NOWITNA NATIONAL WILDLIFE REFUGE
GALENA, ALASKA

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

REVIEW AND APPROVALS

NOWITNA NATIONAL WILDLIFE REFUGE

Galena, Alaska

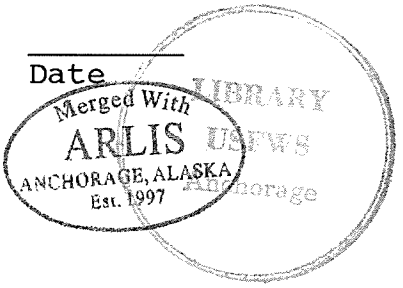
ANNUAL NARRATIVE REPORT

Calendar Year 1989

Refuge Manager 1/9/91 Date

Associate Manager Review Date

Regional Office Approval Date



In Memory of Tim Patton
1948-1989

IN MEMORY

Tim Patton 1948 - 1989

This annual narrative is dedicated to the memory of our dear friend Tim Patton. The sudden loss of Tim in an aircraft accident in June of 1989 was shocking. We are deeply saddened. All those who knew Tim were impressed by his sense of humor and his positive outlook on life. The following is a letter from Jim Fisher, former Refuge Manager of the Nowitna National Wildlife Refuge and Tim's close friend.

> "Tim Patton loved wildlife. He, probably more than most of us, could have done other things that would have afforded him a more lavish standard of living. When Tim applied for the assistant manager position at the Nowitna, he was a biologist with the U.S. Forest Service. He had wanted to work for the Fish and Wildlife Service since he had graduated from college. It speaks highly for the Service that people with Tim's potential are willing to spend their working lives in Galena.
>
> Many people in the field work long hours, but Tim was almost in a class by himself. He was the one who handled all of the details that kept things running. When the rest of us would have rushed off in several different directions to accomplish some task, Tim was the one who made sure that the food was bought, the fuel was delivered, the firewood had been cut, the outboard motors were working, and that there were enough floatation vests for everyone. He was the glue that held everything together.
>
> I have never met anyone who could do so many unrelated things so well. Besides being a fine biologist, he was an accomplished wildlife artist (although the only people who ever saw his work were his friends); he was a skilled woodworker; he was a pretty fair musician; he had been an All-American guard at USC; and had the wildest sense of humor that I have ever come across. More than that, Tim was the best friend that a few of us have ever had.
>
> On a personal basis, my family and I miss Tim very much. I know that the refuge staff misses him too. We lost a good friend. Our lives are better for having known him. That, in itself, is the highest praise that I can think of for anyone."
>
> Jim Fisher

INTRODUCTION

The Nowitna National Wildlife Refuge was created on December 2, 1980 with the passage of the Alaska National Interest Lands Conservation Act.

The refuge lies approximately 200 miles west of Fairbanks in the Central Yukon River Valley. It comprises 2.1 million acres of forested lowlands, hills, lakes, marshes, ponds, and streams. The Nowitna River, a nationally designated Wild River, drains the refuge from south to north. The lowlands along this river are prime waterfowl production and migration habitat. The river and its tributaries support king and chum salmon runs, a large pike population, and one of only three resident sheefish populations in the state. The Yukon River, which forms the northern boundary of the refuge, has a salmon fishery of international significance. The refuge's very productive marten habitat prompted specific reference in ANILCA to its outstanding furbearer value.

Other wildlife of interest common on the Nowitna are moose, wolves, black and grizzly bears, beaver, wolverine, lynx and several species of raptors including nesting bald eagles.

Access to the refuge is by airplane, boat, snowmachine, foot, or dog sled. The refuge has a Cessna 185 aircraft which provides most of the transportation.

The headquarters for the Nowitna is located in Galena, a village of approximately 1000 people, of which 300 are military personnel stationed at the Galena Air Force Station. Galena is a first class city located on the Yukon River and is supplied by barge during the summer and by air service year-round. The state road and rail systems have not yet reached this area of interior Alaska. The village has a school (K-12), a post office, a medical and dental clinic, shopping for basic needs and police and fire protection.

The addition of six new residences in 1986 for refuge families has made Galena a very comfortable, if somewhat isolated, place to live. Without question, the chief disadvantage which Service personnel and their families face in Galena is the high cost of transportation to places which have comprehensive medical and dental facilities and better shopping and entertainment. On the other hand, Galena does provide quite well for the routine daily needs of its inhabitants living in a bush setting. In 1989 the Nowitna Refuge was fused into a complex with the Koyukuk NWR.

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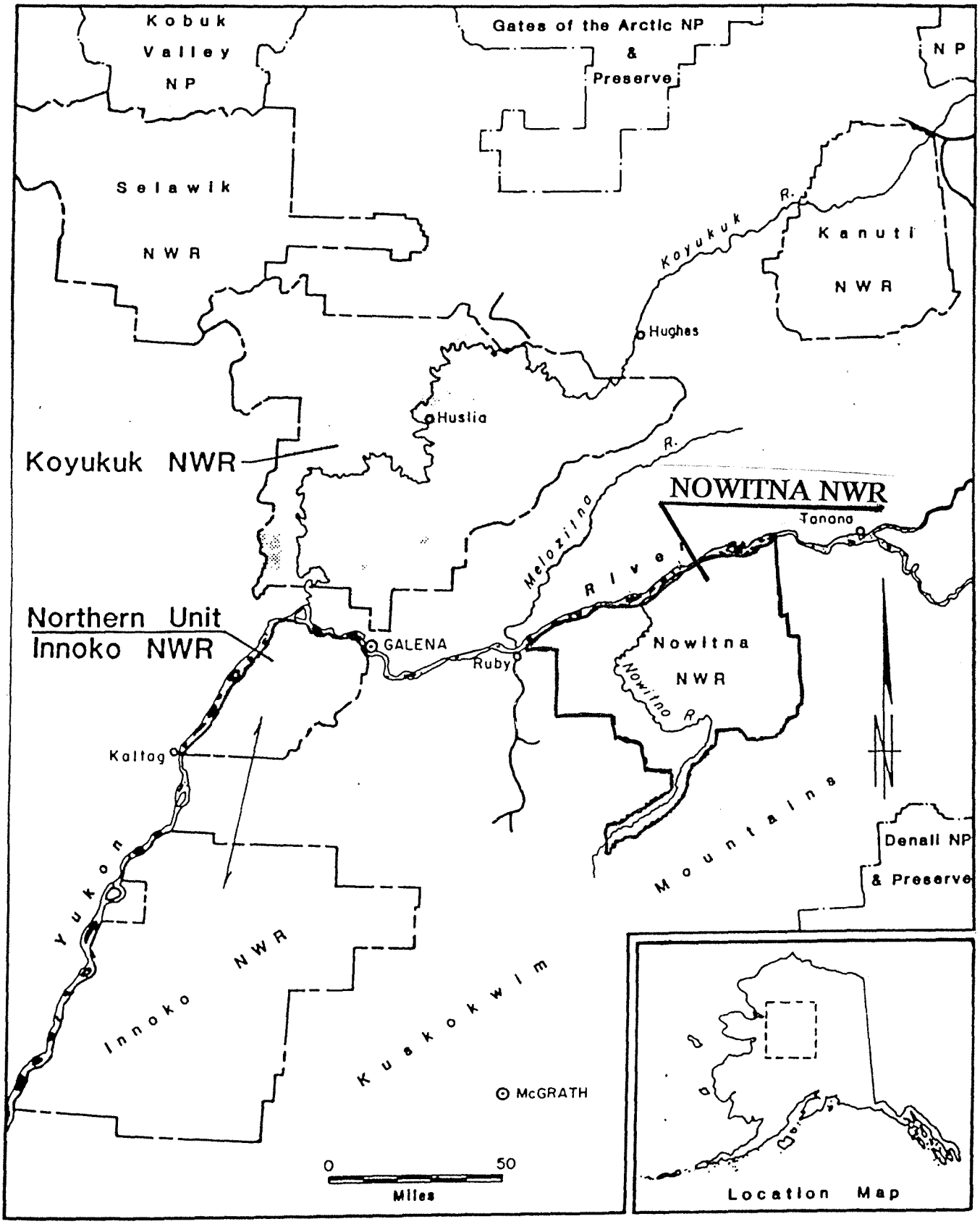
Figure 1. Location of the Nowitna National Wildlife Refuge.



A. HIGHLIGHTS

1. Assistant Refuge Manager Tim Patton killed in June while on annual leave.

2. Record cold spell occurred in mid-winter.

3. Refuge complexed with Koyukuk Refuge.

4. No wildfires occur on refuge in 1989.

5. Waterfowl production on the refuge down by 75%.

B. CLIMATIC CONDITIONS

When highlighting the climatic conditions for 1989, only one occurrence would occupy top billing and it began only 12 days into the new year. The month of January, 1989 went down as one of the coldest experienced in the recorded history of Galena. A progression of sub-zero days was climaxed on January 27 with an official low temperature of -70°F and an unofficial low of -88 F. For the last 18 days of the month the high temperature did not rise above -36°F and averaged -47°F. The low for the same period averaged -57°F.

The cold spell began on January 12 and did not break until February 2nd. Not only did this weather outdo anything experienced by FWS staff in Galena and likely within the State, but even the oldest Athabaskan Indians from the area could not remember a more intense or longer cold period.

Needless to say, the temperature took a severe toll on vehicles, buildings, and morale which is discussed in Section I. The smart and lucky people were those that chose to forego driving their vehicle and had the least complicated heating and water systems.

Severe flooding occurred with spring runoff on many portions of the refuge. The flooding resulted in a dramatic reduction in waterfowl production as discussed in Section G.3. Some parts of the refuge were flooded by up to twenty feet of water.

Breakup of the Yukon River at Galena occurred an 7:30 PM on May 7 and the river froze up during the evening of October 25.

C. LAND ACQUISITION

Ranging of land acquisition priorities was completed on the refuge in 1990 by a Regional Office Team following input from the refuge staff. A total of 227,898 acres were identified as

high priority for acquisition, including 69,036 acres of State of Alaska land, 88,963 acres of Native corporation land, 2,078 acres of Native allotment land, and 10 acres of private land. Nearly all the high priority sites were along the Yukon River to protect waterfowl nesting and brood rearing habitat and salmon spawning habitat. We were informed that there is no funding for acquisitions on the Nowitna at this time. We support the concept of land bank agreements in lieu of acquisition since it has worked well for the Gana-A-Yoo lands on Koyukuk NWR.

D. PLANNING

2. Management Planning

The Nowitna Fisheries Management Plan, which has been in the making since 1985, was moving toward completion late in the year. In November, representatives of the refuge, Fishery Resources, and the Alaska Department of Fish and Game met to review the State's comments on the plan. Little controversy was associated with the plan. It is scheduled to go to the public for comment in March, 1990. We are hopeful that this plan will result in an appropriate amount of attention being given to the aquatic portion of the refuge ecosystem.

E. ADMINISTRATION

1. Personnel

Permanent

1. Daryle R. Lons, Refuge Manager, GS-485-12, EOD 1/1/89, transferred 7/2/89, PFT
2. Timothy M. Patton, Assistant Refuge Manager, GS-485-11, EOD 8/84, Deceased 6/20/89, PFT
3. Colin B. Brown, Pilot, GS-2181-12, EOD 4/84, PFT, local hire
4. Andre J. Loranger, Wildlife Biologist, GS-486-9, EOD 9/86, transferred 2/27/89, PFT
5. Walter L. Johnson, Wildlife Biologist, GS-486-9, EOD 5/21/89, PFT
6. Maudrey M. Honea, Secretary, GS-318-5, EOD, 10/85, PFT, local hire

Temporary

1. Peter DeMatteo, Biological Technician, GS-404-5, EOD 4/89
2. Steven Blatt, Biological Technician, GS-404-5, EOD 5/8/89, terminated 8/89

3. Victoria Tutterrow, Biological Technician, GS-404-5, EOD 5/88, terminated 4/23/89

Daryle Lons was selected as the Refuge Manager for the Nowitna in late December, 1988 and began his duties effective January 1. Daryle previously had been the Assistant Refuge Manager for the Koyukuk NWR and so the physical transfer consisted of no more than cleaning out his desk.

Daryle's tenure as the station's Manager was short when, for medical reasons, he took a position in the Anchorage Regional Office effective the second of July. This impending move prompted a major decision in June which resulted in a complexing of the Nowitna and Koyukuk refuges under Koyukuk manager Mike Nunn. The issue had been raised in the past and Daryle's move provided the impetus to finally follow through.

Organizational structures for the new Complex were discussed among Personnel, the Associate Manager and the refuge until early October when staffing decisions were made and recruitment began for two Assistant Manager positions, one of which included dual function piloting duties. At the end of the year the Complex was left with only Refuge Manager Nunn and Acting Assistant Manager Liedberg (on detail from the Arctic NWR) to function for the four manager positions.

In brief, the new structure will have the GS-12 Refuge Manager supervising two GS-12 Assistant Managers - one for operations/administration and one for biological programs. These two assistants will supervise most of the remainder of the staff.

The most tragic event to occur during the year and surely during the history of the refuge occurred on June 20th when Assistant Refuge Manager Tim Patton along with Koyukuk Assistant Refuge Manager Greg Rost and Greg's wife Joy were killed in Greg's private aircraft. The accident occurred in Idaho where the three were on annual leave and in the process of aerially scouting the Salmon River for an upcoming float trip. Assistant Manager Patton had been with the Refuge since August of 1984.

The deaths of both primary Assistant Managers and the impending move of Manager Lons left the new Complex short by three of its four manager positions.

Bud Johnson

Colin Brown

This void was partially covered by detailing Administrative Officer Paul Liedberg from the Arctic NWR in Fairbanks to the Complex. Paul stayed through the end of the year at which time a list of candidates to fill the positions permanently had been received.

Wildlife Biologist Andy Loranger transferred to the Kenai NWR effective February 22. Andy had served as the station's Wildlife Biologist since September 1986. Recruitment for a new biologist began immediately and on May second Walter (Buddy) Johnson entered on duty from Blackwater NWR where he was an Assistant Manager.

Three biological technicians were on the refuge staff during the year. Leigh Tutterrow, employed since May 1988 was terminated on February 23rd. Steven Blatt was employed from May 8 until August 1989. He had worked for the Refuge as a volunteer in 1988. Peter Dematteo was hired effective April 3rd and remained on the staff through the end of the year.

4. Volunteer Program

One volunteer, Heather Johnson, contributed 70 hours valued at $717 for the refuge in 1989. She assisted the staff in conducting brood surveys in July and early August and in monitoring of a cooperative moose hunter check station at the mouth of the Nowitna River in September.

Due to housing shortages, logistical complications, and a limited number of candidates in the local area the use of volunteers has been limited on the Nowitna in the past. We anticipate that this will change somewhat in the future now that a bunkhouse is available to assist with housing individuals who may be interested in traveling to Galena.

5. Funding

The station's funding for the last five years is shown below.

Table 1. Nowitna National Wildlife Refuge Funding

Program	FY85	FY86	FY87	FY88	FY89
1260	369,000	345,000	488,000	463,000	
1261					254,000
1262					210,000
8610		14,585	30,000	28,700	16,894
Totals	369,000	359,585	518,000	491,700	480,894

May 7, 1989 break-up of the Yukon River at Galena. Some ice chunks were pushed onto the street in old townsite, but the town did not flood.

Heather Johnson- Our #1 volunteer.

The station's operations budget for FY89 remained essentially constant from FY88. Flexible funding made up only $76,000 (16%) in 1989 and it consisted of the following projects:

Monitor wildlife harvest (moose)	$ 3,000
Continue furbearer study	$ 5,000
Continue white-fronted goose study	$14,000
Continue aquatic survey	$ 2,000
Continue moose calf study	$38,000
Band white-fronted geese	$10,000
Continue fishery survey	$ 2,000
Population protection (LE)	$ 2,000

6. Safety

No reportable accidents occurred during the year. This accident-free record goes back to 1985.

A radon test was conducted in the office building with results of 0.6 pCi/L, indicating an acceptable level of this gas.

A station safety and health inspection was completed and submitted on May 15 along with a field crew emergency plan for the field season.

A CPR refresher course was attended by staff members in June.

Regional Safety Officer Hyatt along with WO Chief of Safety Earl Markwell visited the headquarters and housing facilities on August 23 for a review of the station safety program and an orientation to bush operations.

Safety meetings held during the year dealt with a variety of topics including review of OAS survival bags, aircraft crash emergencies, proper use and care of flotation vests and suits and a review of emergency backup heating equipment in the residences. Safety meetings during the summer concentrated on how to conduct operations in an atmosphere of safety-consciousness. All meetings were held in conjunction with the Koyukuk staff.

Six Browning .375 H&H magnum rifles were purchased during the year to aid in compliance with the Regional bear safety policy. Permanent and temporary field staff practiced with the rifles prior to field work.

The Regional bear safety policy itself has come under critical review and, as written, requires this station to at least double the manpower required to conduct field operations. Normally, many of our waterfowl surveys are conducted by a single person being dropped on a lake by an aircraft - often times a one-passenger Super-cub. While the intent of the

policy is a good one, the additional requirements for staff and logistics makes policy compliance costly and more time consuming since we are now supposed to work in pairs. Although bears were encountered in field operations this year, no close encounters required evasive action or warning shots.

The new radio system provides a safety network for both the Nowitna and Koyukuk Refuges but it performed only moderately well during the year. The system was finally up and operational in July and it functioned very well. Unfortunately, by mid-October it was down again. Luckily, we had partial coverage via a mobile radio installed in the office but repeaters or the base station did not function. We hope for better days with the system in 1990.

A contract was let in May to have asbestos removed from pipes in the office and residence 109 (bunkhouse). When the inspection took place on June 14 soil samples were taken under the office. Results received in September indicate that the soil is contaminated with asbestos and must be removed. Funding requests are being made to correct the remaining problem.

7. Technical Assistance

Throughout the year the refuge provided assistance to the Fairbanks District Office of the Bureau of Land Management to help them do brood surveys on areas adjacent to the Koyukuk Refuge. Assistance was in the form of helping set up the brood plots. In the end we used BLM chartered aircraft and staff time for our Refuge brood surveys and we helped BLM conduct their surveys.

Late in the year we received a request by BLM to review and comment on a moose study proposal in BLM areas adjacent to the Refuge. At year's end comments were being prepared.

As usual, the Refuge staff provided technical assistance to the Alaska Department of Fish and Game Biologist, Tim Osborne, stationed in Galena. We encourage participation by Osborne and the same is true of our involvement in State projects.

Tim Osborne chasing moose calf.

Tim Osborne placing collar on moose calf during moose calf collaring project.

Local Fish and Game Advisory Committee meetings were attended by various staff members throughout the year to provide information and advice as requested. With the refuge now functioning as a complex, we have four Advisory Committees to coordinate with, the Ruby, Middle Yukon, Tanana, and Koyukuk.

8. Other

In February Pilot Brown and Koyukuk Biologist Bertram conducted a search for a downed aircraft just outside the boundary of the Northern Unit of the Innoko Refuge. Although nightfall prevented a landing to drop survival gear, radio contact was made to confirm that the pilot and his passenger were in good shape. They had apparently stalled the aircraft prior to landing and it had flipped. They were picked up the following day by State Search and Rescue personnel.

Associate Manager Elison visited the refuge on June 16 to discuss the complexing of the Koyukuk and Nowitna Refuges.

Assistant Regional Director Rogers and Acting Associate Manager Heuer conducted a station review from July 10-12. Included in the review were discussions with most of the staff, assistance with a white-fronted goose banding effort, an aerial tour of the Koyukuk Refuge and a refuge slide program.

Associate Manager Constantino visited Galena on August 30 to review operations, meet staff, and discuss various personnel matters relating to complexing.

Incidental flight status was requested for Acting Assistant Manager Liedberg in August. He attended ground school in late August and had Super-Cub check rides from September to early December on floats, wheels and skis.

Regional realty appraisers were in Galena in September to conduct a five year appraisal of housing lots for revenue sharing purposes and to evaluate office space utilization.

No progress was made on a satisfactory office arrangement.

Native Fish Camp along Yukon River.

The Mourning Cloak butterfly is one of the first to appear shortly after snow melts in late April or early May.

F. HABITAT MANAGEMENT

1. General

The Nowitna NWR is characteristic of Interior Alaska. The majority of the refuge lands are forested and belong to three major plant associations. The extensive bottomland spruce poplar forest is found along the Nowitna River drainages, and to a lesser extent, along smaller streams and tributaries. This type is composed of black spruce, white spruce, balsam poplar, quaking aspen and paper birch. Shrubs include alder, willows, rose, cranberries and blueberries. Herbs, grasses, ferns, mosses, and lichens are also present. The low-bush bog and muskeg community, found predominantly in the northern lowlands of the refuge, is comprised of the black spruce and tamarack. Shrubs include Labrador tea, crowberry, willow, bog cranberry, rose, blueberry, alder, and resin and dwarf birch. Sedges, rushes, and cottongrass, as well as mosses and lichen, are also present. The largest plant association on the refuge is the lowland spruce-hardwood forest. This community is dominated by black spruce, but white spruce, tamarack, paper birch, balsam poplar and quaking aspen are also present. Understory vegetation includes willows, dwarf birch, blueberry, rose, Labrador tea, crowberry, bearberry, cottongrass, ferns, horsetail, lichens, and sphagnum and other mosses.

Table 2. Habitat types derived from LANDSAT, Nowitna NWR.

Habitat Type	Acreage	PerCent
Forest	1,735,847	84.1
Scrub (willows, poplar & alder)	132,881	6.5
Dwarf Scrub (sedge tussocks, blueberry, ledium, and dwarf birch)	58,881	2.9
Herbaceous (grasses - includes bogs and grass lakes)	47,063	2.3
Scarcely Vegetated (floodplains and scree)	1,765	0.1
Water	62,528	3.1
Unclassified (shadow)	20,109	1.0

2. Wetlands

The principal rivers on the refuge include the Yukon, Nowitna, Sulatna, Big Mud, Little Mud and Grand Creek. With the exception of the Nowitna, all of these rivers carry a heavy sediment load. The Yukon at Ruby carries an estimated seventy million tons of sediment per year. Annual spring floods from these rivers recharge nearby wetlands with nutrients.

The Nowitna River is the heart of the refuge. Its most notable characteristic is its meandering, which constantly creates a diversity of habitats for fish and wildlife. The Nowitna's floodplain extends for 8-10 miles on both sides of the river. Annual spring floods bring nutrients to oxbow lakes and sloughs.

Limestone near the headwaters of the Nowitna contribute carbonates which buffer the acidic qualities of the river and make it more productive than many of its Alaskan counterparts. The lower half of the river ranges from 150-450 feet wide and flows at an estimated rate of 2-4 miles per hour. The main channel in the lower river is typically 20-30 feet deep in early summer. From the refuge's southern boundary, the Nowitna River flows approximately 220 miles north through the refuge to the Yukon River.

The Yukon River broke up at Galena at 7:30 pm on May 7th. A large ice jam above Ruby at the old village site of Kokrines formed on the 8th and held until the morning of the 14th. This jam caused significant flooding on the refuge and caused much concern in Galena since there also was an ice jam below town. Approximately 300 square miles of the refuge were flooded. Some of the lower lying areas were covered with approximately 20 feet of water!

Placer mining for gold and other minerals has grown dramatically in the past decade, stimulated by the lifting of Federal restrictions on gold prices in the early 1970's. In 1983, more than 300 placer mines were in operation throughout the state, producing an estimated 169,000 ounces of gold. Because large amounts of overburden were removed to reach the gold in alluvia, frequently active streams were used to wash the site. This technique makes placer mining a major source of aquatic and riparian habitat destruction in Alaska.

Although most placer mining activities are taking place outside refuge boundaries, the impacts on refuge lands are significant due to the large amounts of sediment transported downstream into refuge. Studies of placer mining impacts on downstream sites elsewhere in Alaska have demonstrated adverse effects on biological productivity such as fish abundance, growth, and reproduction. It is reasonable to assume heavy

metals and sediment impacts may be occurring on the refuge. In fact, results of samples collected in 1987 indicate that northern pike from the Sulukna River immediately above the confluence with the Nowitna River contained elevated mercury concentrations. Five of the fish at one sample site contained high mercury concentrations that equalled or exceeded the U.S. Food & Drug Administration action level of 1 part per million (ppm). An action level represents a limit at or above which the FDA will take legal action to remove an adulterated product from the commercial market. Mercury concentrations from fish at other sample locations ranged from average to moderately elevated levels compared to that reported elsewhere in the country through the National Contaminants Biomonitoring Program (NCBP). Arsenic concentrations were also high (0.676 ppm and 0.831 ppm) in two California creek grayling.

Plans have been made to post warnings at the confluence of these locations in the spring of 1991. Results of samples collected during 1988 have not been received. A complete presentation and comparison of 1985, 1987 and 1988 data will be presented upon receipt of all data.

3. Forest

The Nowitna is unusual among Alaskan refuges in that over 80% of it is forested. An estimated 16% of the refuge supports potentially marketable timber. The lower Nowitna drainage has some especially high quality white spruce measuring over 18 inches in diameter and over 100 feet high. However, approximately 36% of the refuge is dominated by black spruce. The primary use by local residents of this timber is for houselogs and firewood, although small commercial sawmills have operated in Tanana, Ruby and Galena. Most of the highest quality timber on the refuge grows along the Nowitna River, whose Wild River designation precludes commercial timbering. Local interest in commercial logging operations on the islands in the Yukon has been expressed. This activity is addressed in the Comprehensive conservation plan for the refuge which does not allow commercial timber harvesting.

9. Fire Management

The 1989 fire season was wet and uneventful. No fires were reported on the refuge. Fire history data back to 1958 was collected from Alaska Fire Service. Because of local weather patterns, fires recently have occurred relatively less frequently and usually burn smaller acreages on the Nowitna when compared to the remainder of Alaska's Interior.

All of the lands within the Nowitna NWR are covered by the Alaska Interagency Fire Management Plan (Tanana/Minchumina

Planning Area). The plan was completed in 1982 and is subject to annual revision. This plan represents a departure from past procedures in that previously all fires were suppressed whenever possible. Under the current plan the following four options may apply to refuge lands:

Critical Protection:	Highest priority response. Fires will receive immediate and aggressive initial attack. This category includes the protection of life and property.
Full Protection:	All fires will receive aggressive initial attack and suppression efforts until fire is declared out. This category includes native allotments and selected private property.
Modified Action:	This option provides protection between "full" and "limited". The intent is to provide manager/owners with an alternative for those lands that require a relatively high level of protection when the risks of large damaging fires are diminished.
Limited Protection:	Suppression actions are taken only to the extent necessary to keep a fire within the management unit or to protect critical sites within the area.

The goal of the interagency plan is to reduce suppression costs during the fire season using appropriate operational responses in relation to values at risk.

Most of the refuge presently falls under the "limited action" category; the exceptions are a narrow strip of land along the Yukon River which is classified as a "full protection" area, and a small block of land in the northeast corner of the refuge which is a "modified action" area. There are few areas on the Nowitna where a fire of 10,000 acres or less would cause any wildlife habitat concern, since fire is a natural part of this regime.

11. Water Rights

No work was done to establish water rights for the refuge this year. Instream flow data is needed for all streams and rivers which originate from lands outside the refuge. A water management plan is scheduled to be written as a step down plan

following the comprehensive conservation plan but this is a far bigger project than the present staff can handle. A full time position is needed for this work to be done correctly.

12. Wilderness and Special Areas

The entire 223-mile length of the Nowitna River, which is contained within the refuge boundaries, is classified as "wild" under the Wild and Scenic Rivers Act. This is a beautiful river which is accessible to the general public only by boat or airplane. A management plan, soon to be written, will guide the management of its resources.

G. Wildlife

1. Wildlife Diversity

The Nowitna Refuge supports a diverse group of wildlife representing most of the species found in interior Alaska. Thirty seven species of mammals, 145 birds, 20 fishes and 1 amphibian are known to occur on or near the refuge.

2. Endangered and/or Threatened Species

Although not seen in 1989, the peregrine falcon regularly occurs here. Suitable nesting areas have been located on the refuge along water courses.

3. Waterfowl

Wetlands within the Nowitna and Yukon river floodplain support extensive waterfowl populations. Principal duck species include American wigeon, northern pintail, mallard, green-winged teal, white-winged scoter, common and Barrow's goldeneye, and lesser scaup. Other breeding ducks include northern shoveler, red-breasted merganser, greater scaup, canvasback, redhead, surf scoter, oldsquaw, harlequin duck, and bufflehead. Arctic, red-throated and common loons, and horned and red-necked grebes also nest on the refuge. Canada geese, white-fronted geese, and trumpeter and tundra swans use the refuge in moderate numbers. The greatest concentrations of waterfowl occur along the rivers during the spring and fall migrations.

Waterfowl inventories conducted on the Nowitna NWR in 1989 included duck production and spring breeding surveys, and swan production surveys. Duck production surveys have been conducted on the refuge since 1983. A stratified random sample design was developed in 1987 to estimate total refuge

production. The 1988 and 1989 surveys used a helicopter to survey inaccessible wetlands.

Aerial swan breeding surveys and fall production surveys were initiated in 1986 and 1987, respectively and repeated in 1988 and 1989.

A. Weather Conditions and Waterfowl Migration Chronology

Break-up on the Nowitna River in 1989 occurred sometime during late April or early May. An ice jam on the Yukon, up river from the village of Ruby, caused extensive flooding along the Yukon and lower Nowitna in May. Some lower lying areas held as much as 20 feet of water.

Many low-lying areas remained flooded well into June. Consequently, waterfowl nesting was adversely affected in some areas. For example, Yukon Lake, a large shallow wetland adjacent to the Yukon River, is typically a good brood rearing area. When it was surveyed in July, the water was still high and no broods were observed. Spring flooding also occurred in other parts of the Interior with similar reductions in waterfowl production. Early nesters such as pintails were probably hardest hit.

Mallard Brood

Pintail

Waterfowl began arriving in Galena around April 13th but precise arrival dates for the refuge are not available. White-fronted geese numbers usually peak in late April, with a peak in Canada geese occurring about one week later.

This fall, most waterfowl began concentrating on the larger oxbows in the Nowitna floodplain in late August and peak fall migration occurred in late September.

B. Duck Production Survey

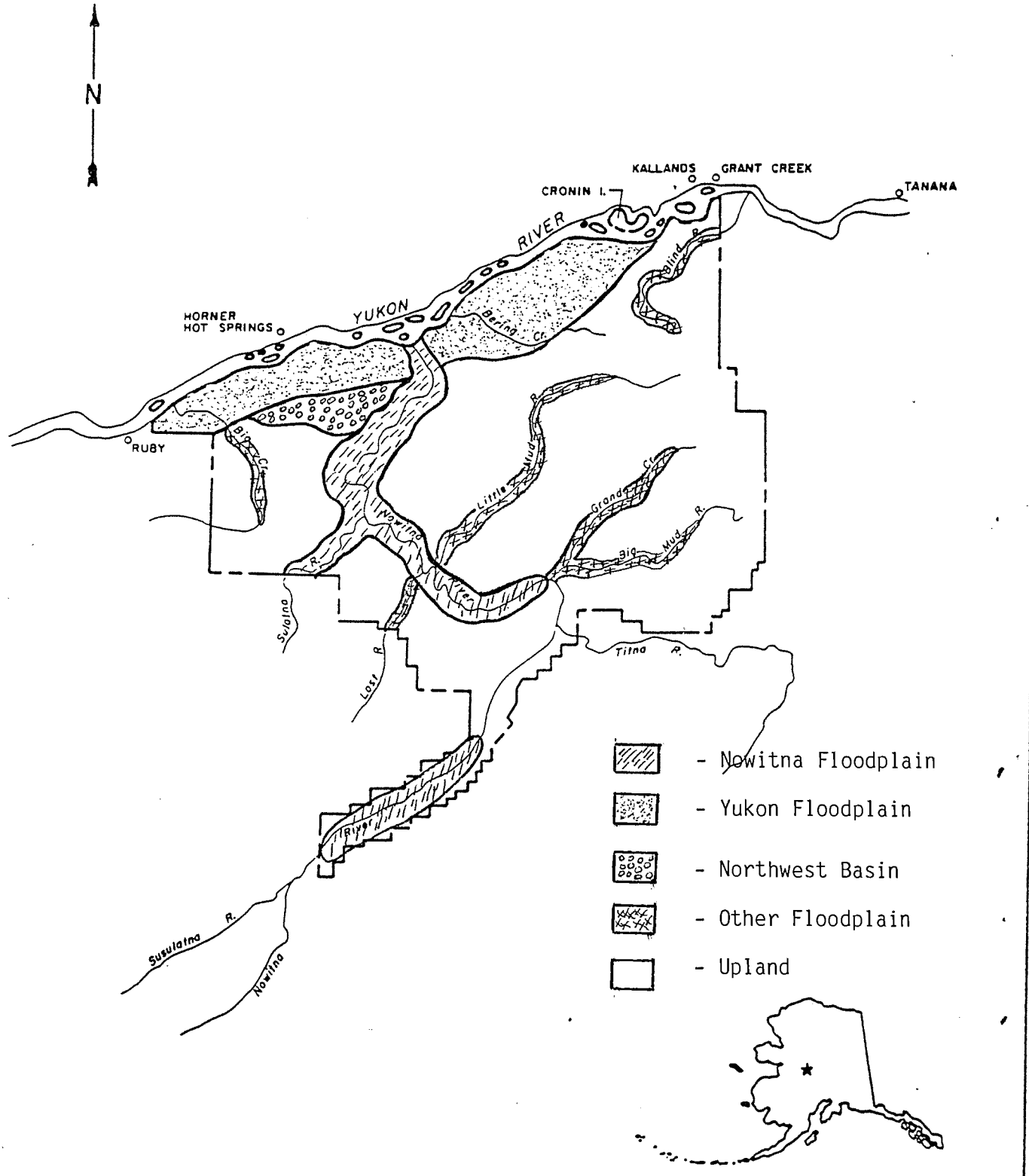
Waterfowl brood surveys have been conducted on the refuge each year since 1983. In 1987, a systematic brood survey aimed at providing statistically valid annual production estimates for the refuge was initiated. In 1988, the survey was refined and a helicopter was used to survey inaccessible parts of the refuge. The 1989 survey was designed to replicate previous efforts, as close as possible. However, estimates for the 1989 survey were derived from one survey verses two in 1988. Moreover, for the purpose of analysis, wetlands were not stratified to the level that they were in 1988 (i.e., the size classification was not used).

The initial stratification of wetlands in 1987 defined five broad geographic areas in which waterfowl production was believed to differ. The five strata are: 1) the Nowitna River floodplain; 2) the Yukon River floodplain; 3) floodplains of other refuge rivers; 4) the northwest basin; and 5) the remainder of the refuge, designated as upland (Figure 2). Connected oxbow lakes were also classified as a separate substratum of the Nowitna River floodplain because of their uniqueness and accessibility which permitted all of them to be surveyed.

Stratification of refuge wetlands was further refined in 1988. All waterbodies within each geographic stratum were classified as bog or non-bog substrata. This classification was based on the plant communities that surround individual wetlands. Color infrared aerial photographs were used to delineate Bog and Non-Bog wetland types. After stratification of wetlands was completed, a sample of 134 wetlands was randomly selected.

A Cessna 185 and Piper Super (PA-18) aircraft, both equipped with floats, and an 18 foot riverboat provided access to wetlands in the three primary strata. All surveyed wetlands were either walked or canoed during the period of July 11-27. Wetlands in selected plots in the Upland and Other Floodplain strata were surveyed by helicopter.

Figure 2. Geographical strata for waterfowl production survey, Nowitna NWR, Alaska.



Total acreage within refuge: 2,060,000 ± Ac.

0 20 40 Miles

NOWITNA
NATIONAL WILDLIFE REFUGE

USFWS DIVISION OF REALTY ANCHORAGE, AK.

Species, sex and age class of all duck broods were recorded, as were broody hens. No attempt was made to distinguish between lesser and greater scaup or between Barrow's or Common goldeneye observations.

Estimated hatch dates were calculated using age class data after Gollop and Marshall (1954). Limited information suggests slightly shorter hatching to fledgling time for some Alaskan birds. Actual hatch dates may be slightly later and the onset of flight slightly earlier than those elsewhere.

Wetland habitat (excluding rivers and streams) on the Nowitna NWR includes almost 2,500 lakes and ponds encompassing nearly 30,000 acres (Table 4). The Upland stratum contains more than three-fourths of the wetlands on the refuge but only about one-half of the wetland acreage. Most of these wetlands are less than 10 acres. The Nowitna Floodplain stratum contains more than one-fourth of the refuge's wetland acreage, primarily as larger oxbow lakes.

Among the strata that were surveyed by walking or canoeing, sampling effort was greatest in the Nowitna Floodplain stratum. Ninety-two of the 136 randomly selected wetlands (68 %) are in this stratum. An additional 328 wetlands are in the Upland and Other Floodplain strata and were surveyed by helicopter. Virtually all of these wetlands are inaccessible by boat or fixed-wing aircraft and contain relatively low densities of waterfowl.

Table 4. Wetlands sampled for waterfowl production, Nowitna NWR, Alaska.

Stratum	Wetland Total	Number Sampled	Wetland Total	Acreage Sampled
Nowitna Floodplain				
Connected Oxbow	6	6	991.7	991.7
Non-Bog Lake	505	60	4553.6	1962.8
Bog-Lake	372	26	2395.1	703.1
Yukon Floodplain				
Non-Bog Lake	67	13	677.9	451.6
Bog-Lake	447	14	1925.7	509.7
NW Basin				
Non-Bog Lake	146	15	802.7	485.1
Bog-Lake	111	0	494.7	0
Upland				
Non-Bog Lake	4185	111	7625.2	408.5
Bog Lake	5306	140	7905.4	463.7
Other Floodplain				
Non-Bog Lake	1182	70	1366.5	122.1
Bog Lake	118	7	134.9	9.2
Yukon Lake	1	1	558.5	558.5
Round Lake	1	1	205.0	205.0
TOTAL	12484	464	29636.9	6871.0

Bog wetlands in the Northwest Basin stratum and larger wetlands in the Other Floodplain stratum were not sampled. Wetlands in these substrata comprise small percentages of total refuge wetlands. Their contribution to refuge duck production is assumed to be negligible.

Three hundred and sixty-one broods were observed during the ground and helicopter surveys (Table 5). Dabbling duck broods were the most frequently observed, accounting for 71.2% followed by diving duck broods at 19.2%. As in past years, the most commonly observed dabbler brood was American widgeon and the principal diving duck species observed was scaup. The relative abundance in 1989 of the five species of dabbler broods is the same as that recorded during annual production surveys from 1983 through 1987.

The total production estimate for all species in 1989 on the Nowitna NWR (excluding rivers and streams) is 4209 ducklings (Table 6). The confidence intervals for this estimate at the 90% level is 14.5% (3599-4819 ducklings). Production estimates were highest for American widgeon (1427 ducklings), scaup (859 ducklings), and green-winged teal (354 ducklings). Confidence levels for species estimates ranged from $\pm$9.3% to 102.6% at the 80% level.

Production estimates for each stratum are presented in Tables 7 and 8. Observed densities (ducklings per 100 wetland acres) are presented in Tables 9 & 10. As in 1988, production estimates were highest in the Nowitna Floodplain and the Upland strata. The large proportion of production found in the Upland stratum is basically a function of the large number of wetlands and total acreage in this stratum. Observed densities in the Upland stratum are actually among the lowest on the refuge while densities in the Nowitna Floodplain, particularly in the non-bog wetlands, are the highest. The influx of nutrients from seasonal flooding on the Nowitna River and the enhancement of invertebrate populations due to changes in water levels in these wetlands contribute to the increased productivity in the Floodplain stratum. Densities were greater in Non-Bog wetlands than in Bog wetlands in all strata.

Average brood sizes for most species declined in 1989 (Table 11). A similar decline was noted for dabblers last year. Loranger (1988) suggested that this may in part be attributed to reduced clutch sizes and/or duckling survival among overflight ducks which normally nest in Canada but were forced to migrate to Alaska because of severe drought. In 1989 the lower brood sizes may, however, be related to the timing of the survey. Because only one survey was scheduled, it was timed to include a substantial proportion of class II broods.

In the past, two surveys have been conducted, one early and one late, and the early survey has been used when comparing brood sizes between years.

Table 5. Number, average brood size and age class of duck broods observed during production surveys on the Nowitna NWR, Alaska, 1989.

Species	Class I		Class II		Class III		Broody Hens	Total Broods	Total Average Size
	N	Size	N	Size	N.	Size			
Wigeon	63	5.30	32	4.03	7	2.71	32	134	4.73
G-W Teal	16	5.56	12	5.25	2	4.00	14	44	5.33
N. Pintail	4	2.75	8	3.00	11	4.73	9	32	3.78
N. Shoveler	4	3.25	17	4.88	0	0.00	4	25	4.57
Mallard	4	4.75	12	3.75	0	0.00	6	22	4.00
Dabblers	91	5.12	81	4.25	20	3.95	65	257	4.63
Scaup spp.	15	5.67	9	6.22	0	0.00	2	27	5.72
Goldeneye spp.	9	7.11	5	4.00	2	1.00	0	16	5.37
Bufflehead	3	4.00	3	3.67	0	0.00	1	7	3.83
Redhead	3	5.67	0	0.00	0	0.00	1	4	5.67
Divers	30	5.93	17	5.12	2	1.00	4	53	5.44
Surf Scoter	1	6.00	0	0.00	0	0.00	1	1	6.00
W-W Scoter	9	5.89	4	5.75	0	0.00	0	17	5.58
Unknown	7	3.00	12	1.80	1	1.00	0	33[a]	3.70
TOTALS	138		114		23		70	361	3.83

[a]Total includes broods of unidentified species and age class

Bio. Tech. Steve Blatt (Top). Pintail hen (Center).

Pete DeMatteo "Cruising" on a duck plot.

Table 6. Estimated production by species for the Nowitna NWR, Alaska, 1989.

Species	No. Ducklings	Percent of Total	90 % CI	80 % CI
American Wigeon	1427	33.9	1156-1698 (=19.0 %)	1216-1638 (=14.7 %)
Mallard	108	2.6	72-144 (=33.6 %)	80-136 (=25.9 %)
Northern Pintail	153	3.6	99-207 (=35.3 %)	111-195 (=27.4 %)
Green-winged Teal	354	8.4	168-540 (=52.5 %)	210-498 (=40.6 %)
Northern Shoveler	205	4.9	181-229 (=11.7 %)	186-224 (=09.3 %)
Total Dabblers	2247	53.4		
Scaup spp.	859	20.4	509-1209 (= 40.7 %)	586-1132 (=31.8 %)
Goldeneye spp.	240	5.7	132-312 (= 45.0 %)	156-324 (=35.0 %)
Bufflehead	40	0.9	11-69 (= 72.5 %)	17-63 (=57.5 %)
Redhead	151	3.6	0-350 (=131.7 %)	0-306 (=102.6 %)
Total Divers	1290	30.6		
White-winged Scoter	140	3.3	77-203 (= 45.0 %)	91-189 (=35.0 %)
Surf Scoter	10	0.2	2-18 (= 80.0 %)	4-16 (=60.0 %)
Total Sea Ducks	150	3.5		
Unidentified Ducks	522	12.4	312-732 (= 40.2 %)	359-685 (=31.2 %)
TOTAL	4209		3599-4818 (= 14.5 %)	3734-4684 (=11.3 %)

Table 7. Estimated production of dabbling duck species by stratum, Nowitna NWR, Alaska, 1989.

Stratum	No. Ducklings MALL	TEAL	AGWT	NSHO	NOPI	1989 TOTAL	1988 TOTAL
Nowitna Floodplain							
Connected Oxbow	33	92	43	9	33	210	332
Non-Bog Wetland	52	549	201	177	77	1056	4524
Bog Wetland	17	38	44	0	17	116	495
Yukon Floodplain							
Non-Bog Wetland	6	120	9	14	0	149	569
Bog Wetland	0	0	0	0	0	0	777
N.W. Basin							
Non-Bog Wetland	0	40	7	5	26	78	1171
Bog Wetland	-	-	-	-	-	-	-
Upland							
Non-Bog Wetland	0	130	0	0	0	130	4171
Bog-Wetland	0	188	0	0	0	188	630
Other Floodplain							
Non-Bog Wetland	0	269	45	0	0	583	852
Bog Wetland	0	0	0	0	0	0	0
Large Lakes							
Yukon Lake	0	0	0	0	0	0	134
Round Lake	0	1	5	0	0	6	21
TOTALS	108	1427	354	205	153	2247	13687

Banded white-fronted goose.

Fireweed bloom.

Table 8. Estimated production of diving duck species by stratum and wetland type for the Nowitna NWR, Alaska, 1989.

Stratum	No. Ducklings REDH	SCAUP	GOLD	BUFF	1989 TOTAL	1988 TOTAL
Nowitna Floodplain						
Connected Oxbow	0	0	4	8	12	58
Non-Bog Wetland	7	71	99	30	207	734
Bog Wetland	0	41	48	0	89	37
Yukon Floodplain						
Non-Bog Wetland	0	19	35	0	54	305
Bog Wetland	30	0	0	0	30	135
N.W. Basin						
Non-Bog Wetland	0	53	0	0	53	195
Bog Wetland	-	-	-	-	-	-
Upland						
Non-Bog Wetland	114	298	37	0	449	1029
Bog-Wetland	0	358	17	0	375	392
Other Floodplain						
Non-Bog Wetland	0	0	0	0	0	109
Bog Wetland	0	0	0	0	0	0
Large Lakes						
Yukon Lake	0	0	0	0	0	56
Round Lake	0	19	0	2	21	86
TOTALS	151	859	240	40	1290	3211

Table 9. Observed duckling densities of dabbling duck species by stratum for the Nowitna NWR, Alaska, 1989.

Stratum	Duckling Density MALL	AMWI	TEAL	No. Ducklings/100 wetland acreas NSHO	NOPI	1989 TOTAL	1988 TOTAL
Nowitna Floodplain							
Connected Oxbow	3.3	9.2	4.3	0.9	3.3	21.2	33.5
Non-Bog Wetland	1.4	12.5	4.4	3.9	1.7	23.2	56.5
Bog Wetland	0.7	1.5	1.8	0.0	0.7	4.8	7.9
Yukon Floodplain							
Non-Bog Wetland	0.9	17.7	1.3	2.0	0.0	21.9	67.3
Bog Wetland	0.0	0.0	0.0	0.0	0.0	0.0	13.1
N.W. Basin							
Non-Bog Wetland	0.0	4.9	0.8	0.6	3.3	9.7	60.0
Bog Wetland	-	-	-	-	-	-	-
Upland							
Non-Bog Wetland	0.0	1.7	0.0	0.0	0.0	1.7	34.3
Bog-Wetland	0.0	2.4	0.0	0.0	0.0	2.4	4.1
Other Floodplain							
Non-Bog Wetland	0.0	19.6	3.2	0.0	0.0	22.9	60.8

Table 10. Observed duckling densities of diving duck species young by stratum, Nowitna NWR, Alaska, 1989.

Stratum	Duckling Density REDH	SCAUP	GOLD	BUFF	Ducklings/100 Wetland Acreas 1989 TOTAL	1988 TOTAL
Nowitna Floodplain						
Connected Oxbow	0.0	0.0	0.4	0.8	1.2	5.8
Non-Bog Wetland	0.1	1.6	2.2	0.7	4.6	8.3
Bog Wetland	0.0	1.7	2.0	0.0	3.7	2.1
Yukon Floodplain						
Non-Bog Wetland	0.0	2.9	5.1	0.0	8.0	33.6
Bog Wetland	1.6	0.0	0.0	0.0	1.6	5.7
N.W. Basin						
Non-Bog Wetland	0.0	6.6	0.0	0.0	6.6	24.9
Bog Wetland	-	-	-	-	-	-
Upland						
Non-Bog Wetland	1.5	3.9	0.5	0.0	5.9	8.3
Bog-Wetland	0.0	4.5	0.2	0.0	4.7	2.8
Other Floodplain						
Non-Bog Wetland	0.0	0.0	0.0	0.0	0.0	14.5
Bog Wetland	0.0	0.0	0.0	0.0	0.0	0.0
Large Lakes						
Yukon Lake	0.0	0.0	0.0	0.0	0.0	10.0
Round Lake	0.0	9.3	0.0	1.0	10.3	41.9
TOTALS	151	859	240	40	1290	3211

Wolf Lake, on oxbow off the Nowitna River.

Recreational opportunities on the refuge include pike fishing.

Table 11. Brood density, average brood size, and estimated duckling production in 1987, 1988, and 1989 in the Nowitna Floodplain, Yukon Floodplain and Northwest Basin Strata, Nowitna NWR, Alaska.

	Broods/100 wetland acres			Average Brood Size			Ducklings/100 wetland acres[2]		
Species	1987	1988	1989	1987	1988	1989	1987	1988	1989
Mallard	1.0	0.7	0.4	5.6	4.5	4.0	5.6	3.1	1.6
A. Wigeon	2.0	2.2	2.0	5.9	5.1	4.9	11.8	11.2	9.8
G.W. Teal	1.2	0.8	0.7	4.8	4.4	5.4	5.8	3.5	3.8
N. Shoveler	0.4	0.5	0.4	5.3	5.5	4.6	2.1	2.7	1.8
N. Pintail	1.6	1.0	0.5	5.4	4.0	3.8	8.6	4.0	1.9
Total Dabblers	6.0	5.3	4.0	5.5	4.8	4.8	33.0	25.4	19.2
Redhead	<0.1	-	<0.1	7.0	-	5.5	0.1	-	0.1
Canvasback	-	<0.1	-	-	7.0	-	-	0.1	-
Scaup	0.4	0.3	0.3	6.5	8.0	6.7	2.6	2.4	2.0
Goldeneye	0.1	0.2	0.2	5.6	7.2	5.6	0.6	1.4	1.1
Bufflehead	0.1	0.2	0.1	3.4	6.4	3.8	0.3	1.3	0.4
Total Divers	0.6	0.8	0.7	5.9	7.3	5.8	3.5	5.8	4.1
W.W. Scoter	0.3	-	0.2	6.0	-	5.1	1.8	-	1.0
Black Scoter	-	<0.1	-	-	3.0	-	-	0.1	-
Surf Scoter	0.1	0.1	<0.1	5.2	7.9	6.0	0.5	0.8	0.1
Total Sea Ducks	0.5	0.2	0.3	5.8	7.4	5.2	2.9	1.5	1.6

[1] Includes broody hens
[2] Avg. brood size * brood density = duckling density

Generally, the early survey will contain a large proportion of Class I broods (last year 85%) and this will skew average brood size upward. The proportion of Class I and Class II broods in the 1989 survey was 50% and 41%, respectively. Consequently, it is nearly impossible to compare this year's average brood sizes to past years.

Estimated hatch dates derived from the 1989 survey were slightly later than those reported in 1988 (Table 12). Although both years were considered to have early springs, the extensive flooding on the Yukon and lower Nowitna floodplains likely delayed nesting in some areas and precluded it altogether in others. Despite the reduction in the number of broods, the pattern of hatch remained the same for dabblers with northern pintails being the earliest nester followed by northern shovelers and mallards. The peak hatch period for wigeon and green-winged teal was late June to early July.

A comparison of duckling production in 1988 and 1989 is presented in Table 13. The production estimate in 1989 is substantially lower than that in 1988 and is the lowest ever recorded. The dramatic decline in production is due in part to severe flooding experienced along the Yukon and lower Nowitna floodplains. Observed densities (ducklings/100 wetland acres) of dabbling duck species dropped from 60.0 to 9.7 in the Northwest Basin stratum and from 80.4 to 21.9 in the Yukon Floodplain stratum. In other parts of the Interior where severe flooding occurred similar declines were noted. The Koyukuk NWR, for example, reported a 68% decline in duck production in 1989.

Unfortunately, direct comparisons between the 1989 survey and earlier surveys is difficult as explained above. A comparison of productivity between 1987 and 1989 is presented in Table 11. Data for these estimates were taken from early surveys in 1987-88 and the single survey in 1989 and do not include the Upland and Other Floodplain strata. Productivity is reported as ducklings per 100 wetland acres and is simply the product of brood density and average brood size. This comparison also depicts an overall decline in production but not of the magnitude shown when using density ratio estimates (Table 13).

While it is evident that waterfowl production on the Nowitna NWR was greatly reduced in 1989, differences in the methodology of the brood surveys make it difficult to estimate the size of the decline. This problem highlights the need for a standardized approach to the collection of data and their subsequent analysis.

Table 12. Mean hatch dates on the Nowitna NWR, Alaska, 1989.

Species	Mean Hatch Date 1983-86	1987	1988	1989
Mallard	1 July	21 June	19 June	23 June
American widgeon	2 July	2 July	29 June	30 June
Green-winged teal	6 July	2 July	26 June	1 July
Northern Shoveler	10 July	23 June	18 June	21 June
Northern Pintail	1 July	18 June	13 June	13 June
Redhead	-	-	27 June	20 July
Canvasback	-	-	26 June	-
Scaup spp.	8 July	12 July	6 July	8 July
Goldeneye spp.	1 July	3 July	28 June	28 June
Bufflehead	10 July	14 July	26 June	30 June
Scoter spp.	1 July	8 July	4 July	3 July

Table 13. Estimated duckling production in 1988 and 1989 on the Nowitna NWR, Alaska.

Species	1988	1989	% Change	Percent of Total Production 1988	1989
Mallard	3204	108	-96.6	18.7	2.6
American Widgeon	4720	1427	-69.8	27.5	33.9
Green-winged Teal	2424	354	-85.4	14.1	8.4
Northern Shoveler	716	205	-71.4	4.2	4.9
Northern Pintail	2623	153	-94.2	15.3	3.6
Total Dabblers	13687	2247	-83.6	79.8	53.4
Redhead	35	151	+331.4	0.2	3.6
Canvasback	9	0	-900.0	<0.1	0.0
Scaup spp.	1977	859	-56.5	11.5	20.4
Goldeneye spp.	637	240	-62.3	3.7	5.7
Bufflehead	553	40	-92.7	3.3	0.9
Total Divers	3211	1290	-59.8	18.7	30.6
Total Ducklings[1]	17140	4209	-75.4		

[1]Total includes seaducks and unidentified species

Volunteer Heather Johnson during a brood survey.

Refuge aircraft fleet parked at the Galena dock, Alexander Lake. At left, N714KH the Nowitna NWR Cessna 185. Center, a charter C-206 used for the brood survey. At right, N4343, the Koyukuk NWR Super Cub.

C. Swan Surveys

The Nowitna refuge falls within the trumpeter swan survey area censused at five-year intervals during the Alaska Statewide Trumpeter Swan Survey. A sub sample of this area has been aerially surveyed each year since 1986 in an effort to determine trends in swan abundance and distribution. Aerial surveys have been supplemented with a ground survey and incidental observations to confirm species identification (no tundra swans have been seen on the refuge since 1986).

In 1989 Aerial surveys were flown using the standardized methods with a float-equipped Cessna 185. Parallel transects were flown at altitudes of 500-600ft. A single observer records data directly on a 1:63,360 topographic map. All potential swan habitat within the survey unit was surveyed.

The spring survey was conducted June 12-14 and the fall survey August 23-24. All accessible wetlands on which swans were observed during the spring survey were revisited during the summer to confirm species identification. Auditory, morphological and behavioral characteristics were used for identification.

Totals of 144 swans and 35 nests were recorded during the spring survey (Table 15). These results are similar to 1988 when 182 swans and 35 nests were observed. The difference in total numbers can be attributed to a decline in the number of flocked birds observed, from 38 in 1988 to 8 in 1989. It is interesting to note that the number of active nests (35) has been the same for the three consecutive years. Average clutch size was 3.25 eggs/nest and nest density was 1/25.9 square miles.

Only four maps were sampled during the fall survey and 90 swans, 50 juveniles and 40 adults were observed (Table 15). This accounts for a 25% decline when compared to the 1988 survey; however, the number of broods increased from 9 to 11. Brood density averaged 1/48.2 square miles and production averaged 3.64 cygnets/brood.

4. Marsh and Waterbirds

Lesser sandhill cranes, Arctic and common loons, and horned and red-necked grebes are all confirmed nesters on the refuge. Yellow-billed loons are an occasional visitor. Seventeen red-necked grebe broods, 3 horned-grebe broods, and 3 common loon broods were observed during the 1989 duck production survey.

Trumpeter swan eggs.

A total of 35 active nests of trumpeter swans has been observed from 1987 to 1989 on the Nowitna NWR.

Table 14. Results of the 1989 spring swan survey, Nowitna NWR, Alaska.

Survey Unit	Singles	Pairs	Nests	Flocked Swans	Adult Swans	Juvenile Swans	Total Swans
Ruby B-3	0	4	4	0	8	0	8
Ruby C-3	1	17	10	0	35	0	35
Ruby C-4	2	8	5	0	18	0	18
Ruby D-2	9	1	3	0	11	0	11
Ruby D-3	2	14	6	5	35	0	35
Ruby D-4	0	8	5	3	19	0	19
Melozitna A-1	4	5	1	0	14	0	14
Melozitna A-2	0	2	1	0	4	0	4
Total	18	59	35	8	144	0	144

Table 15. Results of the 1989 fall swan survey, Nowitna NWR, Alaska.

Survey Unit	Singles	Pairs	Broods	Flocked Swans	Adult Swans	Juvenile Swans	Total Swans
Ruby B-3	0	4	1	0	4	4	8
Ruby D-3	1	24	5	0	25	16	41
Ruby D-4	1	20	5	0	21	20	41
Melozitna A-2	0	0	0	0	0	0	0
Total	2	48	11	0	50	40	90

5. Shorebirds, Gulls, Terns and Allied Species

The Charadriiform species that have been reported on the refuge are: common snipe; whimbrel; western, semipalmated, least, pectoral, spotted, Baird's, and solitary sandpipers; lesser and greater yellowlegs; golden, black-bellied, semipalmated, and upland plovers; long-billed dowitcher; and northern phalaropes. Mew, herring, and Bonaparte's gulls are common, as are Arctic terns and long-tailed jaegars. No active survey or studies are being conducted to assess population distribution or status of the species.

6. Raptors

The refuge supports a diverse raptor population, including northern harriers, rough-legged hawks, red-tailed hawks, goshawks, sharp-shinned hawks, golden and bald eagles, and great-horned, great gray, boreal, short-eared and hawk owls. Probable nesters include the osprey, American kestrel, merlin, peregrine falcon, and snowy owl. Swainson's hawks and gyrfalcons are occasional visitors. No active assessment program is underway for these species.

7. Other Migratory Birds

A diverse group of migratory bird species use the refuge throughout the spring and summer months. Of the 50 passerines occurring on the refuge, the most commonly observed are Swainson's and grey-cheeked thrushes; yellow-rumped and blackpoll warblers; tree, white-crowned, and Savannah sparrows; and cliff, barn, and tree swallows. Common non-passerine birds nesting on the refuge include the belted kingfisher and downy and hairy woodpeckers.

The number of bird species using the refuge declines from 145 to 28 during the winter months. Most wintering birds are passerines, and of these, ravens, gray jays, redpolls, black-capped and boreal chickadees and pine grosbeaks are the most commonly observed.

8. Game Mammals

Moose, black and grizzly bear, wolf, marten, beaver, wolverine, lynx, otter, red fox, and snowshoe hare are found throughout the refuge. Moose and black bear are the most commonly harvested game mammals. Marten are the most economically important furbearers. Incidental observations by refuge personnel and reports from trappers indicate that the refuge snowshoe hare population is increasing.

Our one amphibian Boreal Woodfrog.

Wild Irises.

A. Moose

Moose are present throughout the refuge, their highest densities occurring along the lower Nowitna river drainage. The refuge moose population is an important subsistence resource for local residents and an important recreational resource for non-local Alaskans.

Moose hunting during September represents the greatest portion of the refuge's public use.

In 1980 and 1986 censuses were conducted on the refuge to estimate the total moose numbers and the sex and age composition. Since 1980 annual surveys of trend areas have been conducted to asses the relative abundance and demographics of the population.

In addition, a telemetry study to determine the extent, timing, and causes of mortality in calves was initiated in the spring of 1988. Additional objectives of this study are: 1) to determine the relative importance of various sources of moose calf mortality, including predation, disease/malnutrition, and accidents; 2) to assess the effects of varying snow conditions on overwinter survival of refuge calves; and 3) to determine habitat use, movements, and seasonal distribution of calf-cow pairs.

In 1980 and 1986 the entire refuge was censused to describe the distribution, abundance and demographics of the Nowitna moose population. The 1980 and 1986 surveys were based on the standardized techniques and procedures described by Gasaway et al. (1986). In 1980, 1982, 1983, and 1985 through 1989 aerial trend surveys were used to describe relative abundance and composition of the herd. The quantity of habitat surveyed in the annual trend area surveys varied from year to year and was dependent upon survey conditions (primarily snow cover). A comprehensive analysis of trend information collected since 1980 was conducted in 1989. A progress report entitled "Population demographics of the Lower Nowitna NWR Moose Population 1980-1989" was prepared. A summary of the report follows.

A comparison of moose abundance between the 1980 and 1986 population censuses described a significant decrease in the abundance of moose in the study area, from a 1980 estimate of 1390 ($\pm$27%) down to 783 ($\pm$28%) in 1986.

Bear killed collared moose calf.

Pete DeMatteo with collared moose calf.

The average trend survey area was 93 square miles (range 39-143 square miles). Between 1986 and 1989 the moose trend area density has increased from 1.44/square mile to 1.92/square mile. However, while the density of female moose has increased from 1.1/square mile in 1980 to 1.7/square mile in 1989 the density of male moose has not changed. The total number of males per 100 females declined from 37 in 1980 to 21 in 1989. With the exception of 1987, when 40 males per 100 females was observed, the decline has been consistent over time. Regression analysis of moose densities project a significant positive correlation with total moose density over time ($r=0.71$, $p=0.05$) and a negative correlation in the ratio of males to females ($r=-0.51$, $p > 0.10$). These surveys, by providing age and sex information, describe a population with an increasing female component, while the proportion of males in the population is declining.

Annual variability in the recruitment of young, (calves and yearlings) into the population accounts for much of the annual variation in the density estimates. The density of calves has averaged .46/square mile since 1980 and the density of yearlings averaged .24/square mile. Comparisons of the percentage of calves to yearlings (20% calves to 11%) suggest an average loss of calves of about 9% (Table 16).

Table 16. Density, herd composition and adult age structure of the lower Nowitna river moose population, based on annual trend area surveys.

	area		Density (#/mi^2)				Composition (%of herd)				Adult sex ratio	
Year	(mi^2)	moose	Total	males	females	yrlngs	calves	males	females	yrlngs	calves	males/100females
1980	39	78	2.0	.31	1.1	.25	.38	16	53	13	19	37
1982	66	114	1.7	.15	1.0	.36	.21	8	57	21	12	28
1983	63	148	2.4	.40	1.2	.16	.61	17	50	7	26	38
1985	106	186	1.7	.25	1.3	.09	.08	14	75	5	5	22
1986	108	221	2.0	.24	1.2	.07	.53	12	58	4	26	23
1987	129	330	2.6	.36	1.2	.37	.69	14	45	15	27	40
1988	92	260	2.8	.20	1.6	.43	.63	7	55	15	22	23
1989	143	391	2.7	.25	1.7	.26	.54	9	61	10	20	21
means	93	216	2.2	.27	1.3	.24	.46	12	57	11	20	29

In comparing the structure of this population with one recently described as "abundant and vigorous" on the nearby Koyukuk Refuge several differences are obvious. The percentage of males (adults and yearlings) comprising the Nowitna population has declined from a 1980 high of 22% to 14% in 1989 while on the Koyukuk Refuge, males comprise over 40% of the population. On the Koyukuk Refuge the total number of males per 100 females has averaged 73.

Recruitment of calves to yearlings, and recruitment of yearlings to the adult segment of the Nowitna moose population has been variable over time. The annual calf component (as determined from fall surveys) on the Nowitna Refuge averages 20% and is nearly identical to the 19% average fall calf component of the Koyukuk Refuge. However, results of the annual trend area surveys have documented several consecutive years of poor recruitment from the yearling age class. The average number of yearling males per 100 females on the Koyukuk Refuge from 1987 through 1989 was 17. Low yearling bull to cow ratios would suggest a juvenile biased source of mortality.

Comparisons between the average calf component (20%) and the average yearling component (11%) suggest an average annual loss between these two age classes of about 9%. The respective values for the Koyukuk Refuge (19% calves, 14% yearlings) suggest a greater rate of loss between these two age classes for the Nowitna population. The affects of the slightly greater loss from this cohort on the Nowitna Refuge remain unknown.

An average of 43 male moose have been harvested annually since 1980 within a proposed moose study area. This harvest represents an average minimum mortality of 21% of adult male moose component of the Nowitna Moose population based on an average population estimate of 1,148 and an average male component of 18%. The Alaska Department of Fish and Game has recently proposed amending the recreational moose hunting regulations to reduce the length of the September hunting season by 25%, in an effort to reduce the male moose sport/subsistence harvest.
Considering the analysis of available information on the abundance and sex-and age class composition of the Nowitna moose population, we conclude that, although the population has shown signs of increasing in abundance, that a decrease in the proportion of males may identify obstacles to the future growth of the population. Predation has been identified as a source of significant calf mortality. Sources of non-calf mortality, other than human harvest, have not been studied. The structure of the population, (declining proportion of males and low recruitment rates) suggests a male and/or juvenile biased source of mortality.

A research project to identify the causes and extent of moose mortality among the adult moose has been formulated.

Annual trend area surveys will be continued, with a minimum sample effort equal to that in 1989. The addition of several sample units in moderate moose density habitat may increase the ability to detect changes in the abundance of the population, since the decline in moose abundance described by

Loranger in 1986 is not evident from the current trend data. The next refuge wide census is scheduled for 1990. This census will provide the best information on the status of the Nowitna moose population.

In response to the observed decline in the Nowitna moose population in 1986, the refuge initiated a telemetry study to identify the causes and extent of moose calf mortality and to determine if calf mortality could be responsible for the observed decline in the population. Preliminary results of this study have identified high rates of calf mortality (44%-68%), principally attributable to black bear predation in the fall and wolf mortality over winter (Table 17). However, analysis of annual fall moose trend area data indicate that adequate numbers of calves (8 year average = 20% calves in the fall population) are entering the adult (non-calf) moose population. Expected annual rates of adult moose mortality, reported from 0.07 to 0.26 (Mytton and Keith 1981, Hauge and Keith 1981, Larsen et al. 1989 and Bangs et al. 1989) would suggest that calf mortality is not limiting growth in this population.

Table 17. Nowitna NWR Calf Moose Mortality.

	Total Predation Percent	Black Bear	Brown Bear	Wolf	Other Unk. Causes	Sample
1988	62	4(10%)	15(36%)	1(2%)	6(14%)	42
1989	69	4(9%)	20(43%)	1(2%)	7(15%)	47

Several known sources of mortality are removing moose from the Nowitna population. Immediately upon parturition, predation (principally, black bear) begins removal of about 55% of a cohort by early fall. Over winter mortality, principally by wolves, may remove an additional 10% of that years calf production. We presently have no data indicating a sex bias in calf mortality. Human harvest begins removing about 10-15%/per year of the males out of that same cohort. Clearly, several mortality factors are acting in concert to reduce the size of each cohort to a level where population growth could be limited. The recent increase in the abundance of moose on the Nowitna Refuge can be explained only as a result of an increase in the abundance of females or possibly poor sampling. Sources of non-human mortality in age classes other than calves have not been identified or quantified.

Studies of the dynamics of moose populations have described several factors capable of affecting moose abundance. Brown bears, back bears, and wolves have been identified as predators capable of limiting population growth. Human harvest has been identified as a source of mortality capable of limiting moose populations. Environmental conditions and habitat quality have also been identified as variables affecting moose populations (usually in the absence of large predators).

Uncollared cow moose with calf.

B. Black Bear

Black bear densities on the refuge are believed to be high. They are commonly observed along rivers and in lowland areas. Black bears were the major predator on moose calves on the refuge in 1989, killing 24 of the 49 radio-collared calves. Of all losses due to predation, 83% were attributed to black bears.

Black bears are occasionally harvested in the spring and summer by local residents, especially in the vicinity of fishcamps. Most harvest occurs in September, coincidentally with moose hunting.

C. Brown Bear

Brown bears occur throughout the refuge, but are less numerous than black bears. Highest densities occur in the foothills of the Kuskokwim Mountains located in the southern portion of the refuge. The Kokrine Hills on the northern border support moderate brown bear densities, and salmon runs in the Yukon River and its tributaries attract some of these bears during the summer months. One of 49 radio-collared moose calves killed by predators were taken by grizzly bear during the summer of 1989.

Grizzly bear harvest generally occurs during the summer months and during the September moose season. Alaska Fish and Game reported that no brown bears were legally harvested on the Nowitna during 1989.

D. Furbearers

Twelve species of furbearers regularly occur on the Nowitna NWR: marten, mink, beaver, lynx, otter, red fox, wolverine, muskrat, red squirrel, short-tail weasel, coyote and wolf. All species are harvested by refuge trappers however marten are by far the most economically important. Arctic ground squirrels and least weasels, species trapped in other parts of Alaska, are present on the refuge but are not harvested by local trappers.

E. Marten

The Nowitna region is considered by many to be some of interior Alaska's premier marten habitat. Marten harvest on the refuge has ranged from approximately 500 to 1000 animals annually. As many as 18 trappers, most from Ruby and Tanana, have active traplines on the refuge, though not all may trap in a given year.

Black bears are numerous on the Nowitna NWR, and are the primary predator on moose calves in the spring.

Red foxes are important refuge furbearer and may be an important predator governing waterfowl production.

Because there are no sealing requirements for marten in Interior Alaska, virtually no accurate information is available on annual harvests. To obtain long-term information on the demographics of the marten population and the level of harvest intensity, the Nowitna Refuge began purchasing marten skulls from refuge trappers in 1987. Tooth sectioning and analysis of cementum annuli and radiographs are being used to age animals. Trapper questionnaires are providing estimates of annual trapping effort. It is hoped that this information can be used in concert with two proposed studies to develop a clear understanding of the relationship between harvest characteristics and the status of the Nowitna marten population.

Marten skulls from the 1988-89 harvest were purchased from four trappers. One of the traplines is located in the Telsitna River drainage, approximately 15 miles east of the refuge's southern boundary. Trappers were required to record the sex of each marten and the date it was trapped, and to attach a corresponding numbered tag to each marten skull. In addition, trappers were asked to complete a questionnaire at the end of the trapping season.

Initial aging of each skull was done using a field technique based on cranial muscle development (Magoun et al. 1988). The technique is still being refined but has proved to be very effective for identifying juveniles of both sexes. All skulls that could not be classified as juveniles and a random sample of skulls identified as juveniles were aged via tooth analysis. A canine and second premolar was extracted from each skull and sent for sectioning and age determination by cementum analysis. Radiographs were used to identify juvenile animals prior to tooth sectioning.

Refuge trappers provided 295 skulls during the 1988-1989 trapping season. Trapline harvest among cooperating trappers ranged from 25 to 135 marten (Table 18). Trapper assessment of environmental conditions ranged from poor to excellent. Despite some extremely cold periods most trappers were able to run their lines throughout the entire season.

The age distributions of marten harvested during the 1988-89 season are presented in Table 19. The oldest animals caught were two 13-year old females and the oldest male was a 12-year old. Juveniles accounted for most of the harvest (77%) while yearlings appear to be under represented (7.0%). The overall sex ratio was (M:F) 1.3 : 1 and trapline ratios ranged from 1.1 to 2.1 (Table 13). The ratio of juveniles to females $\geq$ 2.5 years old was 10.8 : 1 and the ratio of juveniles to females $\geq$ 1.5 years old was 7.8 : 1.

Table 18. Total number and sex-and age ratios of marten harvested by four trappers during the 1988-89 trapping season, Nowitna NWR, Alaska.

		Ratios in harvests				
Trapper Number	Total Marten	Males/ female (all ages)	Males/ female (both ≥ 1.5 yr.)	Juveniles per female ≥ 2.5 yr.	Juveniles per female ≥ 1.5 yr.	% Juveniles
01	25	1.8	1.0	0.0	23.0	92
05	135	1.1	2.0	22.8	16.3	84
06	110	1.4	0.9	6.0	4.6	71
07	25	2.1	2.2	4.0	3.0	48
Combined Total	295	1.3	1.3	10.8	7.8	77

Table 19. Age distributions of marten harvested by four trappers during the 1988-89 trapping season, Nowitna NWR, Alaska.

	Age Class														
Trapper Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Males															
01	15	1	0	0	0	0	0	0	0	0	0	0	0	0	16
05	56	7	1	2	0	0	1	0	1	2	0	0	0	0	70
06	49	4	5	1	1	0	1	1	2	0	0	0	0	0	64
07	8	1	0	2	2	0	1	1	0	0	1	0	1	0	17
Total	128	13	6	5	3	0	3	2	3	2	1	0	1	0	167
Females															
01	8	1	0	0	0	0	0	0	0	0	0	0	0	0	9
05	58	2	2	1	0	0	2	0	0	0	0	0	0	0	65
06	29	4	5	2	1	1	1	0	1	0	0	0	0	2	46
07	4	1	1	0	1	0	0	0	1	0	0	0	0	0	8
Total	99	8	8	3	2	1	3	0	2	0	0	0	0	2	128
TOTAL	227	21	14	8	5	1	6	2	5	2	1	0	1	2	295

The use of sex and age ratios as indices of harvest intensity has been reviewed by Strickland and Douglas (1987). These investigators suggested that a harvest containing a low proportion of juveniles and a high proportion of adult females may be indicative of overharvest. The juveniles per female > 2.5 years old ratio of 10.8 in Nowitna NWR 1988-89 sample seems to indicate that harvest intensity was not excessive during this period. However, these ratios are difficult to interpret without information on the fecundity rate for the same period.

Archibald and Jessup (1984) suggested that a harvest in which the sex ratio is nearly equal or dominant to females probably indicates overharvest. The sex ratio from the traplines in our sample was 1.3 males to 1 female. This is somewhat lower than winter 1987-1988 and falls within the expected range for an exploited population (Loranger 1989). Given the observed age and sex ratios, the harvest intensity within the sampled areas is probably moderate. Because the bulk of this years sample came from only two traplines it is inappropriate to form any conclusions about harvest intensity on a refuge wide basis.

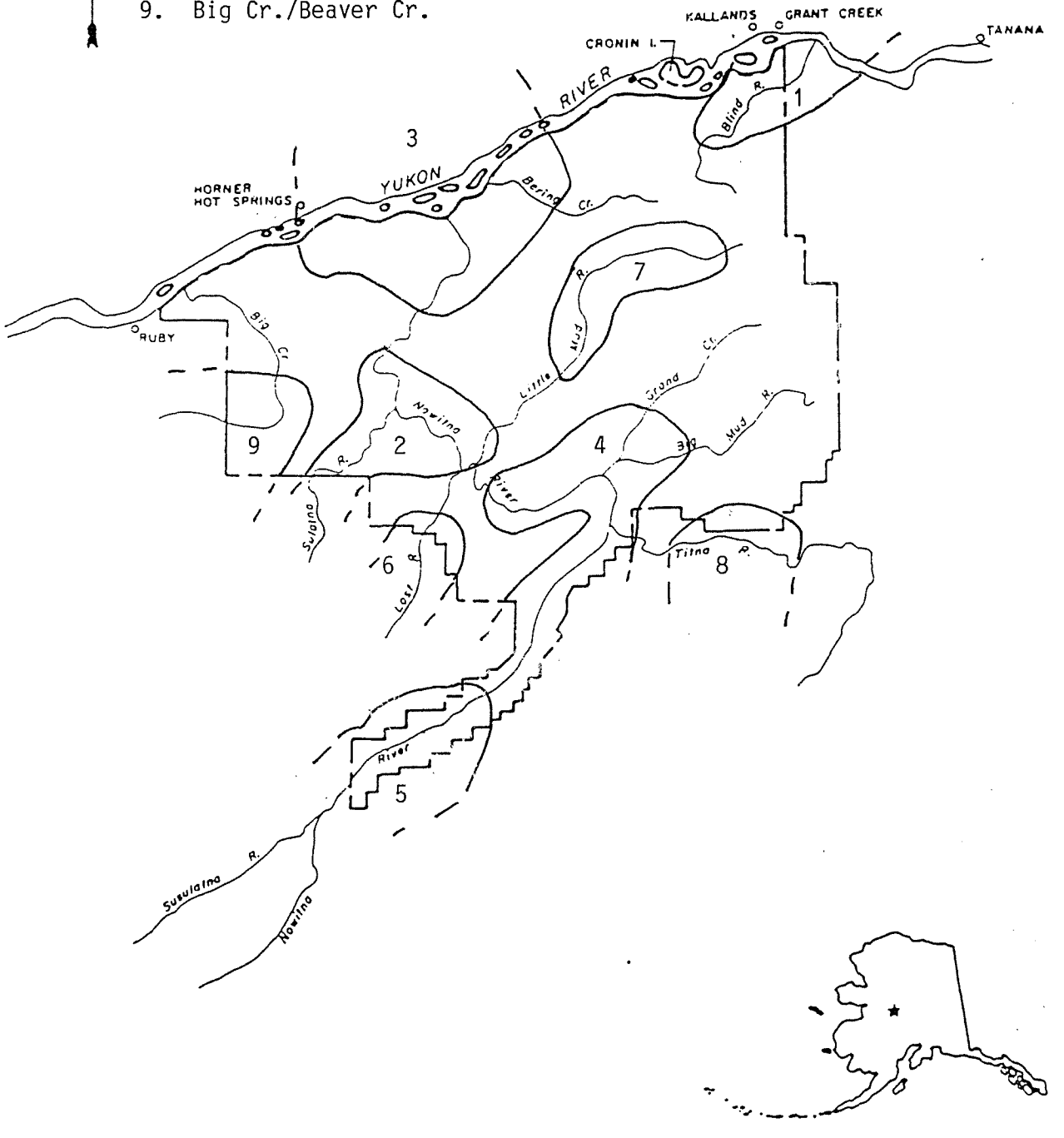
F. Wolf

Aerial wolf surveys conducted on the Nowitna in 1985, 1987, and 1988, generated estimates ranging from 52 to 74 wolves in 6 to 9 packs. Based on these estimates we've concluded that at least 52 wolves in 6-9 packs occupy territories in or partly in the refuge. This estimate was believed to be conservative and it was felt that the wolf population was either stable or increasing.

The 1989 wolf survey was conducted with a ski-equipped aircraft at 200-400 feet and air speeds of approximately 90-100 mph. The survey crew consisted of a pilot and observer. Flight lines were confined to the Nowitna and Yukon Rivers and their tributaries. Deviations from these flight lines were made to inspect smaller drainages when deemed appropriate. The tributaries surveyed included the Blind River, Klatsuta River, Bering Creek, Junekaket Creek, Twin Slough, Deep Creek, Big Creek, Beaver Creek, Flint Creek, Sulatna River, Lost River, Little Mud River, Big Mud River, Grand Creek, Titna River, Mastodon Creek, California Creek, Sulukna River, and Susulukna River. Also surveyed were major ridge lines in the Monzonite Hills and numerous creeks associated with larger tributaries. Whenever possible, fresh tracks were followed to visually locate wolf packs and/or kill sites. Quite often direct counts were not possible and packs were enumerated by counting individual tracks.

Figure 3. Estimated Wolf pack territories on the Nowitna NWR.

1. Blind R.
2. M. Nowitna/Sulatna R.
3. L. Nowitna/Yukon R.
4. Nowitna Canyon
5. U. Nowitna River
6. Lost River
7. Little Mud River
8. Titna River
9. Big Cr./Beaver Cr.



Total acreage within refuge: 2,060,000 ± Ac.

0 20 40 Miles

NOWITNA
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USFWS DIVISION OF REALTY ANCHORAGE, AK.

The first portion of the 1989 survey was flown on February 27th. However, the survey was then delayed until March 8th and was completed on March 9th. Because of the long period of time between surveys, the area covered during the first day was resurveyed on the 9th and the data from the first survey was not used. Thirty-five observations of tracks and/or wolves were recorded including sightings of two packs containing 17 individuals (one pack of 9, one of 8). Tracking conditions were good during most of the survey with approximately six inches of week-old snow and clear sunny conditions. Snow depths were estimated to average 36" over most of the refuge.

Estimated pack sizes based on observations during the 1989 survey are contrasted with those from 1988 in Table 20. The refuge wolf population estimate generated from the 1989 survey is 70 wolves in nine packs. The delineation of packs is somewhat arbitrary as territories cannot be established without repeated relocations of radio-marked animals. Some packs represented separately may actually be parts of larger packs, and conversely, some pack territories may contain two packs. However, over the years most activity noted during surveys has been within the areas defined as pack territories.

Table 20. Wolf pack territories and sizes on the Nowitna NWR, Spring 1988 and 1989.

Pack Territory	No. Wolves 1988	1989
1) Blind River	5+	5
2) Middle Nowitna River/Sulatna River	8	8
3) Lower Nowitna River/Yukon River	6	16[a]
4) Nowitna River "Canyon"	12	8
5) Upper Nowitna River	5	9
6) Lost River	5	12[b]
7) Little Mud River/Big Mud River	4	0
8) Titna River	2+	4
9) Big Creek/Beaver Creek	5	8
Total	52+	70

[a]Appeared to be two packs in 1989, one pack of 12 west of the Nowitna and one pack of 4 east of the Nowitna.
[b]This pack was located approximately 20 miles west of refuge and used only a small portion of the refuge.

Wolf activity observed in 1989 suggest similar pack territories (Figure 3) as those found in previous years. One of the visual observations made this year in the Nowitna Canyon territory was within a few miles of where wolves were observed in 1988. Both visual observations in 1989 were associated with moose kill sites and eleven moose kills were observed during the 1989 survey. Two estimates of territories did show some variations. For example, the Lower Nowitna/Yukon River area appeared to contain two packs in 1989, one on either side of the Nowitna River. Where as no wolf activity was noted previously around the Little Mud River.

Interpretation of the 1989 survey results is difficult because of incomplete data collection. Each observation made during the survey was indicated on a map but no information was included as to the estimated age of tracks or their direction. Although light and snow conditions were adequate, only two visual observations were made. To obtain results that will allow for year-to-year comparisons, it is important to use skilled observers with a good understanding of wolf behavior and the ability to read and interpret tracks. A radio telemetry study of the refuge wolf population planned for FY 90 will provide means to evaluate the accuracy and efficiency of the present survey methods and population estimates.

Based on recent survey results, we concur with Loranger (1988) that at least 52 wolves in 6-9 packs occupy territories within and adjacent to the Nowitna Refuge. Wolf numbers are undoubtedly higher than this estimate and the status of the population cannot be determined from survey results.

G. Beaver

Beaver populations in much of interior Alaska are presently high. They are common throughout the refuge; active beaver lodges were observed in the majority of wetlands surveyed during the 1989 duck production survey. Beaver is an important source of fur and food for local resource users. Pelts sold for approximately $50 in 1989, and beaver meat is highly prized and is a welcome change from moose in the diet of local residents.

H. Wolverine

Relatively little is known about the status of the refuge wolverine population. They are occasionally harvested by refuge trappers.

I. Lynx, Mink, Red Fox, and River Otter

The population status of these furbearer species have not been determined on the refuge. Population fluctuations are known to occur in accordance with fluctuations in prey species populations, primarily microtine rodents and/or snowshoe hare. All are occasionally harvested by refuge trappers.

11. Fisheries Resources

The Yukon River east of Ruby, which forms the refuge's northern boundary, is an important fishery for king and chum salmon. Coho salmon are a relatively small component of the salmon harvest, but are present. King salmon are used primarily for human consumption, and are sold either fresh or dried as strips. The Yukon River supports two chum salmon runs annually (summer and fall). This species is usually dried and used as food for dog teams, or sold commercially in Galena. Fall run chums are also used for human consumption.

The Nowitna River has historically supported king and chum salmon runs. Although preliminary surveys to indicate spawning king salmon in the Nowitna drainage have been unsuccessful, a few spawning king and chum salmon were located on the Titna River in 1988 during water quality work. Chums are known to spawn near the mouth of the Big Mud River (summer run) and in the Nowitna River above the Sulatna River (fall run). The main stem of the Nowitna River near the mouth of Our Creek is a suspected coho salmon spawning area.

Populations of Dolly Varden occur on the refuge and probably remain in freshwater throughout their life cycle. They are generally found in the upper reaches of streams with perennial water sources.

Sheefish found on the Nowitna Refuge are one of three non-anadromous Alaskan populations. Sheefish overwinter at the confluence of the Nowitna and Yukon rivers, and begin migrating up the Nowitna River at breakup to feeding areas. Spawning areas are located in the Sulukna River.

Northern Pike are abundant throughout the rivers, streams, and lakes on the Nowitna Refuge. These populations are generally quite old and growth rates are slow. Despite the present abundance of pike, they could easily be overfished because of low recruitment rates.

Other fish found on the refuge include round, broad, and humpback whitefish, Alaska blackfish, longnose sucker, burbot, least cisco, and Arctic grayling. Arctic grayling have been found throughout the Titna and California creek drainages.

Moose hunters from Tanana, Ruby, and Fairbanks, as well as a few other resident and non-resident hunters are the most significant public users of the refuge.

A moose hunter check station is operated at the mouth of the Nowitna River from Sept. 1-30 each fall in cooperation with Alaska Department of Fish and Game and refuge staff.

H. PUBLIC USE

2. Outdoor Classrooms - Students

In April the staff along with Koyukuk's Wildlife Biologist Bertram gave an EE presentation to the Galena 7th grade class.

Eleven EE programs were also presented by four staff members in December to classes in Galena, Kaltag, Ruby, and Koyukuk. Topics included predation, refuges and spring waterfowl hunting. Poor weather during the month prevented planned visits to Huslia, Hughes and Nulato.

6. Interpretive Exhibits/Denonstrations

The first general refuge brochure written by 1988 Biological Technician David Bloustrom was printed and delivery was taken in August 1989. The brochure is included at the back of this report.

The staff prepared and manned a refuge display at the Koyukon Jamboree held on October 15 and 16 in Galena. The exhibit featured a refuge map, slide shows, wildlife mounts literature, and raffles for adults and kids. In addition to agency and organization exhibits, this first-ever jamboree featured native sewing exhibits, workshops for young people, native games, two potlatches and two fiddle dances.

7. Other Interpretive Programs

Two radio programs were taped in November and December to provided information on refuge activities to the public. The radio station in Galena broadcasts to seven of the eight villages in or near the refuges. The first program dealt with a variety of issues but centered on the new policy of fire protection for permitted cabins on the refuge. The second program provided an overview of the moose populations and the past hunting season. Both programs were repeated several times over the course of the two days.

A Nowitna River Sheefish. The Nowitna has one of the state's three non-anadramous sheefish populations.

An oxbow along the Nowitna River near the Canyon.

8. Hunting

Subsistence and recreational hunting for moose in 1988 once again comprised a significant portion of the Nowitna NWR's public use. The refuge is a popular hunting area for Fairbanks residents who access the refuge by boat or floatplane. Only two air taxi operators were permitted to transport hunters to the Nowitna during the 1989 season. One of the operators (Tundra Air) transported seven moose hunters who harvested two moose.

A moose hunter check station at the mouth of the Nowitna River was staffed in cooperation with the Alaska Department of Fish and Game during the September 5-25 hunting season. The majority of hunters accessing the refuge do so via boat on the Nowitna River and consequently the check station is a natural place to contact hunters and obtain harvest estimates.

Table 21. Nowitna NWR Hunter check station data 1988-89.

	Harvest	#Hunters(Total)	Success rate	Parties
1988	56	178	31.1%	66
1989	49	234	21.0%	74

As was the case last year, this fall was characterized by warm temperatures during the early half of the season. The majority of the moose recorded at the check station were harvested later in the season.

9. Fishing

Northern pike and sheefish are the most sought after non-anadromous species by recreational fishermen on the refuge. Fishing pressure is light from June through August and is conducted primarily by floaters and fly-in anglers with float-equipped aircraft.

No formal surveys are conducted to assess fishing pressure on the refuge. Use of the Nowitna River by floaters is very light. Put-in and take-out points do not allow easy contacts with refuge staff. Unless we have incidental contact with floaters when working in the area, they go undetected.

I. Equipment and Facilities

2. Rehabilitation

Refuge headquarters received a much needed facelift this year. Both the Nowitna and Koyukuk staffs spent many hours preparing and painting the building in June. The results are obvious!

Former Quarters #9, commonly known as the "little house", was converted into a bunkhouse in August. This quarters has always been cramped for families, but makes a great bunkhouse.

Contractors arrived on June 6 to remove asbestos covering from pipes underneath the office and beneath the bunkhouse. The job was quickly completed and the contractors were on their way back to Anchorage the next day. The soil samples that were taken indicated asbestos particles were interspersed throughout the crawl spaces. Currently, funds aren't available to remove the contaminated soil. Asbestos signs have been posted and the staff made aware of the situation.

Florescent lights were installed in the shop/storage rooms in quarters 1-6.

3. Major Maintenance

The winter of '88-89 will always be a vivid memory for those members of the staff lucky enough to be in Galena! Sensaphones have been purchased for all quarters and have notified us on several occasions prior to the pipes freezing.

On 18 January, as the temperature continued to drop, a water pipe in the office burst and was quickly repaired. The furnace was running continuously and could only maintain a temperature of 45 F. A little known fact that was discovered during this cold spell is that paraffins in fuel oil gel at temperatures colder than -60 F., causing furnaces to quit! It was at this time that Koyukuk RM Nunn coined the term "using heaters to heat heaters". As the temperature plummeted to -88 F on January 27th (new North American record low), refuge operations came to a standstill. Everyone stood vigil over their furnaces praying that they wouldn't quit. The cold also took a severe toll on refuge trucks which included frozen batteries, broken gear shifts, u-joints, fan belts and circulating pumps. A gallon of anti-freeze was found in one truck frozen solid. In retrospect, it would have been much simpler if everyone would have stayed at home, watched their furnaces and weathered the storm. By months end, the temperature had risen to a scorching -45 F., but the residual cold had frozen the sewer pipe buried underneath the office. Eventually, this was unplugged with a strong dose of hot water.

It seems ironic, but at the time of this writing, it is -54 F and the sewer pipe is frozen. "Some things never change!"

On May 9th, while waiting in the dark for contractors to repair a severed underground power cable caused by frost heave, a D-8 Cat hit the side of the building, or so we thought! A quick inspection produced nothing but confusion. Reports indicated we had experienced an earthquake that measured 4.8 on the Richter scale and was centered "130 miles north of McGrath", which puts it about in the middle of Galena. Later that day, contractors turned the power back on only to have a main circuit breaker blow - literally. Pieces of hot breaker started a small grass fire beside the transformer behind the office and was extinguished immediately in compliance with the new DOI Fire Management Policy. While all this was going on, the Yukon River was threatening to flood! Eventually, the ice trickled slowly past Galena but not before flooding several hundred square miles of the refuge. A power outage, a grass fire, an earthquake and an impending flood, coupled with the coldest winter on record, sounds like the makings of a great country and western song!

Twenty-three loads of gravel were delivered between the six residences to widen driveways and fill holes caused by frost heave and snow melt.

4. Equipment Utilization and Replacement

Routine 100 hour inspections were regularly completed for Cessna 185, 714KH.

Major equipment received during the year include, six sensaphones, three Reddy forced air heaters, eight pair of binoculars and a fax machine.

Jim Bodkin (top) and Pete DeMatteo sprucing up the office.

Koyukuk/Nowitna Complex office.

5. Communications

A new telephone system was acquisitioned in December.

The fight for an adequate radio system has been exhausting. It was learned in November of '88 that the existing system was inoperable with existing equipment. The Regional Office informed us that we were given top priority and would have the system functional by mid-April. By early June, the repeater at Purcell Mountain was working giving us partial coverage of the north end of the refuge. Still, no communication from headquarters to the field was available. At months end, our system was interfering with the Innoko N.W.R.'s radio system. This problem was remedied and by the end of July the repeater on Totson Mountain was working, Purcell and Hill 2321 repeaters had failed though. On the 3rd of August, all three repeaters were serviced and we finally had communications to the field. The battle had been won, or so we thought! The base radio broke! Another field season had come and gone and radio communications was far from adequate. The saga continues...

J. OTHER ITEMS

1. Cooperative Programs

The request to salvage a B-17 aircraft which crash landed in 1940 in what is now in the Nowitna Refuge proceeded slowly during the year. An individual from Ruby, Alaska has placed a request to salvage the aircraft for the Flying Tigers Warbird Air Museum in Florida. Nothing can take place until the aircraft can be identified and crash records investigated. We did not get a positive ID on the aircraft during the year.

4. Credits

ARM Liedberg wrote sections A-E, and WB Johnson, Bertram, and FMO Granger wrote sections G,H,I, and J. RM Nunn wrote section K, RM Stearns and ARM/Pilot Spindler edited, and Pilot Brown assembled. Secretary's Honea and Lowe did the typing and finalized the text.

K. FEEDBACK

Nineteen hundred and eighty-nine was a year of extremes at Galena. The year began with new record low temperatures established for the North American Continent. During that two week period, every day life was very basic - first order of the day was survival.

Spring came and waterfowl pairs were everywhere. Shortly after the peak of waterfowl nesting began in June, however, the best waterfowl nesting habitat flooded and thousands of nests were destroyed.

In June, tragedy struck when a plane crash claimed the lives of Tim Patton and Greg & Joy Rost. The entire refuge crew was devastated by this loss, but somehow managed to pull together and complete a successful field season.

On a more positive note, the Nowitna and Koyukuk Refuges were finally combined as a complex under one administration. This change has seemed inevitable for some time and it is a relief to have it accomplished. We are sure that it will be a more efficient way of doing business and will better serve the resource and the public.

Advertisements for vacant positions early in the year resulted in 7-9 qualified candidates each. We think that this is largely the result of the new "Administrative Return Rights for Alaska Duty Stations" which assures applicants that they won't get "stuck" in Alaska. Our thanks to the Director and Regional Office staff for a policy that is responsive to the needs of field stations and one that appears to be the solution to a long standing problem.

After 5 years of effort we finally have a radio system installed that works most of the time. Thanks again!

There is still at least one problem in the area of recruitment that needs to be solved for the long term benefit of Region 7. Somehow, the pool of qualified pilot candidates must be increased. Regional Aircraft Manager Sarvis' recent issue paper identified many alternatives that at least partially solve the problem. One solution is to provide pilot training for biologists and assistant managers who are already in Alaska, have an interest in learning to fly, and are willing to make a commitment to use their piloting skills for some amount of time after completing the training. Hopefully, the R.O. and W.O. will agree with John and take this opportunity to solve this problem.