

ANNUAL NARRATIVE REPORT  
Calendar Year 1987



KOYUKUK NATIONAL WILDLIFE REFUGE  
GALENA, ALASKA

US FISH & WILDLIFE SERVICE--ALASKA  
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KOYUKUK NATIONAL WILDLIFE REFUGE

Galena, Alaska



ANNUAL NARRATIVE REPORT

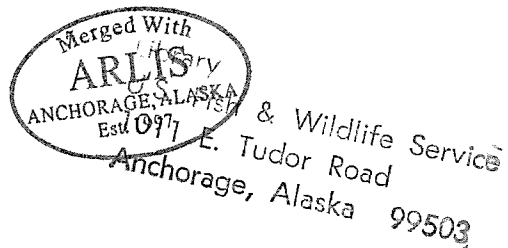
Calendar Year 1987

*Dan R. Paul*  
Acting Refuge Manager

3/4/88  
Date

*John Hunt* 3/31/88  
Refuge Supervisor Review Date

*Paul R. Schmidt* \_\_\_\_\_  
Regional Office Approval Date



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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:

1. 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;
2. To fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitat;
3. To provide the opportunity for continued subsistence uses by local residents; and
4. To ensure water quality and necessary water quantity within the refuge.

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 refuge is situated in a roughly circular floodplain basin of the Koyukuk River just north of its confluences 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 unique combination of wetlands and diverse terrestrial habitats supports a dense moose population (up to nine per square mile). This area also supports black bears, wolves, wolverine, lynx, marten, red fox, land otter and beaver; all of vital importance to local subsistence users.

DRL

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.

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.



Yukon River

DRW

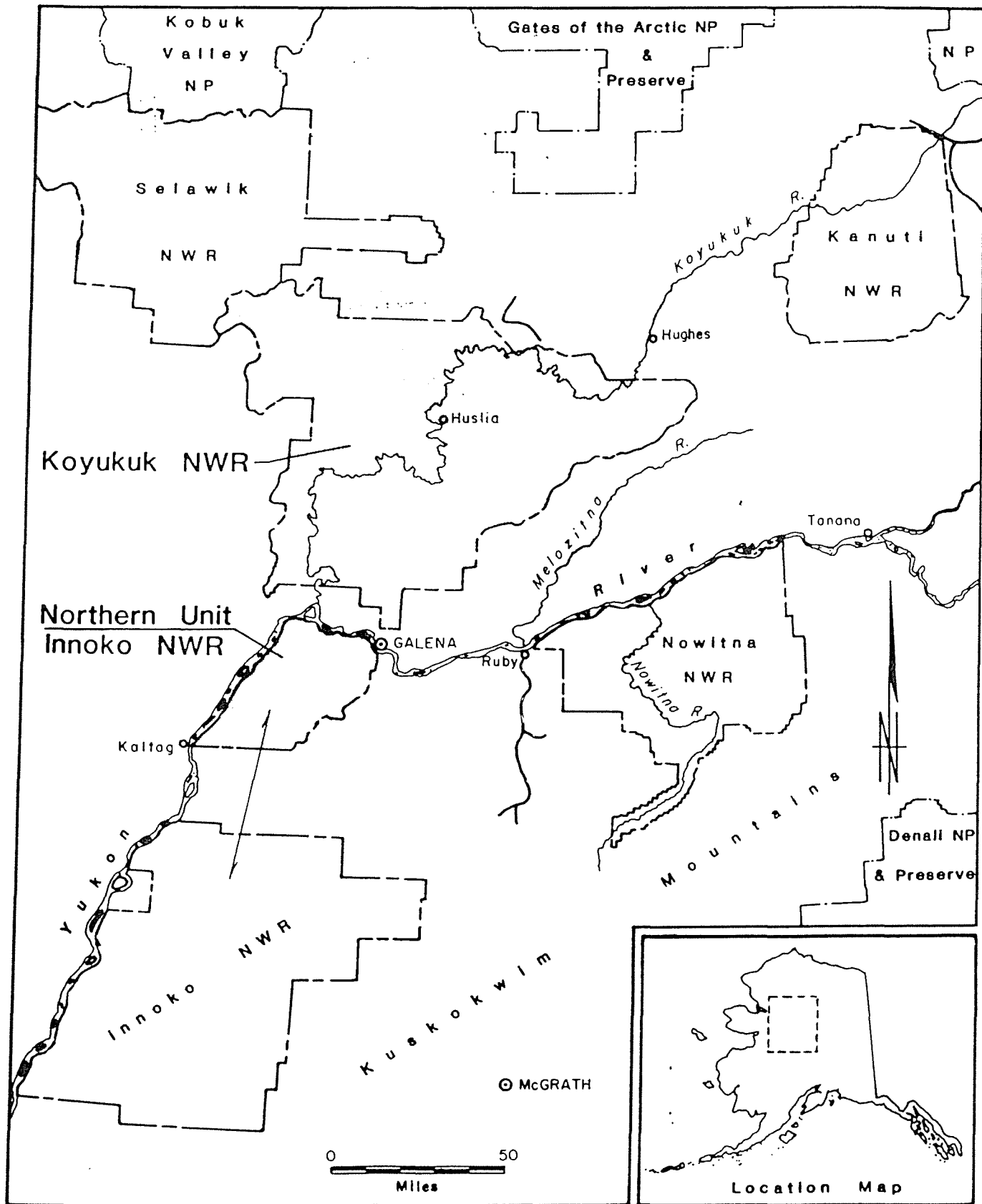
Galena's population of approximately 900 is bolstered by the approximately 325 military personnel stationed at the Galena Air Base where two F-15 Eagle intercept aircraft are kept on 24 hour alert.

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 be to learn as much as possible in order to maintain refuge habitats in their present pristine condition in the face of development of lands within adjacent to the refuge.

Figure 1. Location of Koyukuk Refuge and the northern unit of Innoko Refuge.



# NATIONAL WILDLIFE REFUGES IN ALASKA

- 1 Alaska Maritime
- 2 Alaska Peninsula
- 3 Arctic
- 4 Becharof
- 5 Innoko
- 6 Izembek
- 7 Kanuti
- 8 Kenai
- 9 Kodiak
- 10 Koyukuk
- 11 Nowitna
- 12 Selawik
- 13 Tetlin
- 14 Togiak
- 15 Yukon Delta
- 16 Yukon Flats

Koyukuk NWR and  
Northern Unit of Innoko NWR

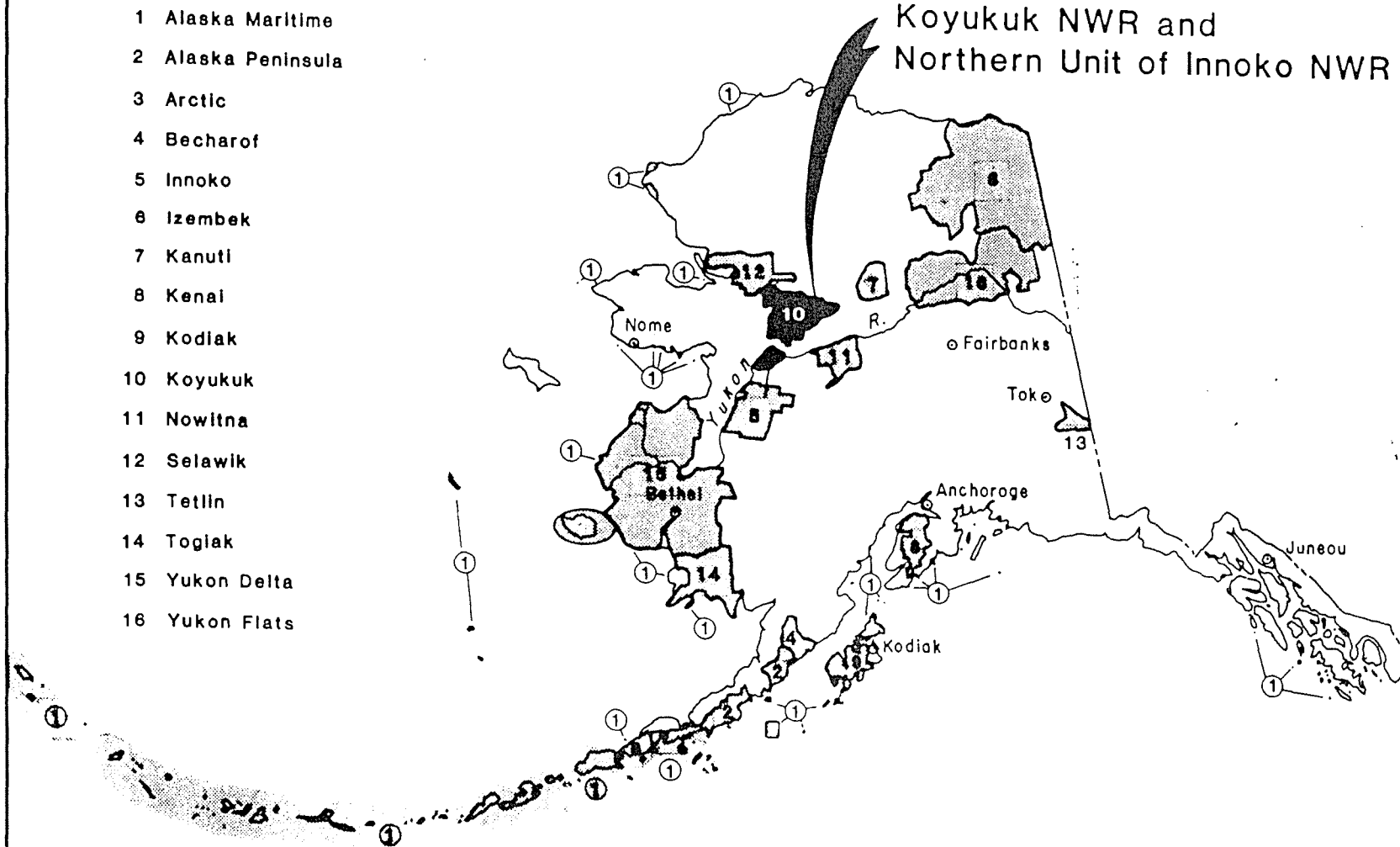


Figure 2. National wildlife refuges in Alaska.

#### A. HIGHLIGHTS

1. Wildlife Biologist/Pilot position converted to Permanent Full Time and new wildlife biologist position approved.
2. Final Comprehensive Conservation Plan printed and record of decision signed.
3. Fire study initiated.
4. Most intensive waterfowl production survey to date was conducted.
5. First refuge moose census conducted.
6. Refuge office relocated.
7. Water quality work continued.

#### 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.



Cold and clear days during the winter makes for good flying conditions. DRL

The year started out with January and February displaying normal interior Alaska winter climatic conditions. March was extraordinary with moderately warm daytime temperatures and mostly blue sky days.

April and May were typical springtime months. The Yukon River broke up in Galena on May 17 which is about a week earlier than normal. The river broke up at a very low water level and no flooding occurred. Clouds and rain predominated weather patterns from mid June to mid August. Clear weather resumed control for most days in late August and September. The first snowfall occurred on September 9, but quickly melted. October was much milder than usual. The Yukon River didn't freeze until November 7, about two weeks later than normal. Ice on many refuge lakes wasn't safe to land aircraft on until late November which is very unusual. November and December were both milder than usual.

TABLE 1. 1987 CLIMATIC CONDITIONS \*

Month	Precipitation			Temperature (F)	
	Mean	1987	Snow	Maximum	Minimum
January	.82	.88	12.3	30	-42
February	.81	.39	5.1	35	-28
March	.63	.26	3.6	41	-37
April	.52	.15	1.8	52	-13
May	.59	.73	trace	69	23
June	1.24	.83	-----	86	38
July	2.22	1.89	-----	83	43
August	2.76	2.86	-----	75	32
September	1.76	1.69	trace	56	21
October	.81	.85	5.3	47	-3
November	.90	1.43	18.4	26	-27
December	.76	.99	16.1	32	-44

Totals/

Extremes 13.80

\* Weather data recorded at Galena Airport.

C. LAND ACQUISITION3. Other

The Alaska National Interest Lands Conservation Act (ANILCA) increased National Wildlife Refuge System lands in Alaska by 300 percent. These refuges are not large solid blocks of lands; but, instead are a complex pattern of native, state, private and federal lands. Of the approximately 5,246,900 included in the exterior boundaries of the Koyukuk NWR and northern unit of Innoko, current "official" Fish and Wildlife Service acreage is about 4,086,500. Current land status is shown in Tables 2 and 3. The acreage estimates will change when the land is surveyed and various inholding claims are adjudicated.

The Act also provided native corporations with the right to enter into land bank agreements with the U.S. Fish and Wildlife Service. Koyukuk NWR and Gana-A' Yoo Limited Corporation were the first to enter into such an agreement in 1986. Approximately 496,800 acres were included in the agreement. The object of the program is "to enhance the quantity and quality of Alaska's renewable resources and facilitate the coordinated management and protection of Federal, State, and Native and other private lands." Under this agreement, Gana-A' Yoo Ltd. agrees to manage the subject lands in a manner compatible with the management plan for the adjacent refuge, to permit reasonable access by



federal agency personnel, not to alienate, transfer, assign, mortgage, or pledge the subject lands, and to develop or improve subject lands only in agreement with specific provisions of the agreement. The benefits to Gana-A' Yoo Ltd. include immunity from: adverse possession; real property taxes; and judgments to recover debts incurred by the owner. In accordance with the agreement, the Service will provide technical and other assistance to Gana-A' Yoo Ltd. with respect to management of those lands. Lands subject to land bank agreements do not become refuge lands. Ownership and management responsibility remain with Gana-A' Yoo Ltd.

In April we learned that Gana-A' Yoo had entered into an agreement with Joseph Manga, a miner from Fairbanks, for a right-of-way across Alaska Land Bank Agreement lands to his mining claims on Bishop Creek. We informed the Regional Office of this apparent breach of contract and the solicitor determined that it was definitely a violation of the Alaska Land Bank Agreement. Since Gana-A' Yoo had mistakenly made the agreement, the Service determined that the best solution would be to have Gana-A' Yoo withdraw the lands in the easement from the Alaska Land Bank Agreement. Gana-A' Yoo agreed and withdrew the easement land on June 9, 1987.

Figure 3. Land status, Koyukuk Refuge and the northern unit of Innoko Refuge, February, 1987.

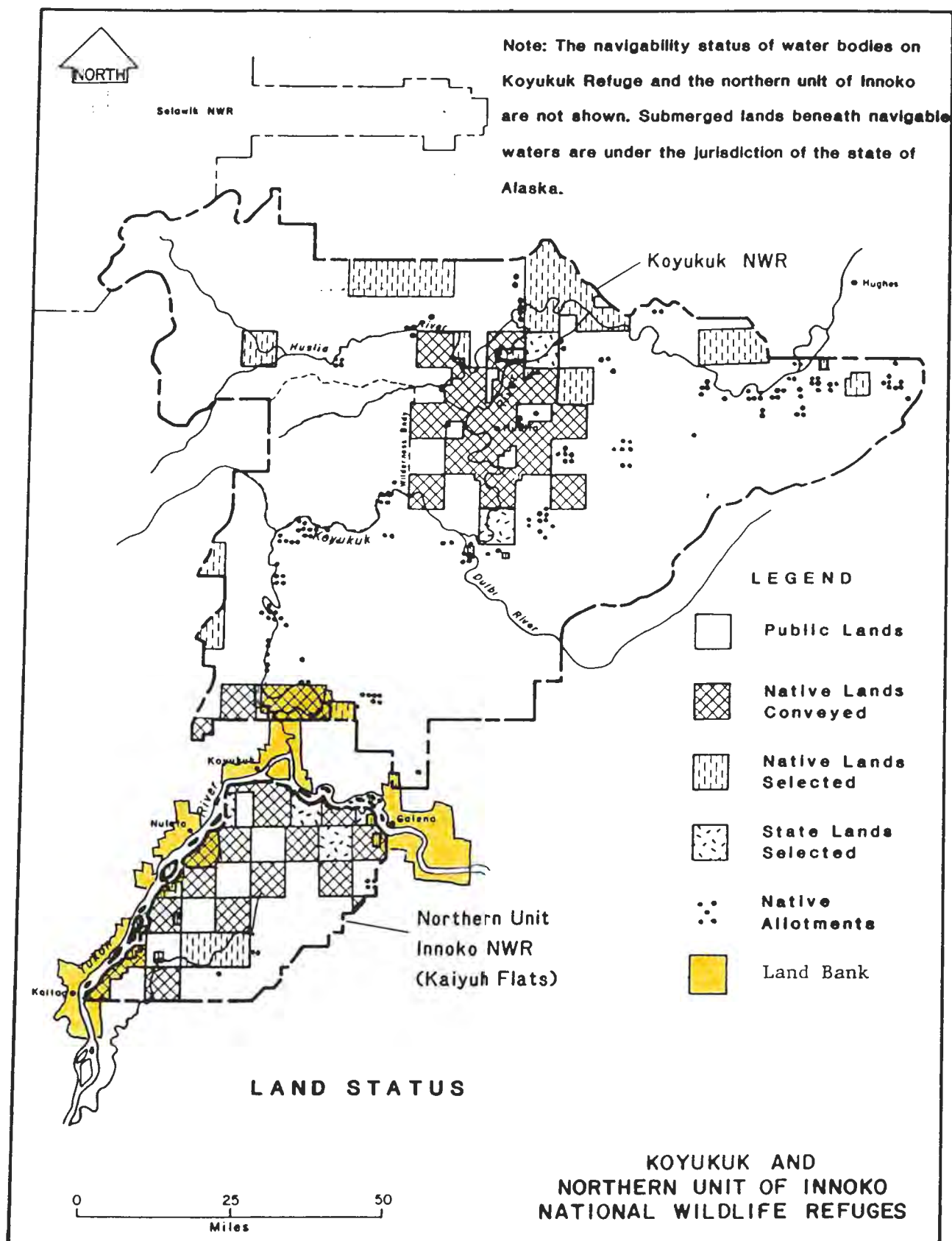


Table 2. Land Status, Koyukuk Refuge, February, 1987.

OWNERSHIP	Acres	% of Refuge
Federal	3,735,700	83
Designated Wilderness	(400,000)	(9)
Native Corporations		
Selections	258,600	6
Conveyances	373,900	8
Regional Native Corporation		
14(h)(1) Selections	66,300	1
14(h)(1) Conveyances	0	0
Native Allotments		
Applications (157)	16,000	-
Conveyances (0)	0	0
Private Parties		
Applications (0)	0	0
Conveyances (2)	(12)	-
State of Alaska		
Selections	44,600	1
State-Native		
Selections Conflicting	1,000	0
TOTAL	4,496,100	100

Acreages are approximate due to rounding, inaccuracies in information available, and changes in land status (e.g., relinquishments, invalidations, and conveyances of selected lands). Table does not include submerged lands beneath navigable and non-navigable waters. Lands under navigable waters are in state ownership. Navigability status of many water bodies on the refuge has not been determined.

Wilderness acreage is included in Federal acreage figure.

Includes both regional and village corporations.

The Native corporations have overselected on the refuge. Consequently, some of these selections may be invalidated.

Includes interim conveyances and patented lands.

Section 14(h)(1) selections are cemetery sites and historic sites that have been identified by the regional corporation, Doyon Limited.

Private inholdings include homestead, trade and manufacturing, mission, Native town, and headquarters sites.

Table 3. Land Status, Northern Unit of Innoko Refuge, September, 1986.

OWNERSHIP	Acres	% of Refuge
Federal	350,800	47
Native Corporations		
Selections	16,700	2
Conveyances	291,200	39
Regional Native Corporations		
14(h)(1) Selections	46,300	6
14(h)(1) Conveyances	0	0
Native Allotments		
Applications (50)	5,600	1
Conveyances (0)	300	-
Private Parties		
Applications (0)	0	0
Conveyances (2)	(4)	-
State of Alaska		
Selections	39,200	5
State-Native		
Selections Conflicting	700	-
TOTAL	750,800	100

Acreages are approximate due to rounding, inaccuracies in information available, and changes in land status (e.g., relinquishments, invalidations, and conveyances of selected lands).

Includes both regional and village corporations.

The Native corporations have overselected on the refuge. Consequently, some of these selections may be invalidated.

Includes interim conveyances and patented lands.

Section 14(h)(1) selections are cemetery sites and historic sites that have been identified by the regional corporation, Doyon Limited.

Private inholdings include homestead sites, trade and manufacturing sites, mission sites, Native townsites, and headquarters sites.

## D. Planning

### 1. Master Planning

Koyukuk's final Comprehensive Conservation Plan was printed in 1986. Section 304 (g) of Alaska National Interest Lands Conservation Act requires the preparation of these plans for each unit of the National Wildlife Refuge System established or enlarged by the Act. These plans will serve as Alaskan refuges' Master Plans. They designate areas within the refuge according to their respective resources and values, specify the programs for conserving fish and wildlife resource values and specify the uses within each area which may be compatible with the major purposes of the refuge. The plan also sets forth those opportunities which will be provided within the refuge for fish and wildlife oriented recreation, ecological research, environmental education and interpretation of refuge resources and values, and economic use.

The last public meetings before the final Comprehensive Conservation Plan was printed occurred in January. Planning Team Leader Norm Olson, Hearing Officer Bill Knauer and ARM Lons conducted these public meetings in Kaltag, Nulato, and Koyukuk on January 12, 14, and 15 respectively. Residents of all three villages preferred alternative A, the Service preferred minimal management alternative.

We received the in-house review draft of the plan in July and sent in our comments to the planning team. The plan was sent to the printer in September and we received copies in October. The record of decision was signed by the Regional Director on December 2.

The plan designates areas within the refuge according to their resources and values, outlines programs for conserving fish and wildlife resource values, and specifies uses within each area that may be compatible with major purposes of the refuge. In addition, the plan discusses opportunities that will be made available for fish and wildlife oriented recreation, ecological research, environmental education and interpretation and economic use of refuge lands.

After careful consideration of the refuge purposes, resources, issues, and opportunities unique to Koyukuk Refuge and the northern unit of Innoko Refuge, two alternatives were formulated to guide the refuge's management.

Alternative A., the current situation or "no action" alternative, maintains the existing range and intensity of management, recreational and economic uses on Koyukuk Refuge and the northern unit of Innoko Refuge. This is the Service's selected alternative in the final plan. It is assumed that existing laws, executive orders, regulations, and policies governing Service administration and operation of the National Wildlife Refuge System will remain in effect.

Under this alternative, all refuge lands are placed in minimal management category as depicted in Figure 4 and Table 4. This category protects the natural diversity of fish and wildlife populations and habitats on the refuge. Disturbance of fish and wildlife habitats and populations is minimized. A variety of fish and wildlife management activities is allowed. Subsistence and recreational uses of the refuge will continue to be allowed using existing access methods.

Some economic uses of the refuge will be permitted under this alternative. Guiding, outfitting, and transporting is permitted, subject to reasonable regulation. Land based facilities in support of commercial fishing will also be allowed, subject to reasonable regulation. Certain oil and gas studies will be permitted, including surface geological studies, subsurface core sampling, and seismic geophysical studies, although no oil and gas leasing will be permitted on refuge lands.

The pristine conditions and fish and wildlife values found on the refuge will be maintained, but no additional refuge lands will be protected by potential designation as wilderness. Under this alternative, changes in management category could be accomplished through administrative action, thus flexibility in future management of refuge lands would be maintained. Proposed changes in management categories will be made after appropriate public involvement.



Figure 4. Alternative A

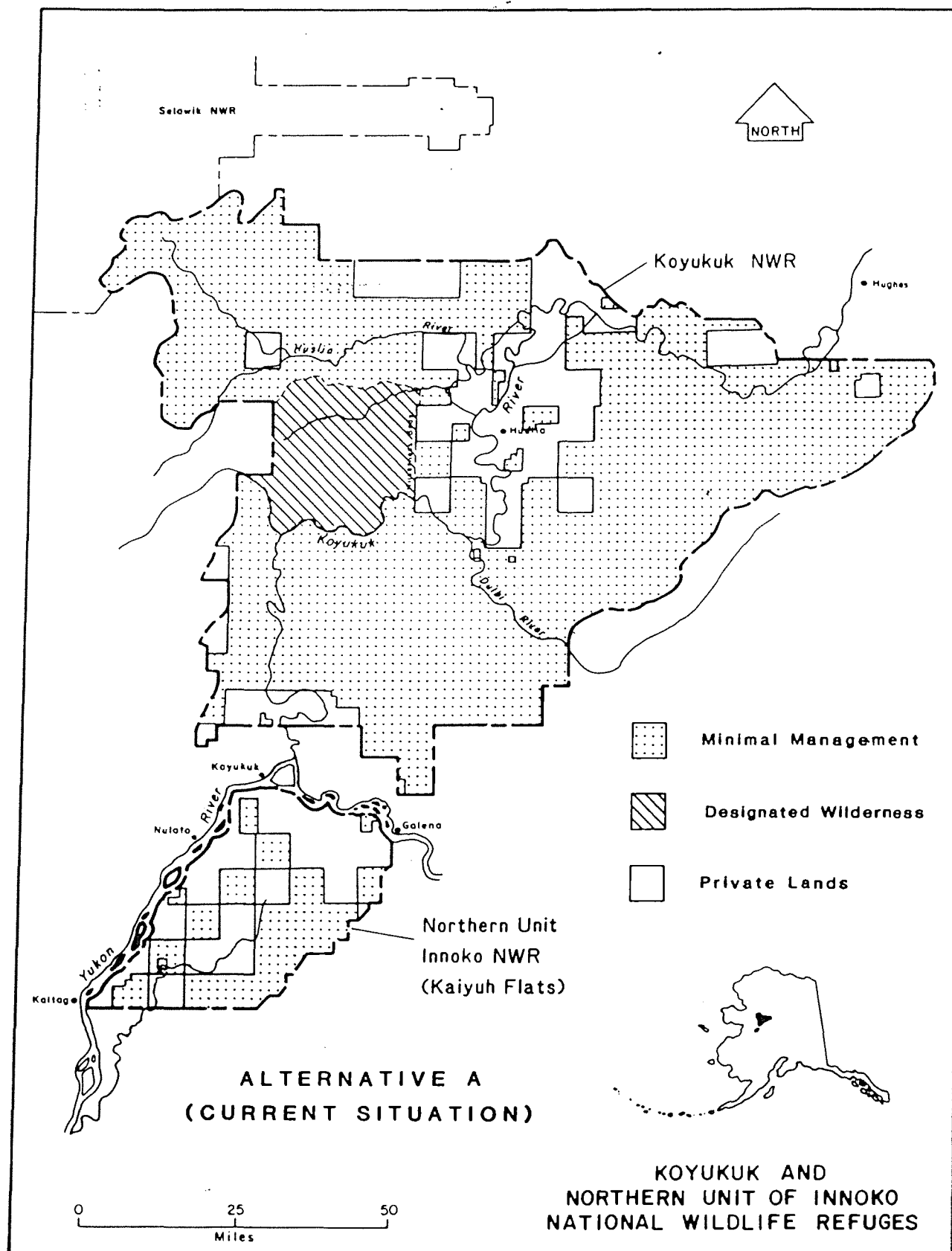


Table 4. Acreage distribution by management category -  
Alternative A.

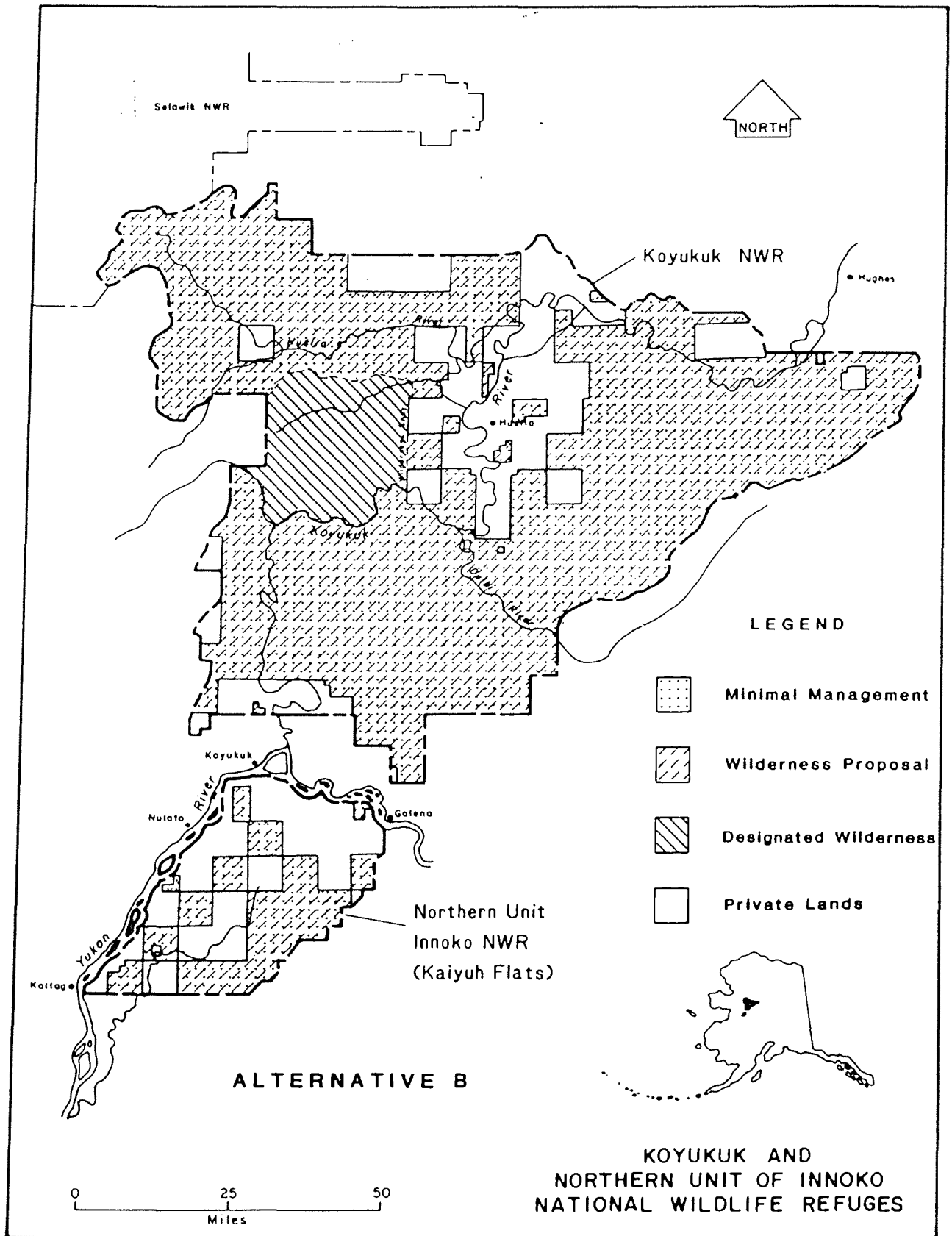
Mgt. Cat.	KOYUKUK NWR		NORTHERN UNIT INNOKO NWR	
	Acreage	% of Refuge	Acreage	% of Refuge
Inten. Mgt.	0	0	0	0
Moderate Mgt.	0	0	0	0
Minimal Mgt.	3,430,000	89%	350,800	100%
Designated Wild.	400,000	11%	0	0
Recommended for Wild. Designation	0	0	0	0

Alternative B would also have maintained the existing range and intensity of management and recreational uses on Koyukuk Refuge and the northern unit of Innoko Refuge. As in Alternative A, it is assumed that existing laws, executive orders, regulations, and policies governing Service administration and operation of the National Wildlife Refuge System would remain in effect.

Under this alternative, all refuge lands (with the exception of the Koyukuk Wilderness) would have been placed in the minimal management category as depicted in Figure 5 and Table 5. The minimal management category provides the basis for the Service's recommendation for future designation as wilderness. However, under Alternative B, all refuge lands outside of the existing Koyukuk Wilderness Area would have been recommended for wilderness designation and possibly could have received the added protection of management under the Wilderness Act. Management under the wilderness category would have begun when a formal proposal was before Congress and would have continued if Congress had voted to include the area in the wilderness system. If Congressional designation was not afforded, management would have reverted to the Minimal category.

This alternative would have provided for maximum protection of the natural diversity of fish and wildlife populations and habitats that occur on the refuge. Disturbance of fish and wildlife habitats and populations would have been minimized. The pristine conditions and fish and wildlife values found on the refuge would have been maintained. Most public and economic uses of the refuge allowed in minimal management would have continued to be allowed using existing methods of access. Opportunities for hunting, fishing, trapping, and other recreational activities, for subsistence harvest, and for scientific research would have been maintained. No oil and gas leasing or exploration activities would have been permitted on refuge lands.

Figure 5. Alternative B.



Surface geological and geophysical studies which do not disturb the surface may have been allowed where site-specific stipulations ensured compatibility with refuge purposes and consistency with management objectives.

Table 5. Acreage distribution by management category - Alternative B.

Mgt. Cat.	KOYUKUK NWR		NORTHERN UNIT INNOKO NWR	
	Acreage	% of Refuge	Acreage	% of Refuge
Inten. Mgt.	0	0	0	0
Moderate Mgt.	0	0	0	0
Minimal Mgt.	3,340,000	89%	350,800	100%
Designated Wild.	400,000	11%	0	0
Recommended for Wild. Designation	3,340,000	89%	350,800	100%

#### 5. Research and Investigation

A moose study, in cooperation with The Alaska Department of Fish and Game, started in October 1984, was continued in 1987. (Section G-8)

A wolf study started in 1986, again in cooperation with Alaska Department of Fish and Game, was continued this year. (Section G-8)

A fire study was initiated in 1987. (Section F-9)

## E. Administration

### 1. Personnel



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

E. Administration

1. Personnel



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





Daryle R. Lons (on left), Assistant Refuge Manager, Permanent Full Time, GS-11/04, EOD 8/14/84.



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



Dianna R. White, Refuge Secretary, Permanent Full Time, GS-5/02, EOD 2/7/86.





Michael D. Motschenbacher, Wildlife Biologist/Fire Management Officer, Permanent Full Time, GS-9/04, Resigned 8/10/87.

We were blessed with two beneficial personnel actions during 1987. First, the Wildlife Biologist/Pilot position was changed from a term not to exceed 4 years appointment to Permanent Full Time in May. In December, we also got approval for a GS - 5/7/9 Wildlife Biologist position. Paperwork for establishment and recruitment of the position was submitted to the Regional Office on 14 December.

Wildlife Biologist/Fire Management Officer Michael Motschenbacher resigned effective August 10, 1987, to attend the School of Veterinary Medicine at Washington State. The position remained vacant throughout the year. Paperwork to recruit for the position was submitted in late December.

Table 6. Five Year Summary of Manpower

	Permanent Full Time	Permanent Part Time	Shared Permanent Full Time	Temporary	FTE
FY 83	2	1	0	0	3
FY 84	3	0	2	1-Local Hire	3
FY 85	3	0	2	1-Local Hire	5
FY 86	5	0	0	1-NTE 4 yrs.	6
FY 87	6	0	0	0	6

## 2. Youth Programs

Abe GreyBear Jr. was selected to be our only Youth Conservation Corps enrollee this year. In addition to assisting our secretary with office work, Abe also painted a refuge residence and cleaned up around the headquarters. He also accompanied Refuge Manager Nunn and Wildlife Biologist/Pilot Rost on a two day float trip on Dulbi Slough while they conducted a goose production survey.

## 4. Volunteer Programs

The refuge had one volunteer in 1987. Jason Nunn assisted us in our duck brood survey during late July and early August.

## 5. Funding

Station funding for the last five fiscal years is shown in Table 7.

Table 7. Koyukuk National Wildlife Refuge Funding

Programs	FY83	FY84	FY85	FY86	FY87
1210	\$80,000	-0-	-0-	-0-	1500
1220	\$60,000	-0-	-0-	-0-	-0-
1260	-0-	\$290,000	\$315,000	\$360,000	\$464,500
1994	\$12,000	-0-	-0-	-0-	-0-
Totals	\$152,000	\$290,000	\$315,000	\$360,000	\$466,000

At the end of CY-87 and the first quarter of FY-88, we were still without at FY-88 station budget.

## 6. Safety

We were fortunate to have another accident free year. Informal safety meetings were conducted throughout the year. A CPR course was 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.

A boating accident on the Yukon River between Koyukuk Village and Galena on 1 June claimed the lives of seven Galena residents. Refuge aircraft and personnel assisted in the search effort on 1 and 2 of June. Five bodies were located, all wearing personal floatation devices. This tragedy reminded us all of the seriousness of boating accidents in the cold waters of this area. Several Mustang suits were purchased with end of year money to help keep us safe and warm while working in river boats.

Other safety gear received during the year included: winter and summer nomex flight suits, two custom flight helmets, and Leatherman survival tools.

The biggest glitch 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 two years, have added some safety to our field season. However, their range is extremely limited. New VHF FM radio equipment was purchased this year. At the end of the year, the regional Contracting and General Services office was working on a contract to install the system on several Alaska refuges. The system includes two mountain top repeater stations. Hopefully, by next field season, we will have a system that will provide communications from anywhere on the refuge.

## 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.

## 8. Other Items

Refuge staff members received the following training and attended the following workshops during 1987.

### Refuge Manager Nunn:

LE Refresher Course, January 26-30.  
 Citizen Participation Workshop, February 2-6.  
 Cross Cultural Training, March 5-6.  
 Service Semi-Annual Firearms Qualification, August 28.  
 Fire Management Program Review, October 13-16 and December 2.  
 Middle Yukon Advisory Committee Meeting, October 24.

### Assistant Refuge Manager Lons:

LE Refresher Course, January 26-30.  
 Interagency Western Arctic Caribou Herd Meeting, March 17.  
 Water Quality Workshop, May 11-12.  
 Service Semi-Annual Firearms Qualification, August 28.

### Wildlife Biologist/Pilot Rost:

Arctic Survival Training, February 2-6.  
 Cross Cultural Training, March 5-6.  
 Annual OAS Ground School, December 2-5.  
 Middle Yukon Advisory Committee Meeting, October 24.

### Wildlife Biologist/Fire Management Officer Motschenbacher:

Cross Cultural Training, March 5-6.

### Secretary White:

Computer Training, February 18-20.  
 Small Purchase Workshop, October 26-30.

"Official" visitors to the refuge during 1987 which are not mentioned elsewhere in this report were:

- Winston Jacobson, Chief of Contracting and General Services, February 10-12, to conduct an administrative review and review bids on leasing new office space.
- John Kurtz, Sue Matthews, and Mimi Hogan, March 23, to conduct public meeting on establishing regulations governing harvest of migratory birds in Alaska
- Engineers Bruce Sherwood, Mitch Johnson, and George Ziots, September 20-22, to look at remaining problems associated with the new residences.



- Royce Purinton, Chairman of the Middle Yukon Advisory Committee, December 12, to discuss refuge issues.

The following Special Use Permits were issued during 1987:

<u>Permit #</u>	<u>Permittee</u>	<u>Activity</u>
-KUK-87-1-5008	Thomas Hamilton, U.S. Geological Service	Surficial Geologic Mapping
-KUK-87-2-5009	Arco Alaska, Inc.	Geological Reconn- aissance
-KUK-87-3-5010	Royce Purinton	Subsistence Cabin Construction
-KUK-87-4-5011	Roger Huntington	Subsistence Cabin Construction

Koyukuk Refuge received a Master Station Bird Banding Permit from the Bird Banding Lab in April.

## F. HABITAT MANAGEMENT

### 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 interspersed 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.



The Continental Divide runs through the Purcell Mountains and forms part of the northern refuge boundary. 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 conjunction with the refuge comprehensive planning process. It was felt that high altitude satellite photo-imagery providing computerized digital data was the most efficient and least costly means of mapping vegetation on the refuge while meeting deadlines imposed by Alaska National Interest Lands Conservation Act.

However, the LANDSAT vegetation mapping for the refuge is generalized. More refined habitat mapping recognizing smaller habitat units may be done later as needed, using traditional aerial photo interpretation. Until then the refuge has been mapped on a 1:250,000 scale using the LANDSAT multispectral high altitude imagery.

Fourteen land and three water cover types were used to describe the vegetation on the refuge. Acreage by cover types for all lands in the refuge, both federal and private, is shown in Table 8.

Table 8. Acreage summary of land classes on Koyukuk Refuge  
(from U.S.G.S. satellite imagery - LANDSAT).

Land Cover Class	Federal (acres)	Private (acres)	Percentage Total Refuge
Open needleleaf forest	212,380	141,170	6.7
Needle woodland	1,105,050	246,510	25.7
Mix needleleaf deciduous forest	203,500	106,820	5.9
Deciduous forest	110,860	26,830	2.6
Alluvial & lowland tall scrub	111,790	31,210	2.7
Alpine & subalpine tall scrub	131,530	22,300	2.9
Dwarf scrub:graminoid, tussock, peatland	1,119,030	300,140	27.0
Prostrate shrub & lichen tundra	39,860	13,710	1.0
Wet herbaceous:graminoid bog, marsh	78,200	24,380	1.9
Moist herbaceous:gram. tussock, shrub	589,640	128,070	13.7
Dry herbaceous:gram. meadow, lichen, moss	40,530	11,010	1.0
Fire regeneration: graminoid dominated	131,030	24,200	3.0
Aquatic vegetation	28,290	10,260	0.7
Scarce vegetated: floodplain, sand, scree	24,550	7,760	0.6
Clear water	135,510	53,240	3.6
Sedimented or shallow water	7,790	11,010	0.4
Heavily sedimented water	3,620	7,280	0.2
Total	4,073,170	1,175,910	99.6

## 2. 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.



Koyukuk River.

DRL

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 quality of these rivers and to establish baseline data for all major refuge rivers. The investigation was continued in 1987 with





Gold placer mine just off the refuge on a tributary of the Hogatza River.  
DRL



special emphasis on Bishop Creek, Camp Creek and the Hogatza River. Elaine Snyder-Conn, Environmental Contaminant Biologist from the Fairbanks Fish and Wildlife Enhancement Office assisted the refuge staff in collecting, conducting water quality tests and processing the samples to be sent to a contracted lab for analysis. Water, sediment and fish samples were collected. All the 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. We haven't received the data back from the lab yet.

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 the lakes resulting in variable water depth and shorelines from year to year. Depths seldom exceed 15 feet and are usually much shallower.



Kaiyuh Flats Wetlands.

MLN





Typical bog (above) and non-bog (below) wetland habitats. MLN, DRL





Water temperatures in shallow lakes reach 70 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.

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

### 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. The old regulations requiring a permit to cut trees greater than three inches in diameter has caused much consternation among locals in the past. This regulation for northern Alaska refuges was changed in 1986 so that a permit would not be needed unless more than 20 trees of size 3"-6" were cut in one area. However, this change has not really clarified or solved the problem.

## 9. Fire Management

The "fire season" never really got going this year. Only six fires occurred on the refuge. They burned an estimated total of 2057.2 acres. The size of the fires ranged from .2 to 1050 acres (see Table 9).



The Kateel River fire burned 1050 acres during July 8-21.  
MLN

Fire has been a natural force on the habitat of this area for thousands of years. It is a key environmental factor in this cold dominated system. The fire cycle ranges from 108 years in the lowlands to 197 years in the surrounding hills. Fire removes organic matter, resulting in the warming of the soil, lowering of the permafrost layer and an increase in organic matter decomposition rates.

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. Under this plan, refuge land is put into one of four management options; critical protection, full protection, modified action and limited action.

Figure 6. shows the fire protection status of land within the refuge boundary. Unplanned land is treated as "modified action" areas that are continually in a critical burning period, which in effect places them in "full protection."

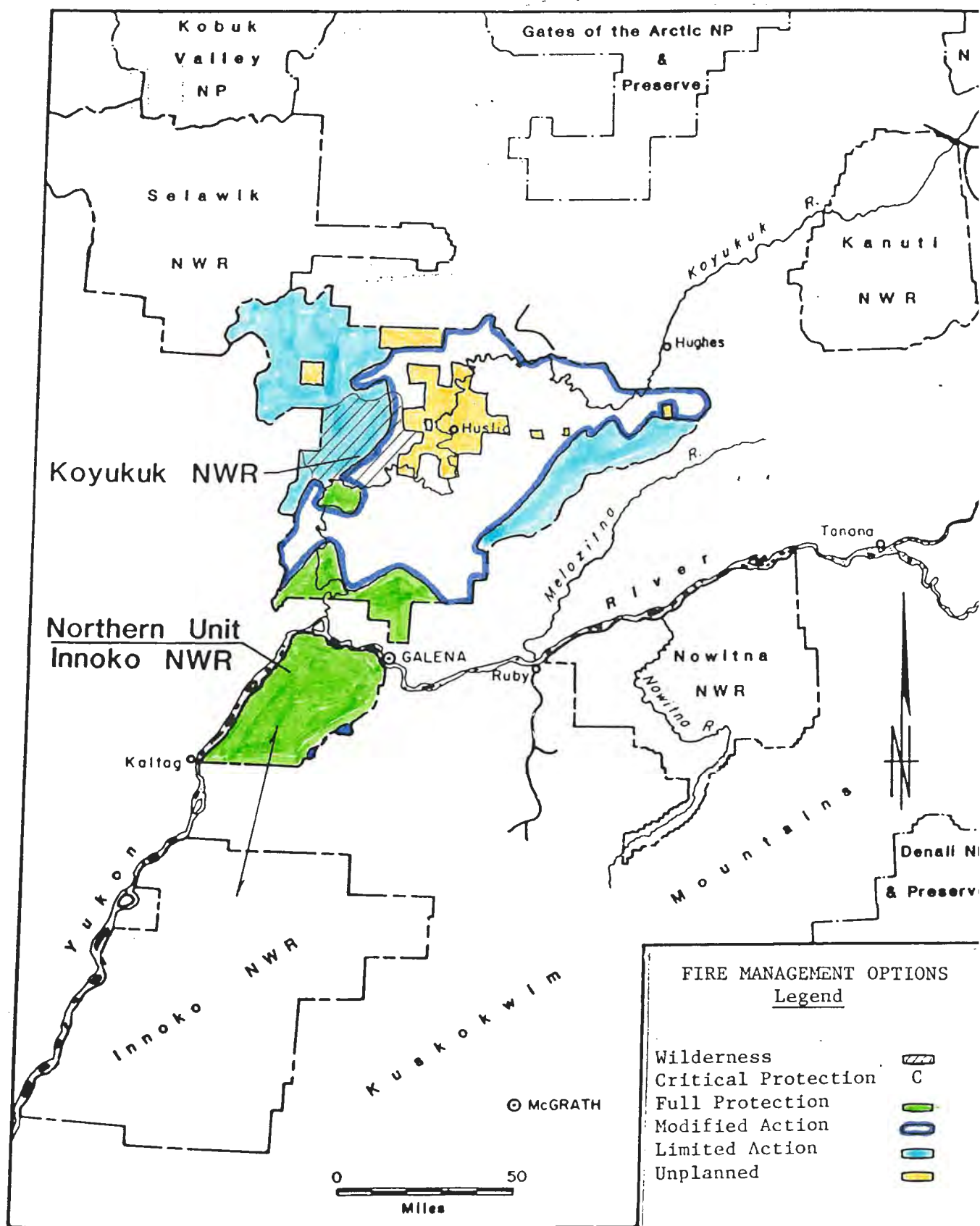
The critical protection option is for those areas where fire presents a real and immediate threat to human and physical developments. These areas or sites are occupied areas such as villages and fish camps. The highest priority in the allocation of suppression forces is given to sites in this option.

The full protection 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 historic 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.

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 the 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 modest commitment 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 balance the acres burned with suppression costs. During the non-critical burning period, "modified action" areas do not receive initial attack or suppression; the intent being to reduce suppression cost and achieve resource management objectives through limited fire activity.

The limited action option recognizes those areas where a natural fire program is desirable, or the values at risk do not warrant 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.

Figure 6. Fire Management Options on the Koyukuk NWR and the Northern Unit of the Innoko NWR.



The interagency fire plan is reviewed for revision yearly by a committee of land managers/owners. Managers may change the management option on any part of agency land at any time between September 30 and April 1, but not during the fire season.

Table 9. Fires on the Koyukuk NWR and northern unit of the Innoko NWR during the 1987 fire season.

Fire #	Date Discovered	Date Out/Dec.	# Acres Burn./	Fire Mgt Opt.
B068	6/16	6/17	2.0	Full Protection
B107	6/24	6/26	.2	Full Protection
B158	7/08	7/17	1.0	Limited Action
B156	7/08	7/21	1050	Limited Action
B103	7/09	7/11	4.5	Modified Action
B216	7/15	7/18	.5	Modified Action
Total				2057.2

A long term fire ecology study titled The Effect of Fire on Wildlife Populations was initiated on Koyukuk NWR in 1987. The objectives of the study are to:

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

The study was initiated on April 13-16. The study area consists of three sites. Two of the sites are located in an area burned in 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 and furbearer track counts and bird counts were conducted along these transects in April. We returned during June 23-26 to establish and run small mammal trap lines, set up vegetative transects and do more bird counts.





Refuge Manager Nunn conducting vegetative transect during fire study.  
GRR



Assistant Refuge Manager Lons setting small mammal snap traps in  
unburned control area of fire study. MLN

## 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 Sect. 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 northeast.



Nogahabara Sand Dunes.

GRR

In addition to the dunes, the wilderness area encompasses some of the best habitat on the refuge, with moose densities of up to 9 per square mile recorded in the fall.



## G. Wildlife

### 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 conducted a raptor survey on the Koyukuk River during July 5-7. The survey was conducted in the refuge's 16' Alumaweld boat. The survey covered approximately 340 miles of the Koyukuk River from the mouth to Florence Island. A total of nine peregrines were observed and four nests were located and examined. Of the four nests examined, two were empty and two contained young (4 and 1). See figure 7.

### 3. Waterfowl

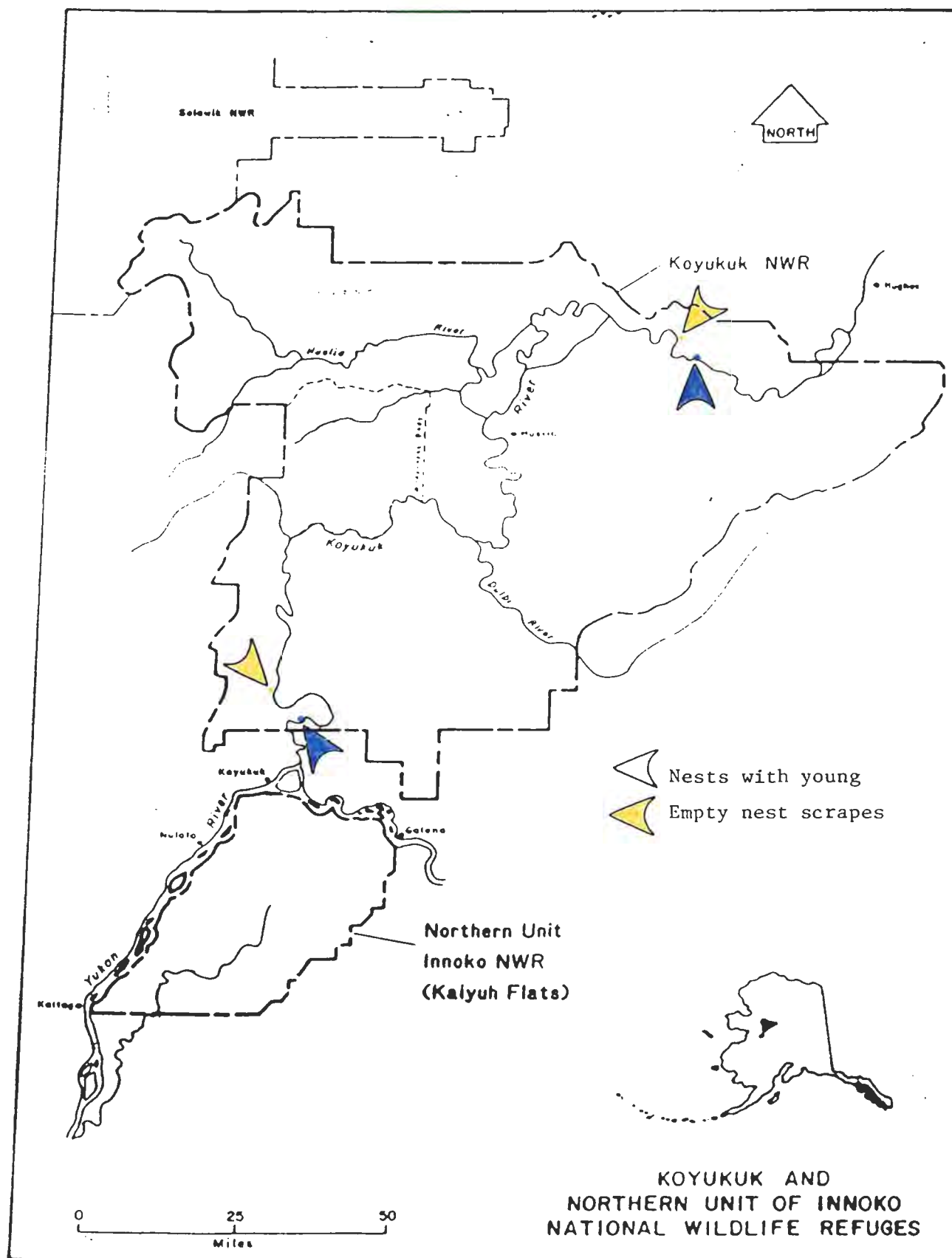
For the second consecutive year, a duck pair count was conducted on five trend areas. The trend areas of approximately one square mile in size were arbitrarily chosen because in the past they have supported high waterfowl production. The five trend areas were surveyed by a pilot and an observer in a Piper Super Cub, flying 80 to 100 mph at an above ground elevation between 150 and 200 ft. The species, number of individuals, and number of pairs of ducks observed were recorded.

A total of 160 ducks representing eight species were observed during the flight (Table 10). This represents a 43% increase over the number seen in the 1986 survey. The 57 pairs seen during the 1987 survey is an increase of 185% compared to the 1986 survey. In 1987, due to time constraints, the five trend areas were not surveyed during the brood count as had been done in the past.

Species seen during the 1987 survey were similar to those seen in the 1986 survey. One notable exception in the 1987 survey was the absence of canvasback ducks. Though not seen on the trend areas, breeding canvasbacks were seen during the brood count. Most of the increase in breeding pairs was due to dabblers seen during the survey. Mallard, pintail,



Figure 7. Peregrine falcon nest sites in 1987



wigeon, and shoveler combined showed nearly a three-fold increase in 1987. As in 1986, no green-winged teal were seen during the pair count, but they comprised 14% of the total production on the refuge.

Table 10. Number of ducks observed on five trend areas, 1987.

Species	Total Birds	# Pairs Observed '87	# Pairs Observed '86
Mallard	21	4	4
Pintail	47	20	5
Wigeon	38	14	7
Shoveler	22	7	0
Scaup spp	27	10	1
Canvasback	0	0	3
Common Scoter	1	--	--
Surf Scoter	2	1	0
White-Winged Scoter	2	1	0
TOTAL	160	57	20

For the third consecutive year, a duck brood survey was conducted to estimate duck production on the refuge. This year's survey was conducted between 9 July and 6 August. Thirty-one one square mile plots on the Koyukuk Unit and fifteen one-square-mile plots on the Kaiyuh Flats Unit were surveyed. Duck production estimates were 128,981 on the Koyukuk Unit and 32,103 on the Kaiyuh Flats Unit (Table 11).



Pintail brood.

MLN

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 Unit. 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.

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 1987 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 1987 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 1987 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 Coughly, 1977. Seven plots were surveyed in each the poor and 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 seven 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 31 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.

Twenty-eight of the plots were surveyed twice - once early (July 9-23, 1987) to coincide with peak dabbler production, and once late (July 28 - August 6, 1987) to coincide with peak diver production. Two of the poor plots (P3, P7) were surveyed only during the second count with the helicopter. Four key plots (K11, K15, and K17), one moderate (M1), and two poor plots (P1 and P6) were surveyed the second time with the helicopter due to time constraints. Motschenbacher (1986), in comparing ground and helicopter counts on five 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 1987, selected from 997 square miles of waterfowl. Five of the plots (KF1-5) were surveyed twice, once early (July 11-24, 1987) and once late (August 4-5, 1987). The helicopter was used for the second count on these five, and the only count on ten additional plots (KF6, KF8-16). KF7 was a duplicate plot and had already been surveyed. The numbering of plots was retained.

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.

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 Unit, 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 equal to the average brood size (rounded to the nearest whole bird) for the stratum.

During the 1987 duck brood survey, 2,614 young (555 broods) from 14 species were classified. Due to the difficulty in distinguishing between female lesser and greater scaup, and between common and Barrow's goldeneye, young of these were classified as scaup species and goldeneye species, respectively.

Estimated production on the Koyukuk National Wildlife Refuge between July 9 and August 6, 1987, was 128,981 birds (se=15%); and on the Kaiyuh Flats Unit, 32,103 birds (se=25%) (Table 10). On the Koyukuk Unit, wigeon (24%), green-winged teal (14%), and pintail (10%) accounted for nearly half the total production (Table 12). Overall, dabblers accounted for 60% of the production, and divers and sea ducks the remainder. On the Kaiyuh Flats Unit (Table 13), dabblers accounted for 88% of the total production, with green-winged teal (34%), wigeon (25%), and mallards (10%) the top producers. Divers and sea ducks produced 12% of the estimated total.

Estimated production for most species appears to have increased from 1986 (Table 14). 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. Also, the 1987 survey consisted of two counts on each water body compared to one count in 1986 and earlier. Although every effort was made to reconcile broods between first and second counts, double counting was still a possibility.

Another important source of bias is the manner in which broody hens are 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 estimate 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. 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, thus the difference between columns 4 and 5, Table 14.

A hatching date was estimated (based on stage of development) for each observed brood. Mean hatching dates were calculated for each species (Tables 15 and 16). Mean hatching dates appear to be slightly later (averaging about a week) on the Kaiyuh Flats Unit than on the Koyukuk Unit (Figure 8). The 1987 survey coincided nicely with peak production.

Due to time constraints, the trend areas surveyed in 1984 through 1986 were not surveyed in 1987. 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 July 6-8, 1987. On 56 3/4 miles of Dulbi River, 298 young were seen (49 broods, 6 species), with wigeon predominating. On Dulbi Slough, 443 young (71 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 3,005 young should be added to the total production figures for the refuge.

Stratification of the habitat on the Koyukuk Unit needs to be continued and refined. Specific exceptions to the criterion have been identified, and need to be incorporated in future sampling to more closely estimate total production. Some of the exceptions are water bodies marked on 1:63,350 scale maps that are in fact dry; and small water bodies that receive massive nutrient input (in flood plains), and thus produce more waterfowl than expected. Similarly, the habitat on the Kaiyuh Flats Unit needs to be stratified, and a random sample of plots surveyed to compute a more accurate estimate of total production.

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 break-up, mean daily temperature, average snow depth, and date of first arrival could yield an accurate indicator for planning survey dates.

Table 11. Estimated total duck production - Koyukuk National Wildlife Refuge and Kaiyuh Flats Unit.

Koyukuk Unit	Ave Young per mi <sup>2</sup>	Total Young All Species	se of Estimate	Ave Broods
Poor	28.1	57,858	8%	7.7
Moderate	50.0	33,750	33%	10.9
Key	93.2	37,373	17%	18.0
TOTAL	41.1	128,981	15%	9.7
Kaiyuh Flats Unit	32.2	32,103	25%	7.9

Table 12. Estimated total young produced - by species - Koyukuk National Wildlife Refuge.

Species	Total Young (a)	% of Total Production
Mallard	8,937	7
Wigeon	31,608	24
Green-winged Teal	18,838	14
Northern Shoveler	6,443	5
Pintail	13,695	10
Redhead	473	0.3
Scaup spp	18,400	14
Ringneck	2,211	1.6
Bufflehead	1,632	1.2
Goldeneye spp	561	0.4
Oldsquaw	1,955	1.5
Black Scoter	12,064	9
Surf Scoter	12,171	9
White-winged Scoter	2,446	1.8
Unidentified	1,893	1.4
TOTAL	133,327	100.2

(a) Total Young =  $T_p + T_m + T_k$  (poor, moderate, and key),  
 where,  $T_i = \{[\text{total observed young} + (\text{broody hens} \times \text{stratum average brood size})] / \text{square miles observed in stratum}\} \times \text{total square miles in stratum}.$



Table 13. Estimated total young produced - by species - Kaiyuh Flats Unit.

Species	Total Young (a)	% of Total Production
Mallard	3,091	10
Wigeon	7,777	25
Green-winged Teal	10,468	44
Northern Shoveler	2,891	9
Pintail	3,390	11
Scaup spp	997	3
Goldeneye spp	299	1
Ringneck	798	2
White-winged Scoter	299	1
Surf Scoter	269	1
Unidentified	897	3
TOTAL	31,176	100

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

Table 14. Annual comparison of estimated production by species.

Species	(1) 84	(2) 85	(3) 86	(4) <sup>1/</sup> 87	(5) <sup>2/</sup> 87	(6) % change from '86 <sup>1/</sup>	(7) % change from '86 <sup>2/</sup>
Mallard	4,015	1,547	7,034	8,937	10,337	+ 27	+ 47
Wigeon	39,997	22,389	23,654	31,608	38,430	+ 34	+ 62
Greenwing Teal	15,434	22,261	28,354	18,838	18,543	- 34	- 35
Northern Shoveler	8,125	2,159	1,523	6,443	7,222	+ 323	+ 374
Pintail	18,775	11,850	10,880	13,695	15,994	+ 26	+ 47
Redhead	753	-----	24	473	400	+ 1,871	+ 1,567
Scaup Spp	25,498	4,622	12,330	18,400	19,908	+ 49	+ 61
Ring neck	-----	-----	-----	2,211	1,774	-----	-----
Bufflehead	4,329	320	3,357	1,632	2,314	- 51	- 31
Goldeneye Spp	1,506	2,963	534	561	640	+ 5	+ 20
Oldsquaw	5,458	4,486	705	1,955	1,523	+ 177	+ 116
Black Scoter	1,255	1,907	1,577	12,064	8,104	+ 665	+ 414
Surf Scoter	4,066	-----	3,529	12,191	11,563	+ 249	+ 228
White Wing Scoter	878	320	253	2,446	2,265	+ 867	+ 795
Unidentified	94	-----	1,994	1,893	2,040	+ 5	+ 2
Total	130,183	74,824	95,892	133,327	141,058	+ 39	+ 47

<sup>1/</sup> Calculated directly from young observed on each plot X total square miles.

<sup>2/</sup> Calculated as in 1985 and 1986 - Broods/mi<sup>2</sup> X total mi<sup>2</sup> X Ave. Brood Size.

Table 15. Mean hatching dates - Koyukuk Unit.

Species	Mean Date	Range	se - days	N
Mallard	6/21/87	5/28-7/12	1.9	37
Wigeon	6/30/87	6/03-7/27	0.9	116
Green-winged Teal	7/01/87	6/11-7/30	1.4	70
Shoveler	6/26/87	6/11-7/15	2.6	18
Pintail	6/15/87	5/23-7/29	1.4	85
Redhead	7/14/87	7/05-7/18	4.3	3
Scaup spp	7/10/87	6/20-7/28	1.2	51
Ringneck	7/25/87	7/20-7/30	5.0	2
Bufflehead	6/24/87	6/10-7/05	3.8	7
Goldeneye spp	7/04/87	6/10-7/27	5.3	7
Oldsquaw	7/05/87	6/30-7/16	2.8	6
Black Scoter	7/12/87	6/28-7/22	1.2	32
Surf Scoter	7/08/87	6/11-7/26	1.4	39
White-winged Scoter	7/19/87	7/12-7/21	0.8	17

Table 16. Mean hatching dates - Kaiyuh Flats Unit.

Species	Mean Date	Range	se - days	N
Mallard	6/26/87	6/16-7/21	3.1	11
Wigeon	7/03/87	6/18-7/26	1.9	33
Green-winged Teal	7/06/87	6/27-7/29	1.8	39
Shoveler	7/06/87	6/19-7/26	4.8	8
Pintail	6/28/87	6/16-7/28	3.2	17
Scaup spp	7/10/87	7/06-7/11	1.2	4
Ringneck	7/28/87	-----	---	2
Goldeneye	6/25/87	6/25-6/26	0.5	2
Surf Scoter	6/26/87	-----	---	1
White-winged Scoter	7/07/87	-----	---	1

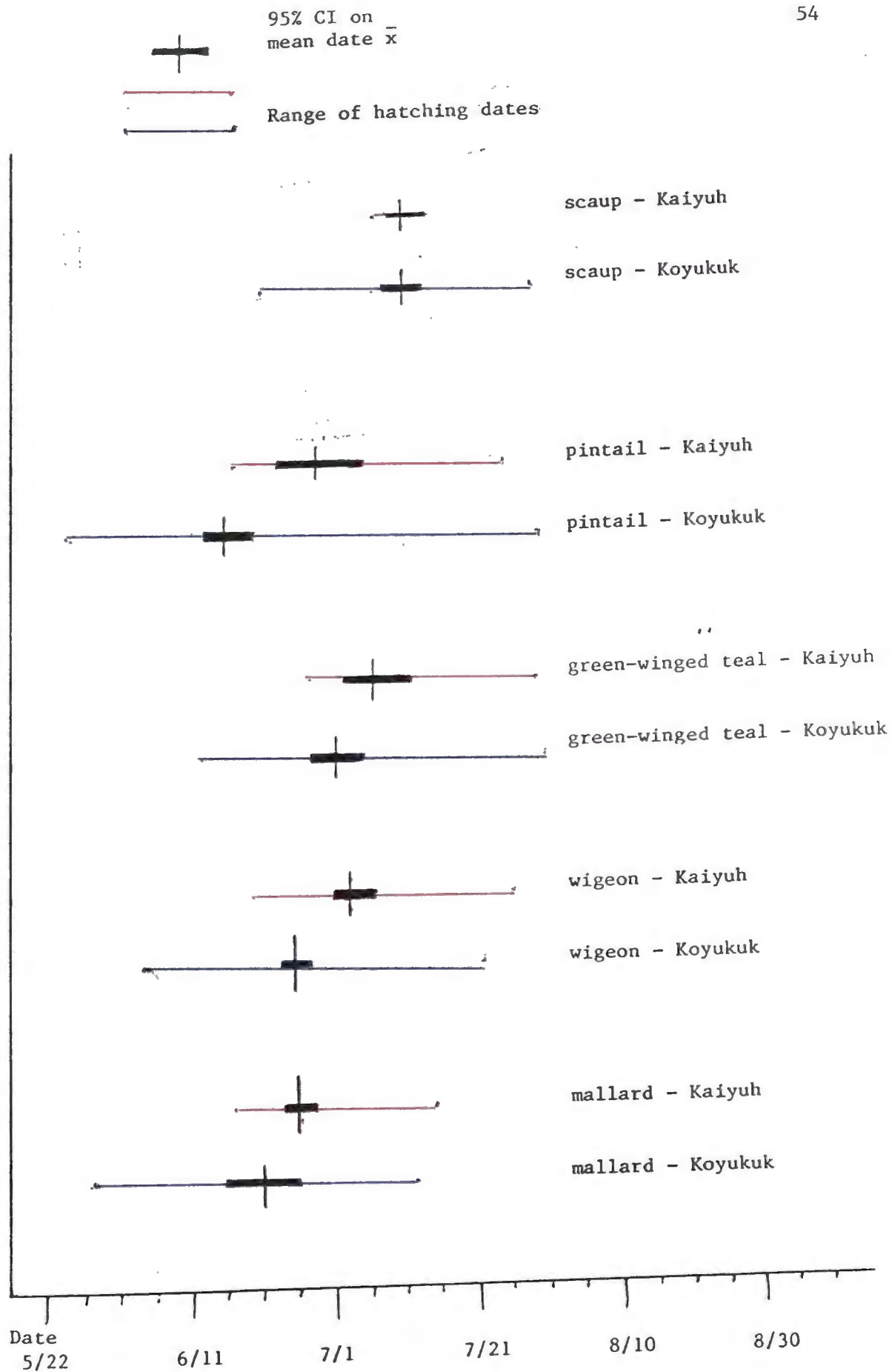


Figure 8. Comparison of mean hatching dates for selected species - Koyukuk and Kaiyuh Unit.

For the third consecutive year, a survey to determine the number of white-fronted and Canada geese was conducted. The refuge was surveyed using a combination of censusing and stratified random sampling. Censusing was used to sample and survey riverine habitat during 6-8 July and 11-12 August. Stratified random sampling was used to survey lacustrine habitat from 9 July to 6 August.

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 July 6-8, 1987, by making concurrent 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 to calculate the estimated production and estimated number of non-breeding adults using the refuge. Riverine habitat was also surveyed by a pilot and observer on 11 and 12 August, 1987, 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 31 square mile plots as previously described in the duck brood survey.

Estimated white-front production on the refuge was 4,846 young birds. This estimate is a combination of the estimated lacustrine production of 1,679 young (se = 50%) and the estimated riverine production of 3,167 young (Table 17). Estimated Canada goose production on the refuge was 1,702 young, 96 (se = 96%) in the lacustrine habitat and 1,606 in the riverine habitat (Table 17). Estimated white-front production was slightly less in 1987 than in 1986, and estimated Canada goose production was slightly more than 1986. However, due to the associated variance of the estimates, only large changes are significant.

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 refuge appears to have been home to more than 3,700 non-breeding white-fronts in 1987.

In contrast, only 1,243 total geese were seen during the August 11-12 survey of the riverine areas (657 white-fronts, and 586 Canadas, including 60 Canadas on Boat Lake). Possibly, a large portion of the geese had already staged and started south by the time we flew our survey.

Table 17. Estimated Goose Production - Koyukuk National Wildlife Refuge.

	<u>1985</u>	<u>1986</u>	<u>1987</u>
White-front	6,573	5,352	4,846
Canada	170	1,049	1,702

Both trumpeter and tundra swans occur on the refuge. However, surveys during recent years indicate that most nesting pairs are tundra swans. Of 28 pairs identified during 1985-87, 27 were tundra swans. It had been previously thought that most of the swans were trumpeters. This year, aerial swan surveys were conducted on two 1:63,360 topographical maps (quads). The Boat Lake quad was surveyed on June 8-9 and the Klymunget Lake quad was surveyed on August 27. Eighty-eight adult swans and twelve nests were observed. Six pairs were identified by species and all were tundras. Twenty-three adults and 10 cygnets were observed on the Klymunget Lake quad. Of the eleven pairs observed, four were identified by species. All four pairs were tundras.

#### 4. Marsh and Water Birds

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

#### 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, red-necked phalarope, Hudsonia godwit, and whimbrel.

#### 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, peregrine 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 four bald eagles, nine Harlan's hawks, one red-tailed hawk, four northern harriers, one northern goshawk and four great horned owls.

#### 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.





Red-necked grebe production was very high this year. GRR







Yellowlegs (above) and snipe (below) are two of the most common shorebirds on the refuge.

MLN





Pine grosbeaks are common winter residents. MDM

#### 8. Game Mammals

Moose are presently the most important game and subsistence mammal on the Koyukuk Refuge. They 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/sq. mi. for the entire refuge with known densities of up to 9 moose/sq. mi. occurring in optimum riparian habitat.





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

Three 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. The telemetry study initiated in 1984 was continued and a moose census on the Kaiyuh Flats Unit and southern portion of the Koyukuk Unit was conducted in November.

Area Game Biologist Osborne has conducted a hunter check station on the Koyukuk River just south of the refuge boundary for the past five years. A total of 143 moose were checked this year. This compares to a total of 111 moose in 1986 and 70 moose in 1985. There has been a significant increase in the number of non-local hunters in recent years. Of the 264 hunters, 151 were local game management unit 21D residents, 92 were non-local state residents and 21 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.

Information collected at the check station in past years indicates bull moose in the Koyukuk drainage of Subunit 21D have larger antler spreads and attain large spreads at an earlier age than most interior Alaska moose. Age and antler spread data from 72 moose killed in the Koyukuk drainage in 1982 indicated that Koyukuk moose attain the 50-inch average at 4.5 years, 1.25 years earlier than moose in the Nowitna drainage and 1.5 years earlier than moose harvested from Units 12 and 20. The 60-inch average is attained at nine years of age along the Koyukuk. The Koyukuk moose are similar to Seward Peninsula moose with respect to their antler spread and early attainment of the 50-inch average size. This similarity is expected since moose are thought to have emigrated from the Koyukuk area to the Seward Peninsula during the last 30 years.

A three year moose telemetry study was initiated in the Three Day Slough area of the refuge in 1984 to investigate: (1) moose movement patterns and distribution on and between ranges (2) mortality rates and causes and (3) seasonal habitat use and preferences. The study is a cooperative effort with ADF&G.

Prior to the initiation of the moose study, it was believed that a substantial portion of the moose were only seasonally utilizing the study area. High concentrations of moose were believed to be in the area from May to December. The study has shown this not to be the case. Many of the collared moose leave the Three Day Slough area during the summer months, but return in the fall. Only one collared moose, a bull, doesn't remain in the Three Day area for the majority of the year.

Four of the seven collared bull moose were harvested during the fall moose season. These were the only mortalities during 1987. The study was to be completed in the fall of 1987 since the radio collars expected battery life was three years. However, since all but one of the collars were still working at years end, we are extending the length of the study until several of the collars fail.

Five of the twelve collared cows were observed with calves this year and one had twins. Of the six calves, three survived through the end of the year.

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 over sample units at 60-80 mph and at elevations of 300-500 feet. When animals are observed, they

are circled at low elevations in order to be accurately classified. Classification include yearlings, medium and large bulls, calves, and cows.

This year, instead of just surveying trend areas, a moose census was conducted. For the purpose of the census, the refuge area was divided into four sub-units (Figure 9), 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 precluded completing the entire 10,000 square miles.

The Kaiyuh Flats (the Northern Unit of the Innoko National Wildlife Refuge), approximately 1,575 square miles, was one census sub-unit. It included Bureau of Land Management lands east of the refuge boundary, to the top of the Kaiyuh Hills, that would logically include moose belonging to the Kaiyuh Flats population.

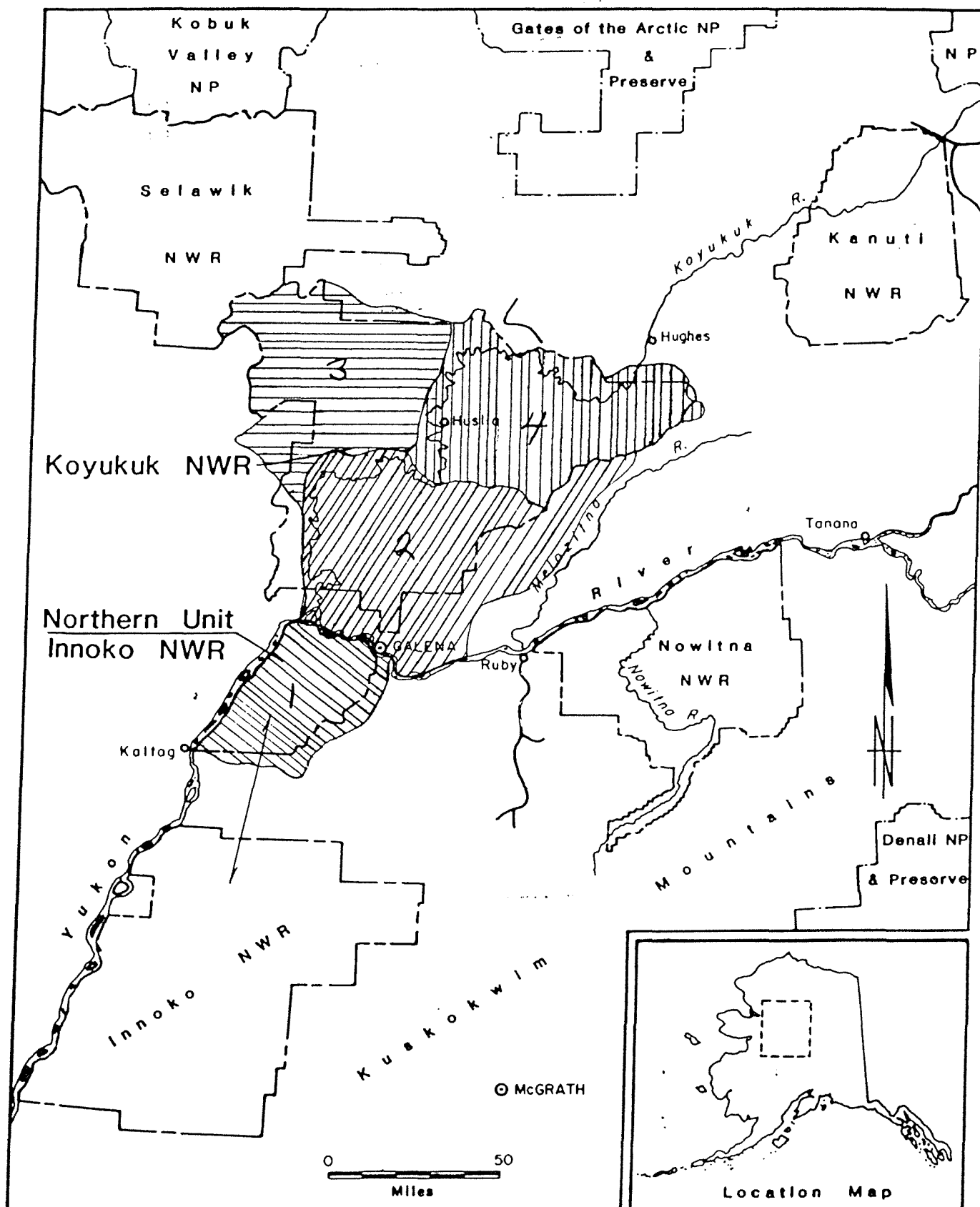
The second census sub-unit was the southern third of the refuge, from the Yukon River east of Galena north to the divide between Dulbi River and Dulbi Slough, and the Koyukuk River, and west down the Koyukuk River to the confluence. Also included in the second sub-unit was the area between the upper and lower ends of Three Day Slough, north of the Koyukuk River and south of Three Day Slough. This is key moose habitat, with population densities significantly higher than most of the remainder of the refuge.

The third sub-unit was the area north and west of the Koyukuk River as it flows from the confluence with the Dakli River to the confluence with the Kateel River. It included all the refuge area north of the Three Day Slough sub-unit, and west of the Koyukuk River flood plain.

The final sub-unit was the remaining refuge area east and south of the Koyukuk River, between the mouth of Papoose Creek and the mouth of the Dulbi River.

As described by Gasaway, et. al. (1986), each of the four sub-units was 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 four strata - low, medium, high, or very high.

Figure 9. Location of Sub-Units - 1987 Koyukuk Moose Census.





Randomly selected sample units were surveyed, allocating sampling effort according to a standard formula. All sample units stratified as very high were surveyed. Search intensity was at the recommended 4-6 minutes per square mile, flying 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, high, and very 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 two 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.

Due to poor weather and time constraints, only two of the four sub-units were surveyed. A total of 4,881 square miles was surveyed, 1,575 square miles in the Kaiyuh Flats sub-unit and 3,306 square miles in the Galena sub-unit. Expanded population estimates for the two areas are 1,702 for the Kaiyuh Flats sub-unit and 4,538 for the Galena sub-unit. Confidence intervals at the 90% level for the two sub-units are plus and minus 20% and 14%, respectively, of the estimates. The total estimate for the area surveyed is 6,240 moose, plus and minus 12% of the estimate at the 90% confidence level (plus and minus 14% at the 95% CL). Overall moose density on 4,881 square miles is estimated to be 1.3 moose per square mile (Table 18). Density in the Very High stratum (Three Day Slough area) rivals the highest reported for Alaska. Stratum density was 9.5 moose per square mile in Three Day Slough for 198 square miles, compared to 9 moose per square mile in the Lower Susitna Valley for 102 square miles (Modafferi, 1987).

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. The lower bull-cow ratios in the High and Very High stratum on the Galena sub-unit are no doubt a result of hunting pressure, as these are the most accessible areas to hunters (Table 20).

Yearlings in the population may underestimated because of the difficulty in detecting antlers on some yearling bulls. Similarly, there is every reason to believe that large (>50") bulls may be 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 21 gives a brief summary of effort expended. This does not include preparation, including mapping, logistics, or flight time to cache fuel; nor does it include flight time to retrieve fuel caches.

We are grateful and would like to thank the many terrific participants who helped make this project a success. John Sarvis (Izembek National Wildlife Refuge, Cold Bay), Dave Sowards (Tetlin National Wildlife Refuge, Tok), Mike Vivion (Yukon Flats National Wildlife Refuge, Fairbanks), John Harmon (Fish and Wildlife Protection, Galena), Hal Graham (Galena Air Service, Galena), and Buck Woods (Friendship Air Service, Galena) safely flew the 220 hours of low level survey flights. Bill Gasaway and Steve DuBois (Alaska Department of Fish and Game,) served as part of the stratification team and provided invaluable technical assistance. Jon Andrew (U.S. Fish and Wildlife Service, Anchorage), Mark Bertram (U.S. Fish and Wildlife Service, Anchorage), Jim Fisher (Refuge Manager, Nowitna National Wildlife Refuge, Galena), Cathy Harms (Alaska Department of Fish and Game, Fairbanks), Dave Johnson (Alaska Department of Fish and Game, Anchorage), Andy Loranger (Nowitna National Wildlife Refuge, Galena), Russ Oats (Kanutli National Wildlife Refuge, Fairbanks), Tim Osborne (Alaska Department of Fish and Game, Galena), Time Patton (Nowitna National Wildlife Refuge, Galena), and Scott Robinson (Bureau of Land Management, Fairbanks) all assisted as excellent observers. Additional thanks go to Tim Osborne for the long tedious hours helping map and measure nearly 10,000 square miles in and around the Koyukuk National Wildlife Refuge in preparation for the census.

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.

Table 18. Estimated moose density by stratum - 1987 Koyukuk Moose Census.

Stratum	Total Area sq. mi.	Surveyed Area sq. mi.	Est. Moose Pop.	Moose Density per sq. mi.
Galena				
Very High	198	198	1,871	<del>1.37</del> 9.45
High	353	160	935	2.65
Moderate	1,212	273	1,416	1.17
Low	1,543	88	297	0.19
TOTAL	3,306	719	4,538	1.37
Kaiyuh Flats				
High	177	123	701	3.97
Moderate	591	240	757	1.28
Low	807	99	240	0.30
TOTAL	1,575	462	1,702	1.08
GRAND TOTAL	4,881	1,181	6,240	1.28

Table 19. Sex-Age Ratios of Moose - 1987 Koyukuk Moose Census.

	Galena	Kaiyuh Flats	TOTAL
Calves:100 Adult Cows	46.0	57.4	48.7
Yearling:100 Adult Cows	27.3	32.3	28.5
Total Bulls:100 Adult Cows	48.7	71.4	54.2
Adult Bulls:100 Adult Cows	34.8	53.1	39.2
Large Bulls:100 Adult Cows	16.4	28.0	19.2
Large Bulls:100 Adult Bulls	47.0	52.7	48.8
% Adult Cows in Population	48	41	46
% Adult Bulls in Population	17	22	18
% Large Bulls in Population	8	11	9
% Yearlings in Population	13	13	13
% Calves in Population	22	24	22

Table 20. Selected Sex-Age Ratios - by Stratum - 1987 Moose Census.

Stratum	Calves: 100 Ad. Cows	Yrlings: 100 Ad. Cows	Adult Bulls: 100 Ad. Cows	Large Bulls: 100 Ad Cows
Galena				
Very High	40.8	28.9	28.7	9.6
High	57.8	35.2	28.6	15.2
Moderate	47.2	21.7	41.8	23.7
Low	40.2	20.1	59.7	29.9
TOTAL	46.0	27.3	34.8	16.4
Kaiyuh Flats				
High	62.1	33.8	39.6	25.2
Moderate	46.5	28.4	49.8	26.9
Low	87.7	43.8	121.9	43.8
TOTAL	57.4	32.1	53.1	28.0
GRAND TOTAL	48.7	28.5	39.2	19.2

Table 21. Summary of Effort - by Sub-unit.

	Galena	Kaiyuh Flats	TOTAL
Total Area (sq. mi.)	3,306	1,575	4,881
Surveyed Area (sq. mi.)	719	462	1,181
Total Sample Units	265	127	392
Surveyed Sample Units	56	37	93
Hours to Stratify	29.5	22.3	51.7
Hours to Survey	138.6	80.9	219.5
Man-days - Stratification	20	16	36
Man-days - Survey	52	38	90

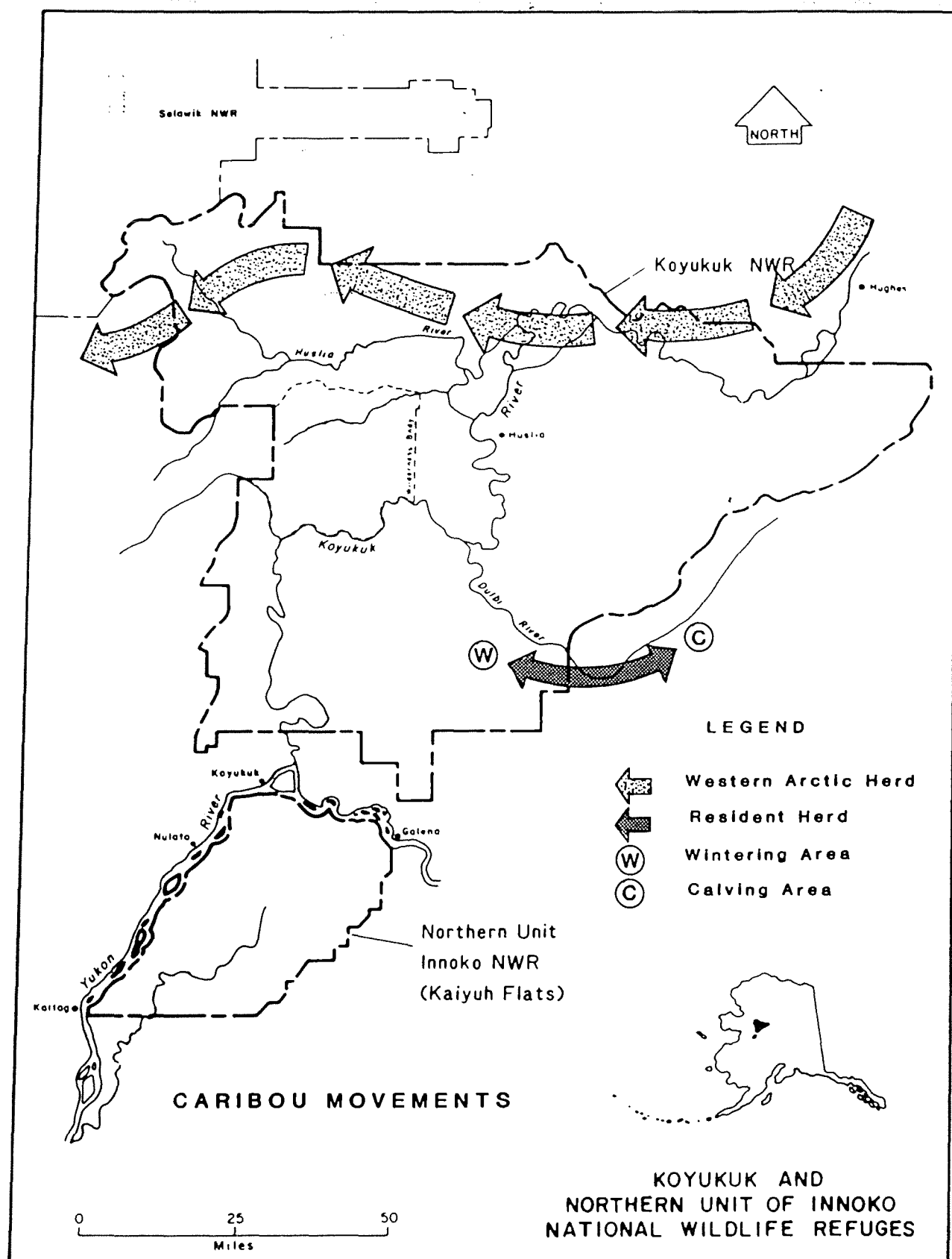
The ranges of two caribou herds include portions of the refuge. Currently the southern edge of the range of the Western Arctic herd, the largest caribou herd in Alaska, is in the northern part of the refuge. The Western Arctic herd has been growing steadily since its crash in the 70's. Current distribution patterns may change if the herd size continues to increase. For the past two years at least 200 of these caribou have wintered on the refuge. Figure 9 displays recent caribou distribution on the refuge.

In addition, a 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.

We assisted BLM Biologist Scott Robinson with super cub support while he and Area Game Biologist Osborn collared six caribou cows on March 23-24. This work was a continuation of the cooperative study initiated on the Galena Mountain herd in the spring of 1986. We also assisted by conducting several radio tracking flights during the year.

Wildlife Biologist/Rost also assisted the National Park Service and Alaska Department of Fish and Game with a caribou collating project at Onion Portage on the Kobuk River. Six conventional and three satellite collars were put on during the period he assisted them.

Figure 9. General Caribou Migration Patterns: 1985 - 1987







Wildlife Biologist/Pilot Rost assisted State and Park Service employees with radio-collaring caribou at Onion Portage on the Kobuk River. GRR



Wolves range throughout Koyukuk refuge and the northern unit of Innoko refuge. 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 northern unit of Innoko National Wildlife Refuge currently have both healthy moose populations and healthy wolf populations.

A wolf track survey of the Koyukuk Unit was conducted during February 26 - March 2. The survey indicated a minimum number of 75 wolves on the refuge at the time of the survey. Most of the packs were small and numbered between 2 and 5. All of the larger packs, except a pack of 8 in the Treat Island area, were up in the mountains on the fringes of the refuge.



The largest refuge wolf packs are in the hills and mountains where aerial wolf hunting opportunities are limited. This wolf sign was on Dulbatna Mountain.

DRL



The refuge wolf telemetry study initiated in 1986 was continued this past year. The objectives of the study are: (1) determine pack sizes, location, home ranges and general age classes of three wolf packs on the refuge (2) determine seasonal habitat use and preferences, including denning areas and (3) develop an estimate of wolf/prey relationships.

The study had several setbacks this year and we only had two wolves with functioning radio collars by years end. The Three Day Slough female wolf was found dead on 17 February. She was killed by another wolf pack despite being well within her, pack's territory. On 28 February a local wolf hunter killed all three wolves in the Kateel River pack. With only one wolf still on the air, we decided we better collar some more.

During March 23-27 we collared four more wolves (1 from the Bear Creek pack, 1 from the North Creek pack and 2 from the Bonanza Creek pack) using a chartered helicopter from Trans Alaska Helicopters, Inc. with Ed Gunter as pilot.



A helicopter and two super cubs were used during the wolf collaring project.

GRR

By August we were only able to locate the Bear Creek wolf and one of the North Creek wolves. Both of these radio signals were very weak. Upon investigating the history of these collars (furnished by Alaska Department of Fish and Game as their part of the cooperative study) we found all of them to be 1984 collars with a two year life expectancy. The two functioning collars were still transmitting weak signals at years end.



Black bears are common throughout most of the refuge. MLN





Grizzly bears are not common on the refuge and are usually observed at high elevations on the refuge. These tracks were observed on April 15 on the Koyukuk River near the administrative cabin.

DRL



River otter slides and scent post.

GRR

Other important furbearers on the refuge include marten, beaver, lynx, wolverine, red fox, mink, river otter and some coyotes. Little is known about the distribution and populations status of these species.





Dulbi River beavers have to contend with extreme water level changes. DRL

#### 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.



## 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.

## H. PUBLIC USE

### 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.

Two new cabin permits were issued during 1987.



The village of Huslia is located on the Koyukuk River in the center of the refuge.

DRL

## 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."

## 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.

## 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.

Under State law, wolves can be taken on a trapping license with the use of an airplane. The airplane must land and the "trapper" must get out of the plane prior to shooting. This is commonly referred to as "land and shoot wolf hunting" as opposed to aerial 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. In addition to wolves, they also take wolverine, fox and lynx. 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 1987 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 1987.

## 17. Law Enforcement

No violations were noted on the refuge in 1987. Law enforcement work on this refuge has not been a high priority due to our limited staff size, extremely large area and relatively few people using the area. However, Refuge Manager Nunn cited an individual for shooting a yellowlegs just outside Galena. The individual was fined \$150. Most of our law enforcement effort is during the September moose hunting season. Several patrol flights were conducted during this period. Flights early in the season were conducted primarily to maintain the integrity of the Koyukuk Controlled Use Area.

Refuge Manager Nunn and Wildlife Biologist/Pilot Rost, spent a couple days after moose season ended checking out several hunting camps to see if they were properly cleaned up. One particular camp has been used many years prior to the establishment of the refuge. A collection of old fuel drums and junk was being left at the camp every year. After we discussed the problem with the individual two years ago, he has been making progress at hauling all of the junk and fuel drums out of the camp. Several other messy moose hunting camps are located in the Three Day Slough area but are located on native allotments.

Alaska Fish and Wildlife Protection Officer John Harmon, was assigned to Galena in September. Galena has not had a full time Fish and Wildlife Protection Officer for several years and John is a welcome asset to the area.

## I. EQUIPMENT AND FACILITIES

### 3. Major Maintenance

The hot water heating system in the duplex was repaired by Portwine Plumbing and Heating from Fairbanks in early June. The furnace's fuel pump had failed during the winter when the building was vacant. Substantial damage due to freezing occurred before we discovered the problem. The repair work cost \$14,570, of which we paid half and the Nowitna Refuge paid half.

Shortly after the heating system was repaired, we relocated our office from a rented building to the duplex. We share the building with the Nowitna Refuge. Installation of additional overhead fluorescent lighting was the only significant work which had to be done to convert the residences to office space. We save about \$26,000 a year by using the duplex instead of renting office space. Although the location is not ideal, the duplex serves as a good office.

Problems with the heating systems in the new residences continued to pester us this year. The circulating pumps kept failing. For an unknown reason, the glycol solution in these systems broke down and formed acidic precipitates. These precipitates were gumming up the pumps and causing them to fail. It is suspected that either the wrong type of glycol was used or that the boilers were set at too high of a temperature setting. The systems were flushed in March and now just have water in them. This has helped but has not entirely solved the problem. One pump has quit since the systems were flushed. In Refuge Manager Nunn's house, a steel pipe coming out of the boiler started leaking. When the pipe was replaced, the entire inside of the pipe was found to be very badly corroded.

The garage floors in all of the new residences were resurfaced in October by the Copper Valley Construction Company. Since some of the garage floors started warping soon after we moved in, there was concern by the engineers that moisture carried in by vehicles would seriously damage the plywood floors and the insulation below. The contractors installed another layer of 1/4" plywood and painted it with an 3M waterproof coating to protect the floor from further damage.



#### 4. Equipment Utilization and Replacement

The refuge's Super Cub had a new engine put in it in March. In December Wildlife Biologist/Pilot Rost flew into Anchorage and left it there to be recovered. OAS estimated this to be a 6-8 week project. Extended range fuel tanks, Cub-crafter seats and a windshield defroster were also ordered to be installed while the plane was being recovered.



The refuge Super Cub spends most of the time on skis and floats,  
however . . . . . GRR





wheels are needed for short periods during spring and fall.

GRR



We often borrow Nowitna Refuge's 4 place Cessna 185 when we need to haul large loads or more than two people.

MDM

### 5. Communication Systems

As mentioned in the safety section, the station is still in need of a reliable field communication system. The equipment for a VHF-FM system with two mountain top repeaters was purchased this year but hasn't been installed. CGS is working on a contract for installation of the system. We hope this past field season is the last time our employees are "on their own" much of the time while conducting field work.

### J. OTHER ITEMS

### 3. Credits

Assistant Refuge Manager Lons wrote the introduction and sections A, B, C, D, E, F, G, H, I, and J. Wildlife Biologist/Pilot Rost wrote section G 3 and 5. Refuge Manager Nunn wrote section K and edited the report. Refuge Secretary White typed the entire report.

## K. FEEDBACK

Calendar year 1987, was a good year to be at Koyukuk. The refuge was blessed with a staff of dedicated professionals, adequate money and equipment to do the job at hand and plenty of work to do.

Since things are going so well here, I thought it would be nice to see if we could help solve some of the problems of the Regional and Central Office.

Moving expenses: There is no doubt that in some cases applicants from Alaska for "lower 48" jobs are not being selected because of the high cost of moving from Alaska. The solution is a "centralized fund" much like the uniform account. It seems that it would be fairly simple to figure out what our average years' moving expenses are and take that money "off the top" to be held in a fund to which moves nation-wide would be charged.

Pilot training: Pilots are always in short supply and yet there are always dedicated refuge employees around who would like to be pilots, but cannot afford the training. Many of these people have a private pilots' license, or could afford to get one if the minimum requirements for official pilot training were lowered, or if some training and the accumulation of hours could be obtained at the station's expense.

It would seem appropriate that employees holding a private pilot certificate should be allowed to fly station aircraft with station pilot aboard and log that time to meet the requirements for formal training or full flight authority.

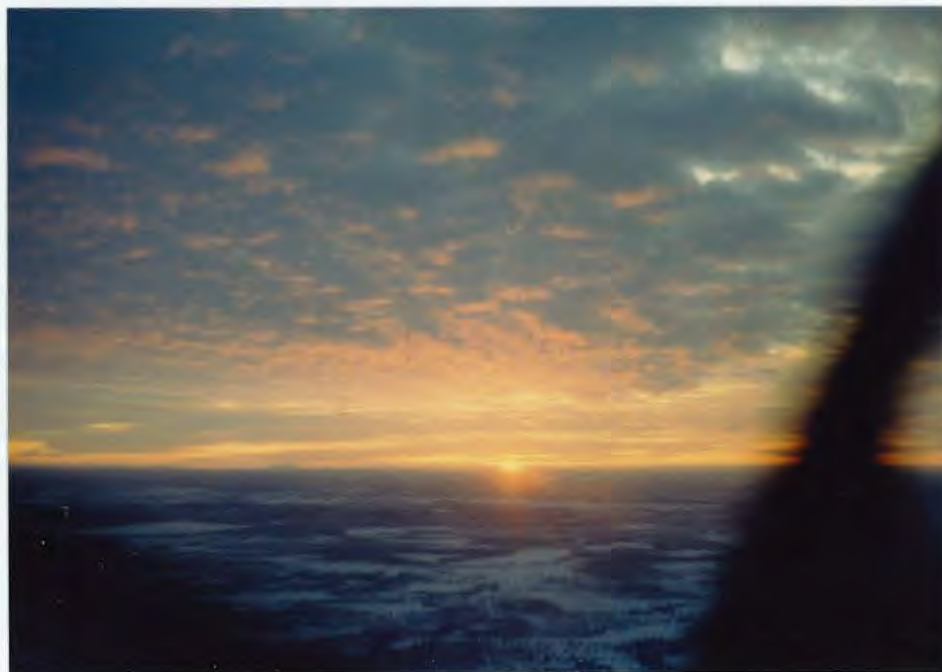


(Feedback continued)

Shared Resources: The sharing of resources, both personnel and equipment should be encouraged by the Regional Office. While this is not a new concept the potential gains from sharing resources are just being realized in Alaska. There are obvious benefits, in that large scale projects can be accomplished at a fraction of the cost of the project being accomplished by a refuge through commercial means.

There are benefits realized that are equally important, however not so easily recognized. This year our pilot flew for Arctic, Innoko, Nowitna, and Selawik, and pilots or observers from Yukon Flats, Nowitna, Tetlin, Kanuti, Izembek and the Regional Office helped us. The net results from this interaction has been nothing but positive. An "esprit de corps" develops, horizons are broadened, and networks are formed that in the long run will provide more benefit to the service than the original work that was accomplished.

However, sharing and cooperative attitudes are fragile things. If demands are made, sharing and cooperation, by definition do not exist. The Regional Office should facilitate sharing resources among refuges without scheduling, forcing, demanding or ramrodding the program.



GRR