver broods must be approached cautiously and brood counts by number and species must be made immediately. The approach to make age class determination must be quick and low and the pilot must move on quickly to avoid bunching broods.

						% change			% change
Species	84	85	86	87a	88a	from 87	87b	88b	from 87
Mallard	4,015	1,547	7,034	8,937	5,209	- 42	10,337	5,427	- 47
Wigeon	39,997	22,389	23,654	31,608	33,328	+ 5	38,430	34,540	- 10
G.W. Teal	15,434	22,261	28,354	18,838	16,537	- 12	18,543	16,584	- 11
N. Shoveler	8,125	2,159	1,523	6,443	1,759	- 63	7,222	1,711	- 76
N. Pintail	18,775	11,850	10,880	13,695	14,960	+ 8	15,994	12,617	- 21
Redhead	753		24	473	116	- 75	400	120	- 7Ø
Scaup spp	25.498	4.622	12,330	18,400	17,825	- 3	19,908	21,840	+ 10
Ringneck				2,211	4,926	+123	1,774	2,813	+ 59
Canvasback					1.030			1,050	
Bufflehead	4.329	320	3.357	1,632	1,289	- 21	2,314	1,128	- 51
Goldeneve spp	1,506	2,963	534	561	1,631	+191	640	2,813	+339
Oldsquaw	5,458	4,486	705	1,955	1,398	- 28	1,523	1,632	+ 7
Black Scoter	1,255	1,907	1.577	12.064	3,291	- 73	8,104	3,898	- 52
Surf Scoter	4,966		3,529	12,191	8,114	- 33	11,563	9,063	- 22
W W Scoter	878	320	253	2,446	4,281	+ 43	2,265	2,730	+ 21
Unidentified	94		1,994	1,893	877	-116	2,040	1,327	- 35
Total	130,183	74,824	95,892	133,327	116,571	- 13	141,058	119,293	- 15

Table 10. Annual comparison of estimated waterfowl production by species.

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a Calculated directly from young observed on each plot X total square miles b Calculated as done exclusively in 1985-86, Broods/mi2 X total mi2 X avg. brood size

Species	Mean Date	Range	se - days	N
Mallard	6/25/88	6/19-7/07	7	14
Wigeon	6/28/88	6/04-7/24	2	120
G.W. Teal	6/28/88	6/07-7/26	3	53
N. Shoveler	6/23/88	6/27-7/06	4	19
N. Pintail	6/06/88	5/21-7/03	2	7 5
Redhead	7/09/88	7/06-7/12	6	2
Scaup spp	7/Ø4/88	6/13-7/20	2	61
Ringneck	7/11/88	6/16-8/02	6	6
Canvasback	6/19/88			1
Bufflehead	6/26/88	6/17-7/05	5	7
Goldeneye spp	7/01/88	6/21-7/02	12	4
Oldsquaw	6/22/88	6/15-6/29	3	12
Black Scoter	7/12/88	6/25-7/30	2	19
Surf Scoter	7/05/88	6/15-8/01	4	35
W.W. Scoter	7/11/88	6/27-7/20	4	11

Table 11. Mean hatching dates - Koyukuk NWR.

N = total number of broods se = standard error

Table 12. Mean hatching dates - Kaiyuh Flats Unit.

Species	Mean Date	Range	se - days	N	
Mallard	7/01/88	6/26-7/09	6	4	
Wigeon	7/01/88	6/23-7/17	3	18	
G.W. Teal	6/24/88	5/31-7/16	9	10	
N. Shoveler	6/29/88	6/25-7/02	7	2	
N. Pintail	6/16/88	5/31-7/09	14	6	
Scaup spp	7/04/88	6/23-7/13	6	7	
Ringneck	7/30/88			1	
Bufflehead	6/28/88	6/22 - 7/04	5	5	
Goldeneve spp	7/08/88			1	
Surf Scoter	7/0/6/88			1	
Black Scoter	7/15/88	7/2-7/27	25	2	
	,,10,00	1/2 1/21	23	2	

N = total number of broods se = standard error



This eclipse mallard drake nearly eludes the camera undetected. MLN

Estimated young production for the Koyukuk NWR and Kaiyuh Flats unit was 97,785 (se=31%), and 24,726 (se=42%), respectively. A comparison of ground and helicopter survey production figures are in Table 13.

Table 13.	Comparison	of ground	and	helico	pter	survey
waterfowl	production	estimates	, Ko	yukuk	NWR -	- 1988.

Koyukuk Unit	Ave. young per mi2	Total young all species	se of estimate
	Ground/Helicop.	Ground/Helicop.	Ground/Helicop.
Poor	27.2 / 16.7	55,943 / 34,324	28 / 80
Moderate	39.4 / 35.5	26,615 / 23,963	33 / 24
Кеу	83.7 / 98.5	33,544 / 39,499	21 / 31
Total	37 / 31.2	116,102 / 97,785	17 / 31
Kaiyuh Flats	38.8 / 24.8	38,684 / 24,726	48 / 42

Helicopter surveys in the Koyukuk NWR, which sampled 15 of 30 plots (75 water bodies - 10 Key, 3 moderate, and 2 poor), favored dabblers but not divers. A plot to plot comparison of ground and helicopter surveys is in Table 14. All dabbler species were favored except for shovelers. The average time span between helicopter and ground counts was 8.2 days (time span 5 to 13 days). 38% more total dabbler young and 58% more total broods were observed by helicopter. But ground counts favored divers with 27% more total young and 50% more total broods observed.

Ground surveys in the Kaiyuh Flats Unit, which surveyed five waterfowl plots (54 water bodies), favored both dabblers and divers. A plot to plot comparison of ground and helicopter surveys is in Table 15. The average time span between helicopter and ground counts was 7.8 days (time span 5 to 16 days). 13% more total dabbler young and 41% more total dabbler broods (23% of the broods were broody hens) were observed from the ground. Divers were also favored by ground surveys with 18% more total diver young and the same number of diver broods observed.

It is felt that the Koyukuk NWR helicopter survey gives a more accurate account of dabbler results. A larger sample was taken and the flying technique of the pilot was more observer compatible.

	Total	Young		Total	Broods	
Species	Ground	Helicop	ter	Ground	Helicop	ter
Mallard	63	98		12	26	
Wigeon	228	429		49	83	
G.W. Teal	138	2Ø2		4 Ø	59	
N. Shoveler	39	27		10	8	
N. Pintail	29Ø	290		38	6Ø	
Dabbler Total	758	1,046	+38%	149	236	+58%
Scaup	366	379		38	37	
Ringneck	10	16		3	5	
Goldeneye	3	6		1	4	
Bufflehead	13	2		4	1	
Oldsquaw	2 2	7		6	2	
Black Scoter	79	9		• 9	2	
W.W. Scoter	6	14		2	2	
Surf Scoter	141	31		22	5	
Unidentified	1	6		1	3	
Diver Total	641	47Ø	-278	123	61	-50%

Table 14. Comparison of helicopter surveys to ground surveys in the Koyukuk NWR - 1988.

	Total	Young		Total	Broods	
Species	Ground	Helicop	ter	Ground	Helicop	ter
Mallard	10	Ø		6	ø	
Wigeon	74	67		22	19	
G.W. Teal	27	24		14	6	
N. Shoveler	6	5		2	1	
N. Pintail	12	16		7	4	
Dabbler Total	129	112	-13%	51	30	-418
Scaup	21	3Ø		4	5	
Ringneck	Ø	Ø		Ø	Ø	
Goldenyeye	5	4		1	2	
Bufflehead	12	Ø		2	Ø	
Oldsquaw	Ø	Ø		Ø	Ø	
Black Scoter	7	Ø		2	Ø	
W.W. Scoter	Ø	Ø		Ø	Ø	
Surf Scoter	4	Ø		1	Ø	
Unidentified	ø	6		Ø	3	
Diver Total	49	40	-18%	10]Ø	Øg

Table 15. Comparison of helicopter surveys to ground surveys in the Kaiyuh Flats Unit, Koyukuk NWR - 1988.

The helicopter data was also analyzed by comparing ground surveys conducted within or greater than six days of the helicopter survey. Both the Koyukuk NWR and Kaiyuh Flats unit were combined for this comparison. It is noted in parentheses what percentage of young or broods were seen on helicopter surveys in comparison to before (lst) or after (2nd) ground counts. The following observations were made:

Comparing helicopter to ground surveys made within six days:

- 27% more dabbler young seen with helicopter than on ground (42% before, 11% after)
- 20% more dabbler broods seen with helicopter than on ground counts (18% before, 18% after)
- 29% fewer diver yound seen with helicopter than on ground (52% before, 18% after)
- 23% fewer diver broods seen with helicopter than on ground (18% before, 26% after)

Comparing helicopter to ground surveys made greater than six days:

Nearly three times (175% more young) as many dabbler young seen from helicopter than on ground (251% before, 23% after)
Nearly twice (72% more broods) as many dabbler broods seen from helicopter than on ground (182% before, 30% after)

In general, it costs twice as much to survey by helicopter but the work is accomplished in half the time with a savings of 10 mandays (see Table 16).

Table 16. Cost comparison of helicopter survey and ground survey methods for 20 plots (129 waterbodies).

Method	Cost	Mandays	Working days	
Helicopter	\$ 9,250.00	14	5	
Ground	\$ 4,235	24	9	

Helicopter surveys appear to favor dabblers but not divers and should be considered for use on the first or early count for refuges using the early and late count method. The savings is mandays make this method well worth considering when time constraints occur during the field season.

Due to time constraints, the trend areas surveyed in 1984 through 1986 were not surveyed in 1988. Presumably, the estimates of total production each year should be as reliable as any other trend data we might collect.

Two float trips were conducted primarily to document goose production, but duck production information was also recorded. Dulbi River and Dulbi Slough were both surveyed June 29-30, 1988. On 56 3\4 miles of Dulbi River, 55 young were seen (13 broods, 6 species), with wigeon, northern pintail, and goldenyeye predominating. On Dulbi Slough, 462 young (100 broods, 5 species) were seen in 69 miles, wigeon and pintail predominating. With a minimum of 445 miles of Dulbi River type, and 106 miles of Dulbi Slough type, at least 1,141 young should be added to the total production figures for the refuge.

In order to accurately predict the peak of brood occurrence, more needs to be known about the relationship between mean hatching date and common phenological indicators. A comparison of mean hatching date and such variables as breakup, mean daily temperature, average snow depth, and date of first arrival could yield an accurate indicator for planning survey dates.

Goose Surveys

For the fourth consecutive year, a survey to determine the number of white-fronted geese (Anser albifrons) and Canada geese (Branta canadensis) within the boundaries of the Koyukuk National Wildlife Refuge was conducted from 27 June to 18 August, 1988. Estimates of production were 3,953 white-fronts (se = 67%) and 676 Canadas (se = 96%). The highest densities were along Dulbi River and Dulbi Slough.



Canada goose productin estimates were down in 1988 compared to recent years. MRB

Censusing was used to sample and survey riverine habitat during 27-30 June, 1988, and 16-18 August, 1988; and stratified random sampling was used to survey lacustrine habitat from 6 July to 15 August, 1988.

Riverine habitat was delineated from 1:250,000 scale USGS topographical maps and was defined as any section which contained a double-lined river or slough, an oxbow lake connected to a river or slough, Dulbi Slough, or Boat Lake. The area of river habitat was 756 square miles. Riverine habitat was sampled June 27-30, 1988, by making float trips down the Dulbi River and Dulbi Slough. The number of geese observed per mile of river was expanded by the total amount of similar habitat to calculate the estimated production and estimated number of non-breeding adults using the refuge. Riverine habitat, the river corridor survey, was also surveyed by a pilot and observer on August 16-18, 1988, in a Piper Super Cub flying 500 feet above the river and slough corridors, over oxbow lakes, and over Boat Lake. The area surveyed included any portion of waterfowl habitat within 1/4 mile of the water bodies surveyed. The number of birds observed served mainly as a comparison against estimated production. Lacustrine habitat was delineated from 1:63,360 scale USGS topographical maps and was defined as any section with at least 15 acres of water, exclusive of river habitat. Lacustrine habitat included lakes, sloughs with water flowing less than three miles per hour, or streams meandering through marsh habitat. The area of lacustrine habitat was 2,653 square miles. Lacustrine habitat was sampled using the same 30 one-square mile plots described in the waterfowl brood survey.

Estimated white-front production on the Koyukuk National Wildlife Refuge was 3,953 young birds in 1988 (Table 1). This estimate is a combination of the estimated lacustrine production of 481 young (se=67%) and the estimated riverine production of 3,472 young. Estimated Canada goose production on the refuge was 676 young, 72 (se = 96%) in the lacustrine habitat and 604 in the riverine habitat (Table 17). Although total estimated white-front production was down 18% compared to 1987, riverine production was up 10%. Canada goose production, down in both lacustrine and riverine habitats, was down 60% compared to 1987. Few non-breeders were observed in the sample of the lacustrine habitat. However, large numbers of non-breeding white-fronts were seen on the two float trips. The Koyukuk National Wildlife Refuge appears to have been home to more than 8,500 non-breeding white-fronts in 1988, which more than doubles the 1987 estimate.



Non-breeder white-fronted geese sometimes travel in early summer flocks up to 300 birds. MLN



White-fronted geese

MRB

Table 17. Estimated production - Koyukuk National Wildlife Refuge

	1985	1986	1987	1988
White-front	6,573	5,352	4,846	3,953
Canada	170	1,049	1,702	676



The highest densities of white-fronts were in the Dulbi River and here along the Dulbi Slough. MLN

In contrast, only 2,246 total geese were seen during the August 16-18 survey of the riverine areas (1,484 white-fronts, and 762 Canadas. Possibly, a large portion of the geese had already staged and started south by the time we flew our survey.

Swan Survey

For the fourth consecutive year, a swan survey was conducted to develop trend data on the breeding population on each of two swan species on the Koyukuk NWR. Both tundra and trumpeter swans breed on the refuge.

A survey of swan nests was conducted June 14-16 and August 31, 1988 on the Koyukuk National Wildlife Refuge and the Kaiyuh Flats Unit. Of the 19 nest sites identified, 13 (68%) were trumpeter swan (Cygnus buccinator) nests and six (32%) were tundra swan (Cygnus columbianus) nests.

Swan nests were located by flying one-mile transects over suspected swan habitat in the study area. Transects were flown in a Piper Super Cub equipped with floats at altitudes averaging about 500 feet.

All accessible swan nests that were observed from the air were subsequently viewed from the ground. Swan species identification was made by visual, behavioral, and/or auditory cues of adult swans associated with the nest. An accessible



Swans tend to nest on isolated bog islands in large lakes. (Mr. Tundra Swan - John Sarvis) MRB

swan nest was defined as any nest that was within one-half mile of a waterbody that was accessible by float plane. A total of 21 swan nests were located in 1988. Of nests which could be identified, 13 (68%) were trumpeter swan nests, and six (32%) were tundra swan nests.

Bird identification was made by flying low near the nest. Definite behavioral cues separated the two species. It was observed that, in addition to the yellow spot in front of the eye, tundra swans were also more timid and less defensive at the nest site. Positive ground identification (with spotting scope) was made of five trumpeter and two tundra swan nests. The seven ground identifications confirmed previous air identification.

Clutch size ranged 4-8 eggs for trumpeter swans with a mean of 5.1; tundra swan clutch size ranged 2-6 eggs with a 3.6 mean. Over two-thirds of swans surveyed in 1988 were trumpeters. Of 28 pairs identified in 1985-87 only one pair was identified as trumpeter. Hopefully the noteable increase in trumpeter swan in 1988 will be seen again in 1989.



A noteable increase in nesting trumpeter swans ocurred on the refuge in 1988. MLN

4. Marsh and Water Birds

Common, Pacific and red-throated loons; red-necked and horned grebes; and sandhill cranes are commonly observed on the refuge. Yellow billed loons are also occasionally sighted.



Rednecked grebes are one of the most abundant waterbird species on the refuge. MRB



Sandhill cranes are also common summer residents.

MLN

5. Shorebirds, Gulls, Terns and Allied Species

Numerous species of shorebirds inhabit the refuge. Those species observed in 1987 included: lesser yellowlegs, greater yellowlegs, Arctic tern, glaucous gull, mew gull, Bonaparte gull, herring gull, long-tailed jaeger, semipalmated plover, common snipe, spotted sandpiper, least sandpiper, pectoral sandpiper, solitary sandpiper, northern phalarope, Hudsonia godwit, and whimbrel.



Nortern Phalarope

MRB

6. Raptors

The refuge has nesting populations of rough legged hawks, merlins, sharp-shinned hawks, northern harriers, red-tailed hawks, goshawks, great horned owls, great gray owls, boreal owls, northern hawk-owl, peregine falcons and bald eagles. Only one active bald eagle nest was observed this year. A nest in the Three Day Slough area which had been active for the past several years was found to be in poor condition and unoccupied this year. During Area Game Biologist Osborne's peregrine survey on the Koyukuk River, he observed two eyeries, with three eyases each, and four other falcons. Three of the four were identified as adults. Four bald eagles, nine Harlans hawks, one red-tailed hawk, four northern harriers, one northern goshawk and four great horned owls were also observed.



Great horned owls, a refuge resident, commonly nests along river corridors and back sloughs. MLN



Pine grosbeaks are common year round residents on the refuge. MRB

7. Other Migratory Birds

Numbers and species composition of passerine birds fluctuate with the seasons. Redpoll, common raven, blacked-capped and boreal chickadees, and pine grosbeaks are common winter residents. Species commonly seen in the spring and summer include alder flycatcher, olive-sided flycatcher, tree swallow, gray jay, robin, gray-cheeked thrush, Bohemian waxwing, yellow warbler, rusty blackbird, savannah sparrow, dark-eyed junco, tree sparrow, white-crowned sparrow, fox sparrow, Lincoln sparrow, and song sparrow.



Gray Jay or "Camp Robber"

MRB

8. Game Mammals

Moose are presently the most important game and subsistence mammal on the Koyukuk Refuge. The are found in almost all refuge habitats, but are most numerous in the riparian habitat along the Koyukuk River and its major tributaries. Historically, moose arrived in the area where the refuge now exists in the early 1940's and following Federal wolf control efforts, have been abundant during the past 30 years. Average moose densities are estimated to be .5-1.0 moose/sg. mi. for the entire refuge with known densities of up to 9 moose/sg. mi. occurring in optimum riparian habitat.



Moose are a very important subsistence resource on Koyukuk Refuge. MRB

Two major projects pertaining to refuge moose populations were conducted during the year. A hunter check station was set up on the lower Koyukuk River during the September hunting season. And a moose census in the northwewstern corner of the refuge, centered on the Huslia River, was conducted in November.

In addition, three telemetry relocation flights were conducted to locate collared moose from the 1984 moose telemetry study.

Area Game Biologist Osborne has conducted a hunter check station on the Koyukuk River just south of the refuge boundary for the past six years. A total of 181 moose were checked this year. This compares to a total of 143 moose in 1987 and 111 moose in 1986. There has been a significant increase in the number of non-local hunters in recent years (Table 17). Of the 299 hunters, 158 were local game management unit 21D residents, 121 were non-local state residents and 17 were out of state residents. Although the increased hunting pressure is not currently hurting the moose population, a moose management plan is being initiated to address future management considerations.

Non-local	Non-Res.	Unit Res.	Total Hunters
29	3	132^	164
67	9	92 ^	168
74	4	117^	195
8Ø	9	140^	229
92	21	1510	264
121	17	158#	299
	Non-local 29 67 74 80 92 121	Non-localNon-Res.293679744809922112117	Non-localNon-Res.Unit Res.293132^67992^744117^809140^9221151@12117158#

Table 17. Number of moose hunters by residency class checked through the Koyukuk River Check Station.*

* checking in and out is not mandatory and compliance was lower during the first year, 1983.

- ^ counts every trip made by hunter
- @ Hunters counted only once. By city Galena 84, Koyukuk 40, Nulato 23, Huslia 4
- # By city Galena 82, Koyukuk 45, Nulato 29, Ruby 1, Kaltag 1

Three telemetry flights were made in 1988 to relocate moose with active collars from the three year moose telemetry study initiated in 1984. Fourteen of fifeteen collared moose were relocated in January and April and three of six of last years calves were still alive. By June only eleven collars appeared functional and of visuals made on eight cows, four had single calves and two had twins.

Moose Census

From 1981-1986, Area Biologist Osborne and the refuge staff have been aerially surveying moose on the refuge using a trend area method developed by the state. Trend areas are 40-60 square miles in size and are comprised of several 12-15 square mile sample units. One-quarter mile wide transects are flown units at 60-80 mph and at altitudes of 300-500 over sample When animals are observed, they are circled at low feet. accurately altitudes in order to be classified. Classification include yearlings, medium and large bulls, calves, and cows.

Since 1987, instead of just surveying trend areas, a moose census has been conducted. In 1987 two of four sub-units were sampled on the refuge, the Galena and Kaiyuh Flats sub-units. In 1988 an attempt was made to sample the remaining two subunits but, due to poor weather and time constraints, only the Huslia River Sub-unit was sampled (Figure 6). The Bear Mountain Sub-unit has yet to be sampled.

The refuge was initially divided into four sub-units in 1987 to avoid the problems associated with trying to survey such a large area (nearly 10,000 square miles). Each sub-unit was treated as a complete census, with appropriate statistical methods being used to combine estimates from each sub-unit into a total for the refuge (See Gasaway, et. al., 1986, for a complete description of the census technique). Dividing the refuge area into several sub-units resulted in more intensive total sampling effort, but avoided the possibility of collected data being rendered useless if weather or other problems preclude completing the entire 10,000 square miles. In 1987 poor weather did limit censusing the entire refuge and only the Kaiyuh Flats and the Galena sub-units were completed.

As described by Gasaway, et. al. (1986), the Huslia River and Bear Mountain sub-units were divided into 10-14 square mile sample units. Each sample unit was examined from the air using a Cessna 185 flown 700-800 feet above ground level, and assigned to one of three strata - low, medium, or high. Randomly selected sample units were surveyed, allocating sampling effort according to a standard formula. All sample units stratified as high were surveyed. Search intensity was the recommended 4-6 minutes per square mile, flying at transects at 1/4 mile intervals, 300-500 feet above ground level with Piper Super Cubs or equivalent. A sightability correction factor was determined by flying intensive searches (10-12 minutes/square mile) in randomly selected 2 square mile sections of the surveyed sample units in the medium and high strata. All selected sample units were surveyed within two days after stratification.

A population estimate, corrected for sightability, with appropriate confidence limits was calculated for each census sub-unit. A total estimate for the refuge area censused was calculated from the sum of sub-unit estimates.

Certain assumptions were made in calculating sex and age ratios. Numbers of yearling bulls and yearling cows in the population were assumed to be equal. Thus, the number of adult cows is the total cows minus those assumed to be yearlings, based on the number of yearling bulls observed. The number of adult bulls is the total bulls minus those identified as yearlings. As in any wildlife work, it is assumed that the sample units surveyed and the moose seen were representative of the total population.





Five Supercubs and a Cessna 185 all operated out of a remote field camp for the 1988 moose census. MRB

Due to poor weather and time constraints, only one of the remaining two sub-units were surveyed. A total of 525 square miles of the 2,418 square mile Huslia River sub-unit was surveyed and the expanded population estimates for the subunit is 1,863. Confidence intervals at the 95% level were plus and minus 21.7% of the estimate and plus and minus 17.9% at the 90% confidence interval. Density estimates for the high, medium, and low strata are 3.5, .8, and .06, respectively. Overall moose density on 2,418 square miles is .8 moose per square mile (see Table 18).

Overall, the moose population on the Koyukuk appears to be healthy. Calf-cow ratios, yearling-cow ratios, and bull-cow ratios (Table 19) are all in the range considered acceptable. Calf production was good (51 calves/100 cows) and yearling recruitment was very good with 60 yearlings/100 cows. Yearlings in the population may be underestimated because of the difficulty in detecting antlers on some yearling bulls. Because we sampled late in the month some antler drop was noticed by observers and an already high bull/cow ratio (102 bull/100 cow) may be underestimated. This remote area of the Table 18. Estimated moose density by stratum, Huslia River Sub-unit - 1988 Kouykuk NWR Moose Census

Stratum	Total Area (sq. miles)	Survey Area (sq. miles)	Estimated Moose Pop.	Moose Density
High	125.5	125.5	442	3.5
Moderate	1,766.3	321	1,353	. 8
Low	526.1	78.9	33	.Ø6
Totals	2,417.9	525.4	1,828	.8

- expanded moose population estimate = 1,863 +/- 21.7% at 95%
CI

refuge obviously receives little hunting pressure which explains the high numbers of bulls observed. It is also possible that large (>50") bulls may be somewhat overestimated because of the tendency of inexperienced observers to call any large antlered bull "large", even though it may not in fact have an antler spread greater than 50 inches.

Table 19. Sex-age ratios of moose, Huslia River Sub-unit 1988 Koyukuk NWR Moose Census

Calves:	100	Adult	Cows	51.4
Yearlings:	100	Adult	Cows	60
Total Bulls:	100	Adult	Cows	101.8
Adult Bulls:	100	Adult	Cows	71.4
Large Bulls:	100	Adult	Cows	28.6
Large Bulls:	100	Adult	Bulls	40
<pre>% Adult Cows : % Adult Bulls % Large Bulls % Yearlings in % Calves in po</pre>	in po in po in po popula	opulat: oopulat oopulat oulatio ition	ion ion ion on	35 25 10 21 18

Table 20 gives a brief summary of effort expended. This does not include preparation, including mapping, setting up temporary field camps, logistics, or flight time to cache fuel or haul camp supplies; nor does it include flight time to retrieve fuel caches and break camp. This census operated from one remote field camp which housed 15 people. It took three people the better part of a month to prepare the winter camp.

Table 20. Summary of effort - Huslia River Sub-unit, 1988 Koyukuk NWR Moose Census

Total area (sg. mi.)	2,417.9
Surveyed area (sq. mi.)	525.4
Total sample units	195
Surveyed sample units	42
Hours to stratify	19
Hours to survey	76.8
Man days to stratify	16
Man days to survey	36



The moose census operated from a temporary field camp, three weatherports end to end, and provided enough comfort to plan operations. MRB
We appreciate the help of all participants and our thanks go out to the following people. John Harman (Fish and Wildlife Protection, Galena), Mike Vivion (Yukon Flats NWR, Fairbanks), Colin Brown (Nowitna NWR, Galena), George Walters (Yukon Flats NWR, Bethel), and Paul Ladegard (Innoko NWR, MaGrath) safely flew over 76 hours of low level survey flights.

Tim Osborne (Alaska Department of Fish and Game), Scott Robinson (Bureau of Land Management), Mike Nunn (Refuge Manager, Koyukuk NWR, Galena), and Mark Bertram (Wildlife Biologist, Koyukuk NWR, Galena), piloted by Greg Rost (Pilot/Biologist, Koyukuk NWR, Galena), all served as part of the stratification crew.

Harvey Heffernan (Arctic NWR, Fairbanks), Phil Feiger (Innoko NWR, MaGrath), Mike Granger (Fire Management Officer, Koyukuk NWR, Galena), and Tim Patton (Nowitna NWR, Galena) all assisted as excellent observers. Also thanks to Daryle Lons (Assistant Refuge Manager, Koyukuk NWR, Galena) and Dianna White (Secretary, Koyukuk NWR, Galena) for logistical support. And special thanks to Jason Nunn for volunteering his time and providing us all with warm shelter and hot meal back at camp. We're also very grateful to Selawik NWR for loaning the refuge cub which was very needed.

Based on the information collected during this census, a moose management plan will be developed for the Koyukuk National Wildlife Refuge. The plan will be developed in cooperation with the Alaska Department of Fish and Game.

We also assisted BLM Biologist Scott Robinson and provided staff and air support in a moose stratification of BLM lands adjacent and west of refuge boundaries on December 1-2. The majority of these lands are in the mountains and 3,559 caribou and one wolverine were also observed.

Caribou

The ranges of two caribou herds include portions of the refuge. Currently the southern edge of the range of the Western Arctic herd, the largest caribou herd in Alaska, is in the northern part of the refuge. The Western Arctic herd has been growing steadily since its crash in the 70's. Current distribution patterns may change if the herd size continues to increase. In 1988 the Western Arctic herd shifted migration patterns and travelled through areas in the southwestern and southern regions of the refuge normally only occupied by the Galena Mountain herd. Figure 7 displays recent caribou distribution on the refuge.

The smaller Galena Mountain herd (300-500) winters on the refuge in the Hozatka Lake area. This herd summers in the mountains and hills east of the refuge.

Refuge staff made a flight on March 11 to look at caribou wintering on the northwestern portion of the refuge. Several hundred caribou were present in the Billy Hawk Creek and Huslia River drainages. Ten to fifteen thousand caribou were present on the southern side of the Purcell Mountains, near the refuge boundary. Approximately 2-3,000 caribou were inside refuge boundaries at the time of the flight.



The Western Arctic Herd shifted migration patterns in 1988 and traveled through areas in the southern region of the refuge.



Figure 7. General caribou migration patterns - Koyukuk NWR - 1988

Upon recommendation of State Area Biologist Tim Osborne, the Department of Fish and Game implemented an emergency opening of a portion of the refuge to caribou hunting. The season was opened from November 26 in response to several thousand caribou of the Western Arctic herd unexpectantly coming into a portion of Game Management Unit 21D which is closed to caribou this time of the year. The refuge opposed this idea because of our concern that the potential to kill caribou in the small resident Galena Mountain herd was too great. Fortunately no animals from the Galena Mountain herd were harvested. The season was closed on January 11, 1989.

We assisted in the ongoing BLM study of the Galena Mountain caribou herd by conducting two radio tracking flights this year.

Staff also provided assistance to the Nowitna NWR in a moose calf mortality study throughout the year.

Wolves

Wolves range throughout Koyukuk refuge and the Kaiyuh Flats Unit. Though wolves prey on a variety of species, they are primarily dependent on large ungulates. Their numbers tend to respond to population fluctuations of the large ungulates on which they prey. In addition to prey numbers, harvest intensity of wolves is another factor determining the wolf population of an area. Koyukuk National Wildlife Refuge and the Kaiyuk Flats Unit currently have both healthy moose populations and healthy wolf populations.

Although the 1986 wolf study has been completed, two flights were made to locate wolves with active collars. The North Creek wolf was located in January and the Bear Creek wolf in February. Both wolves were later killed in March by local hunters. State Game Biologist Tim Osborne received word from his Fairbanks office that a wolf we collared on the Kaiyuh Flats Unit was observed in the Sheenjek River drainage and later on the Itkillick River in December. These rivers are 100 miles apart and over 400 miles from the original collaring site. We had lost radio contact with this female wolf shortly after she was collared and had assumed that the transmitter had failed.

Bears

Black bears are abundant in the forest, lowland habitat of the refuge. Hunting pressure is low and habitat quality is excellent. Over 40 bears were observed by biologists on August 31 while conducting swan surveys in the Dulbi River area. About 40% of the classified land cover types on the refuge are rated key for black bears.



This bear was just awaken moments earlier from a restful sleep. MRB

Grizzly bears, while uncommon, can be found on the refuge in open upland areas. Only two grizzlies were observed on the refuge in 1988.

Many furbearers occur on the refuge and marten and beaver in particular are highly sought after by trappers. Other important furbearers include lynx, wolverine, red fox, mink, river otter, and low numbers of muskrat and coyotes. Little is known about the distribution and population of these species.

10. Other Resident Wildlife

Willow and rock ptarmigan occur on the refuge. Willow ptarmigan numbers have increased tremendously during the past two years. Rock ptarmigan occur at the higher elevations of the refuge. Spruce and ruffed grouse are also common inhabitants of the refuge. Porcupine, short-tailed weasel, muskrat, snowshoe hare, red squirrel and other small mammals may also be found. Little is known about population levels or geographic distribution.

The only known amphibian present is the boreal frog. This species appears numerous in shallow refuge ponds in the southern end of the refuge and may be found throughout the refuge as baseline data is gathered.



Ruffed grouse, another refuge resident, are common. MRB



The boreal or wood frog is the only amphibian on the refuge. MRB

11. Fishery Resources

Anadromous species found in the Koyukuk River include chum, chinook, coho, sockeye and pink salmon. Chum salmon, summer and fall runs, and chinook salmon are the primary subsistence fish of the refuge. Coho and sockeye are occasionally found and pink is a rare occurrence.

Fresh water species found on the refuge include sheefish and burbot, both of which are important subsistence species. Other species which occur are broad whitefish, humpback whitefish, Alaska blackfish, least cisco, Arctic grayling, longnose sucker, northern pike, and ninespine stickleback.



Arctic Grayling

MRB

16. Marking and Banding

An attempt was made in late July to band white-front geese at Boat Lake which encompasses about six square miles. Surveys early in the day indicated hundreds of geese were congregated in this area. After several hours of preparation the nets were in place, personnel were ready, and the banding pliers oiled and warm. Repeated attempts were made to funnel the geese into the nets with a Cessna 185 and inflatable with outboard, but geese decided to retreat overland to adjacent water bodies and could not be driven back to Boat Lake. We will refine our technique for future white-front banding efforts.



Aerial view of white-front banding site on Boat Lake. MRB



1. General

The major public use is subsistence in nature and conducted by people living near or within the exterior boundaries of the refuge. This includes residents of Galena, Huslia, Hughes, Koyukuk, Kaltag and Nulato. In addition to hunting, fishing and trapping, other subsistence activities include berry picking and wood cutting. Sport hunters and fishermen from Anchorage and Fairbanks use the refuge to a lesser degree. No new cabin permits were issued in 1988.

8. Hunting

Moose and black bear are the major sport and subsistence species hunted on the refuge. However, ducks, geese, snowshoe hare, grouse, ptarmigan, sandhill cranes, caribou and grizzly bears are also taken. While total take for most species is unknown, subsistence studies in Huslia, Hughes, and Koyukuk during the last several years have given us a good feel for the subsistence harvest.

Most of the refuge is also covered by the Koyukuk Controlled Use Area established by the Game Board which closes the area "during all open moose hunting seasons to the use of aircraft in any manner for hunting moose, including transportation of moose hunters into or within this area, and the transportation of moose parts to or from this area."

Two special use permits were issued to guides and outfitters in 1988.



Subsistence moose hunters' camp. DRL



Black bear and moose are common sports and subsistence species on the refuge. MLN



9. Fishing

Fisheries resources provide a very important source of protein for local residents. The subsistence studies done in Huslia, Hughes, and Koyukuk in the past several years show an annual harvest from 14,000 to 22,000 salmon. The summer chum salmon run accounts for the bulk of fish harvested for subsistence. Most are preserved by drying or smoking. King salmon and fall chums are also important but runs are smaller. Sheefish, whitefish, grayling and pike are also harvested by local subsistence users. There is no commercial fishing on the refuge.

Most fish harvested for subsistence are taken in set nets. Fish wheels are not used on the Koyukuk River. Blackfish are taken in funnel traps and burbot are taken with nets or trot-lines set under the ice in the winter.

In addition to being eaten by people, summer chums are also commonly fed to dogs and used as trapping bait.

Sport fishing is usually done in conjunction with hunting trips by non-local residents, however, there is some sport fishing by residents of Galena. Northern pike, grayling and sheefish are the primary species caught.



Sheefish, which average 10 lbs, can get up to 50 lbs. MLN

10. Trapping

Trapping provides an important source of cash for residents of the villages of Hughes, Huslia, Koyukuk, Nulato, Kaltag and Galena. 333 beaver, 10 lynx, 2 wolves, 5 otter and 1 wolverine were reported taken last year on the Kaiyuh Unit and 754 beaver, 30 lynx, 33 otter, 15 wolves and 26 wolverine were reported taken on the Koyukuk Unit. The total number of marten trapped on the refuge is not known, but marten are the most important fur animal in terms of numbers harvested. Most of the fur is sold, however, some is used for the making of hats, mittens, boots, parkas and ruffs on parkas. Beaver are also important as food items.

Traplines are not registered but are generally passed down from generation to generation within a family. Thus, claim for a certain area for trapping is recognized and respected by other local residents and disputes are not common, however, they can be very heated when they do occur.

Beaver trapping is treated slightly different from other trapping in that beaver areas are often shared by several people perhaps because of their importance as a food item.

Snowmobiles are the primary means of transportation for trapping with a few individuals traveling up to 200 miles round trip on the trapline. Dog teams are used by a few trappers and some simply walk their traplines. Marten are taken using pole sets and cubby sets. Beaver are taken with snares through the ice and more wolves are shot than actually trapped.



Aerial view of Huslia, the runway is in the foreground. DRL

Until recently wolves could be taken on a state trapping license with the use of an airplane. This method was commonly referred to as "land and shoot wolf hunting." Effective July 1, 1988 a limit on the number of wolves taken was established and the hunter must now purchase a hunting license instead of a trapping license. The method remains the same however, and the hunter must land the airplane and get out of the plane prior to shooting. This is still referred to as "land and shoot wolf hunting" as opposed to aerial hunting. The July State ruling also made it illegal to take wolverine, fox, and lynx by land and shoot hunting. Each year in late winter, several land and shoot wolf hunters come to Galena from Anchorage and Fairbanks, much to the consternation of some locals. The problem arises in that they do not know where active subsistence traplines are located and conflicts occur. There is also the temptation to shoot while airborne or herd animals into large lakes or openings suitable for landing. The number of wolves harvested in 1988 by this method is not known.

12. Other Subsistence Activities

Berry-picking and woodcutting are important subsistence activities in addition to hunting, trapping, and fishing. Cranberries, both low and high bush, and blueberries provide the bulk of the berries used. The cutting of dead trees for firewood is permitted. Special Use Permits are required for cutting of house logs. No permits were issued for house logs in 1988.

17. Law Enforcement

Several violations were recorded on the refuge in 1988. Special Agent Ed Wickersham from Portland worked with the local Wildlife Protection Officers in the Galena area for a couple of weeks. They spent a week on the Koyukuk NWR and made one wanton waste case and several tagging cases. Refuge Manager Nunn also flew on some patrols to assure compliance with the Koyukuk Controlled Use Area.

State Fish and Wildlife Protection Officer Harmon also made several flights over parts of the refuge during late January to see if anyone was jumping the gun on the February 1-5 moose hunt.

Assistant Manager Lons and Wildlife Biologist/Pilot Rost flew to Huslia and Hughes on March 16 to discuss Service policy on subsistence waterfowl hunting. While in Hughes, most of the gear in the Cessna 185 was stolen. Victor Williams, a Hughes man, entered a plea of guilty in U.S. District Court, Fairbanks on November 10 and was sentenced to six months in jail, 18 months probation, and was ordered to pay full restitution for the missing items. Four of the six months jail time was suspended.

1. New Construction



A floatplane dock was built on Alexander Lake to service both Koyukuk and Nowitna refuges. MRB

Major Maintenance

The furnace system in quarters #6 rendered itself inoperable on March 8. Portwine Plumbing and Heating repaired leaks and replaced some of the pressure relief valves. Heating systems on guarters #2 and #4 were also modified later in August for \$7,500 a shot. In spite of these costly modifications all refuge houses experienced heater problems during the winter of 88-89 when temperatures dropped below -50 F. We'll save that story for next years narrative.

Quarters #1 received some remodeling this year which included, new carpeting, drywall replacement, and new bathroom fixtures. The drywall and carpet replacement were added to the list at the last minute due to a water leak which ocurred prior to the contractors arrival. The water flooded the house ruining the carpet and wallboard. After the repairs were made and the contractors had left town we discovered the house was again flooded. The contractors had failed to tighten a connection on the bathroom sink. Fortunately the carpet and walls were not ruined again. Contractors removed the carpet and dried everything out.

4. Equipment Utilization and Replacement

The refuge supercub arrived back in Galena on March 5 from the OAS shop in Anchorage. The newly recovered plane really looks sharp. Cub-crafter seats, extended range fuel tanks, and a windshield defroster were installed and add a great deal to comfort and performance. Later in the year a new radio and encoding transponder were also installed as Supercub 4343 received a 100 hour inspection. The Arctic Tern (68AT) was used twice during the year when the cub was in the shop. Repairs to the tern included, tachometer and primer replacement and a repaired fuel leak.

Major equipment purchased during 1988 included: a 1987 Dodge pickup, a lap-top Toshiba computer, remote and local weather stations, and a 8 HP Mercury outboard motor.

5. Communication Systems

As mentioned in the safety section, the station still does not have a fully operational radio system. Although equipment has been hooked up, the lack of proper microwave interface parts renders the radio system only partially operable. The current radio system setup is being reviewed by Regional Communications Specialist Tim Miller and he is researching what control measures are needed to make the system fully operational. We expect to have the radio System working in early spring.



The newly recovered Supercub was outfitted with extended range fuel tanks in 1988 and is now better suited for field operations. MRB

3. Credits

Assistant Refuge Manager Lons wrote the introduction and sections A and B. Wildlife Biologist Bertram wrote sections C, D, E, G, H, I, and J and typed and printed the entire report. Fire Management Officer Granger wrote section F. Refuge Manager Nunn wrote section K and edited the report. Photos taken by refuge staff.

K. FEEDBACK



Selfexplanatory

MRB

We have been complaining for years that something should be done to enhance our recruitment efforts for Alaska bush stations. Finally in 1988 that help came in the form of the "Policy for Administrative Return Rights from Alaska Duty Stations." This new policy has resulted in double or triple the number of applicants for recently announced positions. Thanks to the Regional Office for being responsive to our needs!

We are still in need of a national centralized fund to cover moving expenses, so that the merit promotion system can function properly.