KENAI NATIONAL WILDLIFE REFUGE

Soldotna, Alaska

ANNUAL NARRATIVE REPORT

Calendar Year 1990

U. S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

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Daniel W Doshier 6/26/91
Refuge Manager Date

Refuge Supervisor Review 12/27/91
Date

Paul R. Schmidt
Regional Office Approval

Date

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INTRODUCTION

The Kenai National Wildlife Refuge is situated on the Kenai Peninsula in southcentral Alaska. The northern portion of the Refuge is only 20 air miles from the State's largest population center, the City of Anchorage. Although a scenic 112 mile drive through the Kenai Mountains is necessary to reach the wildlife Refuge via road, commercial commuter aircraft fly into Kenai and Soldotna daily from Alaska's largest city, 60 air miles north.

Located within the center of the Kenai Peninsula and extending 115 miles from Turnagain Arm on the north to nearly the Gulf of Alaska on the south, this Refuge encompasses about one-third of the Peninsula. The western portions of the Kenai Mountains generally form the eastern Refuge boundary, a common boundary shared with our Chugach National Forest and Kenai Fjords National Park neighbors.

Since the establishment of the Refuge on December 16, 1941, under E.O. 8979, these lands have undergone at least two boundary changes and a name change. The original Refuge included 2,058,000 acres and, among other mandates, authorized settlement, location, and other disposition under public land laws applicable to Alaska. At that time, the Refuge was bounded on the northwest, from Point Possession to the Kasilof River, by the waters of Cook Inlet. A six mile wide strip of land from Boulder Point to the Kasilof River and a six mile strip of land, including portions of the Kenai River, were open for development. Homesteads, grazing areas, road systems, and other developments occurred in these areas which were eventually excluded from the Refuge during a 1964 boundary adjustment. Also excluded, were Cook Inlet coastal lands one to three miles inland and considerable portions of the Harding Ice Field, reducing the Refuge area to 1.73 million acres.

Passage of the Alaska National Interest Lands Conservation Act December 2, 1980, not only changed the Kenai National Moose Range to Kenai National Wildlife Refuge but further increased the Refuge acreage to 1.97 million, with the addition of mostly mountainous regions, an area of approximately 150,000 acres on the extreme south and about 90,000 acres of formerly adjacent Forest Service lands to the extreme northeast near the Chickaloon Flats. At the same time, the passage of the Alaska National Interest Lands Conservtion Act, commonly known as "The Alaska Lands Act," withdrew from the Refuge 16,535 acres to satisfy the claims of the Salamatof Native Association under the Alaska Native Claims Settlement Act. The now-1.953 million acre refuge has been reestablished and is managed to: 1) conserve fish and wildlife populations and habitats in their natural diversity, 2) fulfill international treaty obligations with respect to fish and wildlife, 3) insure water quality and quantity, 4) provide opportunities for scientific research, interpretation, and environmental education, and 5) to provide opportunities for fish and wildlife-oriented recreation. In addition to establishing new boundaries, new purposes, and a new name, 1.35 million acres of the Refuge were formally designated as wilderness.

The Refuge is divided into two generalized physiographic types, a mountainous region and a forested lowland. Elevations on the Refuge range from 150 feet in the lowlands to over 6600 feet in the Kenai Mountains. Treeline is at 1800 feet and among the peaks lie the Harding Ice Field which thrusts numerous glacial fingers out from the mountains. The glaciers, mountains, lakes, alpine tundra and receding foothills are extremely scenic.

The vegetation of the Refuge may be subdivided into three major classes: 1) humid coastal forests dominated by Sitka spruce (Picea sitchensis); 2) interior forests of white and black spruce (Picea glauca, P. mariana) with a mixture of birch (Betula papyrifera); and 3) mountain tundra, including glaciers and snowfields.

Forests cover 39 percent of the Refuge. Swampy forests of black spruce alternate with peatbogs and grassy mires while white spruce forests are distributed in the drier areas and in the foothills and mountains. They are often intermixed with or include, deciduous trees such as white birch, especially in old burns and cut-over areas. Aspen (Populus tremuloides) is also found with white spruce and birch. Lowland shrub (alder and willow) covers 9 percent of the Refuge.

Mountain tundra covers about 11 percent of the Refuge. Of this class, about 87 percent is dwarf shrub and lichen tundra and 13 percent is tall shrub (alder and willow) thickets usually associated with tundra.

Water and associated wetlands cover 13 percent and snow, ice and glaciers cover the remainder of the Refuge.

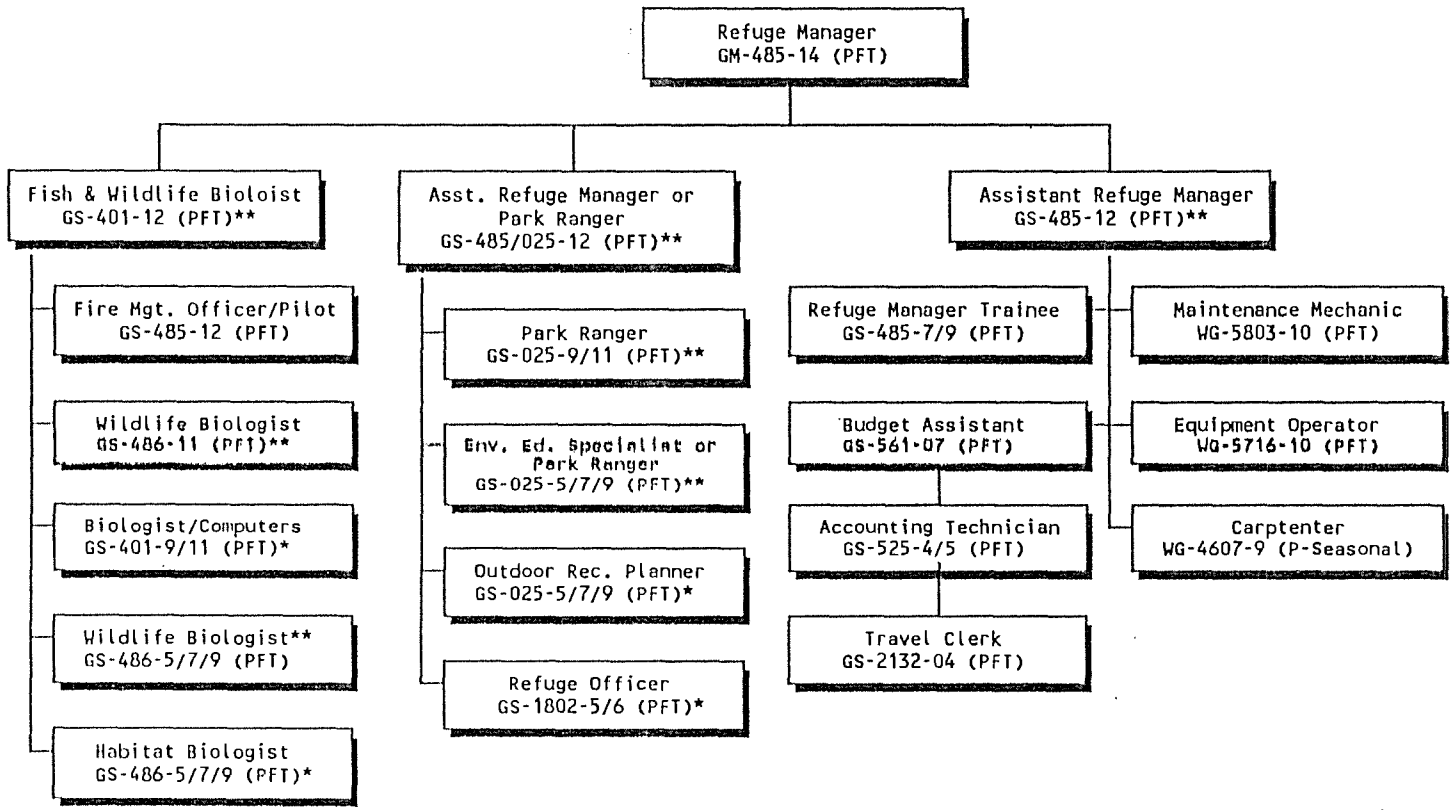
The Kenai River, the largest river system on the peninsula drains about 2,148 square miles (5,563 km^2). About 54 percent of the watershed is on the Refuge, 37 percent in the Chugach National Forest, and the remainder on private lands. Ten major tributaries feed the Kenai River System: Beaver Creek, Slikok River, Soldotna Creek, Funny River, Moose River, Killey River, Skilak River, Russian River, Cooper Creek, and Juneau Creek.

Other refuge river and stream systems flowing westward into the Cook Inlet include Kasilof River (which drains Tustumena Lake), Deep Creek, and the Swanson, Fox, Ninilchik, and Chickaloon rivers.

There are thousands of lakes on the Kenai Peninsula. Nearly all of them are on the Refuge. The largest are two glacial lakes, Tustumena Lake (74,000 acres or 31,000 ha), and Skilak Lake (25,000 acres or 10,000 ha). More than 4,500 smaller lakes dot the Refuge mostly in the Moose, Swanson, and Chickaloon River drainages.

At least 199 species of amphibians, birds, and mammals use the wildlife habitats on the Refuge. None of these species are known to be threatened or endangered. Significant populations of brown and black bear, sheep, goat, wolves, bald eagles, trumpeter swans, caribou, moose, loons, four species of salmon and a wide variety of furbearers occur on the Refuge.

KENAI NATIONAL WILDLIFE REFUGE
(Organizational Chart)



PFT - Permanent Full Time
* - Projected position; individual approval required to officially establish.
** - Position Redescription

Proposed by: Daniel W Dostier — Refuge Manager — 4-5-90 Date

Concurrence: Paul R. Schmidt — Assistant Regional Director Refuges and Wildlife — 4-17-90 Date

Approval: Walter D. Steiglitz — Regional Director — 4/19/90 Date

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Nothing to report

A. HIGHLIGHTS

- Mt. Redoubt continued activity on a regular basis as the new year started.
- Near record snowfall occurred on the Refuge, resulting in large overwinter moose mortality.
- Graduate Student Carlos Paez completed caribou study in 1990.
- Office Automation Plan finalized.
- Long-time Refuge employee Bob Richey retires June 1.
- YCC program increased to include five enrollees.
- Weak Kenai River King salmon runs forced catch and release restrictions.
- Refuge trapping permits increased by 30 percent.
- Old Kenai Headquarters and residence are spruced up in preparation for City of Kenai bicentennial celebration.
- The last-known PCB-contaminated areas at Swanson River Oilfield were released as clean.

High Noon - Ash cloud from Mt. Redoubt about to envelope headquarters. 01/90/JF

B. CLIMATIC CONDITIONS

The Kenai National Wildlife Refuge is located in South Central Alaska on the Kenai Peninsula. The climate is generally described as being sub-arctic. Mild weather predominates and summers are generally cooler than interior Alaska while winters are warmer. Temperatures rarely rise above 80° Fahrenheit (F) in summer or drop below -30°F in the winter. The "cold spell" in January and February, 1989, was an exception as it brought extended sub-zero weather; below zero for 25 consecutive days and -30°F or colder for 6 consecutive days. The average wind speed is about 6 knots at lower elevations and rarely exceeds 40 knots.

Annual precipitation varies from about 19 inches on the western edge of the Refuge (Kenai) to about 40 inches on the Refuge's mountainous eastern edge. The southern portion (Homer) gets about 23 inches annually. Average snowfall on the Kenai Peninsula is about 60 inches per year (Table 1). During the 1989-90 season the Refuge received 106.8 inches, ranking it second behind the 1948-49 season which had a record 135.3 inches. As a note of interest, one month during that season (January 1949) received 59.2 inches of snow; nearly as high as the present yearly average.

Near record snowfall during the 1989-90 season...
01/90 JEF

...made for near-continuous snow removal. 01/90 JEF

The number of frost-free growing days ranges from 71-129 days per year. However, long summer days of up to 19 hours of daylight offset this brief growing season.

The new year started cold but January's low still came nowhere near the low in January 1989 with -45°F Table 2). In February, the temperature got as low as -33°F but extended periods of cold weather did not occur (as in 1989). Warm, sunny weather in March, combined with volcanic ash, melted the snow much sooner than expected. Fantastic weather prevailed throughout the remainder of spring and well into August, providing sunshine in abundance - relative to normal Kenai Peninsula weather. However, the sunshine and warmth came at no small cost as air quality deteriorated rapidly (due to volcanic ash dust) with increasing air temperature. It may be safe to say that many gained a newfound appreciation for rain as it suddenly became such a critical factor in beating down the volcanic ash.

Extremely wet weather during the second half of August and most of September finally brought some relief from the dust. In that six-week period the Refuge received approximately seven inches of rain. September precipitation alone was 5.08 inches, 162 percent and 48 percent higher than 1988 and 1989, respectively. The last month to receive more than 5.08 inches of precipitation was September 1982 with 6.13 inches. Annual precipitation was 5.65 inches higher than normal, at 24.83 inches.

Table 1. Yearly (January-December) versus Seasonal (September-May) snowfall from 1980-1990 for the Kenai National Wildlife Refuge.

Year	Snowfall (inches)	Season	Snowfall (inches)
1980	34.3	1980-81	14.9
1981	42.6	1981-82	39.3
1982	32.6	1982-83	36.6
1983	41.7	1983-84	64.6
1984	48.3	1984-85	45.8
1985	41.4	1985-86	16.0
1986	20.3	1986-87	35.8
1987	60.4	1987-88	55.3
1988	58.6	1988-89	60.9
1989	67.6	1989-90	106.8
1990	90.1		
1949 (Record)	133.4	1948-49 (Record)	135.3

45-year average (yearly) is 59.3 inches.
Information obtained from monthly Climatological Reports and State Climatologist at (907) 257-2737.

The eruption January 8 that engulfed us in darkness and left us with 1/4 to 1/2 inches of volcanic ash. 01/90 JEF

Winter was ushered in by the middle of November when lowland lakes became frozen. Record average monthly low temperatures of 10.2°F were 11.3°F below normal. Recorded temperatures reached -30°F by the end of the year. Cumulative snowfall was considerably lower at the end of 1990 than at the same time in 1989.

This picture was taken at high noon, January 8, as an ash cloud from Mt. Redoubt moves into position over Refuge Headquarters. We were immersed in total darkness for nearly two hours. 01/90 JEF

Mount Redoubt was active on a regular basis as the new year started. On January 8, Soldotna received 1/4 to 1/2 inches of volcanic ash from an eruption occurring at about 9:30 a.m. By 12:30 p.m. a cloud of ash moved into position over Soldotna immersing us in total darkness for nearly two hours. Needless to say, clear skies and sunlight were a welcome sight when the cloud finally passed. The volcano's last significant eruption took place April 6. Since then it has been active but at a decreased level, occasionally spouting off steam. By the end of the year, seismic activity indicated the potential for future eruptions, however, the mountain remained relatively quiet.

Table 2. Monthly temperatures (extremes) and precipitation data.*

	Temperature (Fahrenheit)						Precipitation		
	Low			High			Inches		
	1988	1989	1990	1988	1989	1990	1988	1989	1990
January	-19	-45	-25	39	38	38	0.22	0.99	2.87
February	-12	-27	-33	41	36	33	0.25	0.37	1.90
March	10	-8	-6	41	42	41	1.06	0.16	2.71
April	12	18	21	53	58	53	0.84	1.03	0.55
May	25	28	30	60	63	67	1.60	2.44	1.53
June	32	36	39	69	72	72	1.43	0.72	1.72
July	37	40	43	70	79	71	0.35	2.56	1.05
August	40	39	36	70	71	74	3.21	4.57	2.03
September	24	31	33	60	66	61	1.94	3.78	5.08
October	12	6	11	51	51	51	2.74	4.51	1.60
November	-8	-15	-26	38	41	39	1.15	1.54	0.76
December	-10	-22	-30	41	41	33	0.95	2.37	3.03
Totals							15.74	25.04	24.83

*Reported by the Federal Aviation Administration, Kenai Airport.

C. LAND ACQUISITION

1. Fee Title

a. Alaska Native Claims Settlement Act

(1) Kenai Native Association, Incorporated (KNA)

No correspondence was received from KNA regarding land exchanges during 1990. Refuge staff corresponded via telephone several times with KNA officials regarding applicability of the Refuge Public Use Regulations on their Alaska Native Claims Settlement Act (ANCSA) section 22(g) lands. KNA officials were supportive of the Refuge Public Use Regulations being generally applicable to visitors as well as to the KNA shareholders.

KNA has not posted their lands except for a large green Native Association sign posted along Swanson River Road. The sign has fallen over leaving the common Refuge boundary and KNA boundary unmarked. KNA continues to close a large gate at Sunken Island Road during the moose hunting season. Still, unauthorized public use is common. Indiscriminate littering, target shooting and occasional timber removal have resulted on KNA lands from the one mile set back of the gate on Marathon Road. Previously the gate was located at the Refuge boundary. Although Refuge officers have assisted KNA with patrols, native lands were not targeted for patrols and are therefore easy targets for unauthorized activities.

(2) Salamatof Native Association, Incorporated (SNA)

Still pending is an exchange agreement developed in 1985 between the SNA and the U.S. Fish and Wildlife Service (Service), whereby the Service transfers sand and gravel resources to Salamatof in return for non-development easements along the Kenai River. Although the gravel has long since been transferred and utilized by Salamatof for the development of Moose Range Meadows subdivision, and Salamatof has included the non-development easement in survey plats, the non-development easement agreement has not been formally ratified. The still unsurveyed river front sections of the Salamatof lands have remained an obstruction to a finalized exchange. In 1989 the Refuge staff determined it was not possible to identify the non-development easement on unsurveyed land. In 1990 the Refuge staff reviewed the issue and its position. Hopefully this will hasten the easement transfer.

During 1989 Salamatof had agreed to enforce several easement violations, prior to the United States taking possession of the easement. Salamatof sent letters to property owners regarding the easement but otherwise took no legal action to protect the easement.

While the Service and Salamatof wrangled over the actual easement transfer, Solicitor Regina Slater determined that we could enforce several ongoing easement violations as a third party interest. On June 29, certified letters were sent to Diane and Louis Larrimore, Eugene and

Peggy Smith, and Jack Richardson requesting restoration of previous easement encroachments. The letters were the first legal measure to prevent further encroachment and seek restitution on past problems.

By August, three of the property owners sent the Refuge Manager notice via legal counsel that they did not intend to comply with the non-development easement. Memorandums were then prepared, requesting legal assistance from the Regional Solicitor to prevent additional encroachment and to seek rehabilitation for existing damage. Investigative summaries were prepared for each of the three encroachment incidents. As of year's end the easement violations had not been remedied and the easement had not transferred despite general agreement to do so from the Refuge, Salamatof and their counsel.

(3) Tyonek Native Corporation, Incorporated (TNC)

Refuge Manager Doshier had telephone conversations and two meetings in Anchorage regarding Tyonek, Inc.'s desire to have a timber sale on their lands. The economics of the project hinged on Tyonek's ability or inability to utilize Swanson River Oilfield roads for access. At year's end a formal proposal had not been received.

Tyonek has not posted their lands, although public use remained at a very low density.

(4) Point Possession, Incorporated

On June 25, 1987, the Point Possession Group, under ANCSA, was conveyed 4,481.32 acres of Refuge land. Title to this land remained subject to the laws and regulations governing use and development of those lands under ANCSA Section 22(g).

A field inspection along the Point Possession beach during September 1990 revealed that the native group had posted their lands prohibiting unauthorized use. Point Possession also put out newspaper notices posting the land.

(5) Cook Inlet Region, Incorporated (CIRI)

1. Native Allotments

(a) Although final easements and waterways recommendations under 17(b) of the ANCSA within Cook Inlet Region's 14(h)(1) land selections at Russian River were reviewed in a Bureau of Land Management (BLM) decision document dated March 21, 1988, CIRI requested a deadline waiver in order to select more lands which BLM certified. Service representatives attended an interagency meeting in 1989, at the BLM District Office, Anchorage, to discuss recommended public easements on the additional Refuge lands certified. Those certified lands include acreage within the Kenai Wilderness and portions of the Kenai-Russian River Campground including the road access to that campground/parking facility.

Refuge staff provided a map during 1990 to BLM roughly delineating the developed area of the Kenai-Russian River Campground. Of concern to the Refuge staff is a potentially strict interpretation of the edge of developed campground by BLM. Kenai-Russian River Access area annual operations and future redesign options would be negatively affected if the campground boundary was not expanded to the Sterling Highway.

The Refuge is opposed to a transfer of the Kenai-Russian River Access Area and lands directly adjacent which are need for orderly management of the area. We will be working with Realty staff to see if something can be done to improve the situation.

(b) The Alec Dolchok Native Allotment claim (AA8272) within Kenai Wilderness at Harvey Lake remains unresolved although BLM is currently reviewing the entire claim. Forty acres were initially approved in 1983 in absence of a thorough investigation of the claim. At that time Refuge staff did not conduct an investigation based on erroneous advice that all claims were legislatively approved by Alaska National Interest Lands Conservation Act (ANILCA) rendering a factual verification of the claim unnecessary. BLM approved the original allotment based on the "prima facile" evidence in the case file which later appeared to be suspect.

When heirs to the allottee sought to increase the acreage to 100 acres and the BLM reinstated and approved an additional 60 acres, Refuge staff reexamined the case. While investigating the new claim, the Refuge discovered the original 40-acre land claim was based on falsified dates and factual issues.

On January 15, 1987, the Regional Solicitor filed a Notice of Appeal. The Interior Board of Land Appeals remanded the entire claim to BLM for a government contest hearing to reexamine factual issues. To date, BLM has not rendered a decision nor requested a hearing.

2. Easements

Unauthorized encroachment on the Salamatof/Kenai River public use and non-development easements continues. Property owners were served notice of the violations but no legal action has occurred and the easements remain under several incidents of encroachment.

Refuge staff met with several property owners regarding minor encroachments. Compliance was generally poor. Refuge staff, Regional Office staff and a solicitor took several photos of the easement encroachment as well as photos of the entire shoreline adjacent Moose Range Meadows Subdivision in order to document the existing character of the area.

For the second summer in a row large numbers of anglers used the 25-foot public use easement fronting private property within the Moose Range Meadows Subdivision. Litter, visitor information, regulations enforcement, campfires, etc. will be growing concerns as the public becomes more familiar with the easement.

On at least two occasions private property owners complained about easement users behavior and requested Refuge assistance with visitor management on the easement. Refuge officers visited the easement several times, however, management authority remains unclear. Management of visitor parking and congestion within Moose Range Meadows associated with utilization of the easement remain beyond Refuge jurisdiction and requests for help were politely declined.

Refuge staff commented on final 17b easement identification on non-federal lands in the Lower Kenai Peninsula. Primary concern was with Clam Gulch easement EIN 9002 which provided access from the Clam Gulch area to the Refuge portion of the Caribou Hills. Portions of the easement crossed Refuge lands unavailable to all terrain vehicle use and available to snowmobiles only seasonally when Refuge resources are protected during periods of adequate snow cover. BLM reality specialists were advised to slightly relocate the existing trail in order to avoid future conflicts.

3. Other

a. Inholders

Permits were issued to several Bear Creek Inholders on Tustumena Lake for use of three and four wheeled all terrain vehicles for winter access. Travel beyond the inholding destination and use of the same route by others remain problems with the program. Several new cabins were constructed at the Bear Creek Inholding as Subdivider Art Thompson continued to sell properties. Mr. Thompson attempted in 1988 to sell his land to the Refuge but the parties could not agree on the land's value.

Tustumena Lake Inholder Art Thompson stopped in at Refuge Headquarters on October 5, 1990. He reported that his private property lost several feet to the pounding surf of a late September storm. He inquired about getting permission to build a retaining wall. He was informed that a Refuge permit and an Army Corp of Engineers wetland permit may be required. He agreed to submit a proposal if he wished to pursue the idea.

Fire Management Officer Larned sent letters to tent camp operators and cabin permittees on the Refuge describing the level and methods of protection they could expect in the event of wildfire. This action formalized our suppression responsibilities to these inholders.

Refuge Inholder Glen Wade was sentenced to several years in prison for his part in stealing a Chugach Electric front end-loader that he subsequently used to excavate Refuge beach in front of his property. Mr. Wade was the subject of a multi-agency search warrant, which resulted in two felony convictions.

Mr. Wade had been given a suspended sentence and a fine for an earlier misdemeanor conviction for the beach excavation. A condition of the suspended sentence was to restore the beach which he had failed to do by the court order with a November 1990 deadline. The State Attorney was informed of the failure to comply with the court order.

b. Old Refuge Headquarters

Nothing to report.

c. Land Acquisition

Refuge staff met with Danielle Jerry of the Regional Office to assist in mapping resources and threats for the Refuge land protection plan. Identification of Refuge resources at risk from development of private inholdings in order to target high value private lands needing protection was the primary thrust of the project.

D. PLANNING

1. Master Plan

Nothing to report.

2. Management Plans

a. Moose Management Plan

Over 40 years of moose population and habitat data on the Refuge were analyzed and summarized in 1990 in preparation for writing the Refuge's Moose Management Plan. This information and a detailed discussion of the factors affecting moose population dynamics, including habitat, weather, harvest and predation, were drafted into a Technical Supplement to the management plan. Initial drafts of the Moose Management Plan itself were reviewed internally and revised. A final draft is scheduled for completion in the spring of 1991, at which time it will be submitted to the Regional Office for interagency review.

3. Public Participation

Nothing to report.

4. Compliance with Environmental and Cultural Resource Mandates

Staff reviewed and commented on an Environmental Assessment (EA) regarding an Alascom request to construct two microwave relay towers on Refuge lands. The EA was prepared by the Regional Realty Office and represented a good effort to analyze the potential impacts of the Alascom proposal. One tower, if constructed, would be visible from the newly redesigned Hidden Lake Campground and many locations within Skilak Wildlife Recreation Area. Refuge staff had suggested the use of site 16 along the Sterling Highway rather than the Hidden Hill proposal.

5. Research and Investigations

a. Beaver

Selection and use of lakes by beavers on the Kenai National Wildlife Refuge, Alaska - Richard McAvinchey - Kenai National Wildlife Refuge.

Field work on this project continued through 1990 with lakes in 1969 burn habitat (Finger Lakes Area) and mature forest habitat (Vogel Lakes Area) sampled by Richard McAvinchey for beaver use. An abstract prepared for shs Sixth Northern Furbearer Conference in Fairbanks summarized some of the preliminary findings to date:

> In May 1989, a 3-year study was begun on the Kenai National Wildlife Refuge in Alaska to examine beaver use of lakes in 3 study areas: the 1947 burn, the 1969 burn, and northern mature forest. Goals of the study are to: (1) determine which lakes

had current and past beaver activity; (2) confirm the accuracy of fall aerial surveys for active beaver lodges; (3) determine which environmental conditions beavers seek in choosing lakes to inhabit; (4) determine colony size in lodges; and (5) compare nutritional quality of beaver food items collected from caches. Data were collected on forest vegetation surrounding each lake, shoreline profile, aquatic vegetation, measurements, composition and approximate year of last use for structures built by beavers, and sightings of beavers, loons, and other wildlife. Of 290 lakes surveyed by canoe or on foot, 12%, 32%, and 40.6% had active beaver colonies in the 1947 burn, 1969 burn, and mature forest, respectively. Active colonies observed during fall 1990 aerial transect surveys were between 62-74%, 50-86%, and 38-44% of verified active lodges in the 1947 burn, 1969 burn, and mature forests, respectively. A small percentage of colonies occupying lodges in the summer switched to other lodges or built new lodges in the same lake, or abandoned that lake, before the October aerial surveys. Non-lethal methods for determining colony size will be tested. Data will be analyzed for clues to beaver selection of lakes. Nutrient analysis has been done on major beaver foods collected from caches.

McAvinchey makes a spring visit to a beaver lodge in a small lake west of Waterfowl Lake. The lodge was built the previous summer, however, the five beaver observed then were no longer present. 04/01/TB

b. Lynx

Lynx/Coyote investigators on the Kenai National Wildlife Refuge - Win Staples - Kenai National Wildlife Refuge/University of Alaska (Fairbanks).

Field work on this project continued through 1990 by Graduate Student Win Staples and the Refuge biological staff. Two abstracts were prepared and presentations given at the Sixth Northern Furbearer Conference in Fairbanks.

Winthrop Staples recollars female lynx (F41) captured with aid of cat hounds. He is assisted by dog handler Darrell King and Bio-Tech Jozwiak. 10/90/TB

A study to determine the population dynamics of Kenai Peninsula lynx (Felis canadensis) in relation to changing forest succession, food habits, and human-related mortality was initiated in 1982. Preliminary analysis of field data collected during study phase III (1988-90), a hare-low period, supports the conclusions of earlier study efforts (1982-87). The majority of lynx using the 250 square kilometer core study area during the three year period (19 individuals) and 15 coyotes were radio-collared and located 1,317 and 398 times respectively. Vulnerability of naive lynx to study trapping

efforts, indifference of lynx to human presence during 79 daylight sightings, and the suspected illegal killing of 4 study lynx suggest that few lynx in accessible areas would have survived this critical period if lynx hunting and trapping seasons had been open. Superficial examination of 375 coyote and 261 lynx scats suggest that coyotes depended heavily on moose carrion (Alces alces) while lynx continued to feed mainly on snowshoe hare (Lepus americanus). Over 54 coyote and 60 lynx kill/scavenging observations suggest that Kenai coyotes also fed extensively on salmon carcasses and that adult lynx can be quite opportunistic where alternate foods to snowshoe hare are available. Tendency of lynx to localize around large carcasses and other alternate food sources suggests that scat analysis alone may underestimate the importance of non-hare foods to lynx. Capture-related techniques and potential problems are also discussed.

A technique to live-capture lynx for the study was tried in October 1990. The results of those techniques are described in the following abstract:

When lynx (Felis canadensis) in and adjacent to a 250 square kilometer study area within the Kenai National Wildlife Refuge on the Kenai Peninsula, Alaska became extremely difficult to live-capture in rubber-jawed, leg-hold traps because of lower densities, widespread movements, and avoidance of traps, we live-captured them with 2-4 trained dogs. During 19 days (18 October-6 November, 1990) we captured 9 lynx with an estimated 126.3 person-days of effort (14 person-days/capture). Five of the 9 captured lynx had functioning radio collars, 3 had failed collars, and one was uncollared. Capture effort included an estimated 973.9 and 36.8 person-hours on the ground and in aircraft, respectively. We thoroughly searched for fresh lynx tracks during this period by slowly driving an estimated 230.4 km on roads and hiking 258.4 km on trails. Dogs followed older trails of lynx 3-4 times but did not jump the lynx. Lynx were actively pursued by baying dogs and jumped on 10 occasions. Each jumped lynx was successfully treed but 1 lynx was abandoned in a tree because of darkness and its height in the tree. Estimated times of pursuit by dogs averaged 66 minutes from the time the lynx were first scented to when it was first treed. One treed lynx jumped to the ground and another jumped to an adjacent tree before they could be darted. Once darted, 1 lynx jumped to the ground and another jumped to an adjacent tree before becoming immobile. Once immobile, 5 lynx fell out of the tree, 2 were shoved out, 1 was shaken out, and 1 was caught on the ground in order to process them. Lynx were treed is aspen (Populus tremuloides) 6 times, birch (Betula papyrifera) 3 times, spruce (Picea spp.) 3 times, and cottonwood (Populus

trichocarpa) twice at an average estimated distance of 11.8 m (range 1.8-24.4 m) above ground. Limitations and details of using trained dogs to capture lynx are discussed and its success is compared to previous lynx live-trapping efforts and success in the same study area.

Walker cat hound "Digger" barks at treed lynx in the vicinity of Afonasi Lake. 20/19/TB

c. Caribou

Alpine vegetation of areas utilized by introduced populations of caribou (Rangifer tarandus) on the Kenai Peninsula, Alaska - Carlos Paez - Kenai National Wildlife Refuge/University of Wisconsin.

This project was completed in 1990 by Graduate Student Carlos Paez through the University of Wisconsin. An abstract of the thesis appears below:

Abstract. Alpine vegetation in the Kenai Peninsula, Southcentral Alaska, was studied in relation to the winter grazing of introduced caribou populations. I sampled: 1) two areas utilized by recently introduced caribou (61 macroplots), 2) one area utilized by a longer established herd (21

acroplots), and 3) four compatible areas without caribou (60 macroplots). The 142 macroplots were 100 m^2, each of which was sampled by 20 quadrats of 0.25 m^2.

A total of 60 species were recorded: 19 lichens were Stereocaulon alpinum, Cladina mitis, Cladina rangiferian, and Cladina stellaris; the most common vascular plants were Empetrum nigrum, Diapensia lapponica, Dryas octopetala, and Vaccinium caespitosum. The number of species in any one area ranged from 44 in a non-caribou area to 58 in the area of greatest caribou pressure. The latter also had the highest species diversity index. On the other hand, lichen heights and biomass were greatest in the least disturbed areas.

Vegetation differed more from area to area than the measured environmental variables. These differences suggest that biotic differences (including caribou pressure) play a more important role in vegetation variation in my data set than did the physical environment. Of the plants, lichens varied more from area to area than did vascular plants.

Increased caribou pressure correlates with a decrease in biomass, especially of preferred lichen species. High levels of caribou pressure are associated with increasing dominance in vascular plants.

Carlos Paez measuring lichen composition and abundance on Skyline Trail Caribou Project. 06/90/TB

d. Wolverine

Wolverine investigations on the Kenai National Wildlife Refuge, Kenai National Wildlife Refuge, Alaska.

Attempts to live-capture wolverine in the Mystery Creek Hills-Jean Lake-Surprise Creek Area in late winter 1989-90 were without success. The project has been on hold since the spring of 1990 when the interagency wolverine team agreed to write yet another proposal covering the entire Kenai Peninsula. No further field work will continue on this project until an interagency agreement is reached on the objectives of the study and a re-evaluation of the Refuge's budget and plans for Fiscal Year 1992.

e. River Timing and Spawning Distribution

River timing and spawning distribution of coho and late run Chinook salmon in the Kasilof River watershed, Alaska, 1987 - Kenai Fishery Assistance Office, Kenai.

Although this study was conducted in 1987, the final report was not available until September 1990. An abstract of the study follows:

> Chinook (Oncorhynchus tschawytscha) and coho (O. kisutch) salmon were studied during their migration to spawning grounds in the glacial Kasilof River watershed, Alaska in 1987. The hatchery enhanced early chinook salmon run returned in May and June to a tributary (Crooked Creek) at river kilometer (RKM) 11.3. The naturally occurring late run spawned in the mainstem, migrating past rkm 13.1 beginning about July 25. Two main spawning areas of late run chinook salmon were identified: the "slackwater" area below the outlet of Tustumena Lake (rkm 27-30), and the vicinity of the large bend at about rkm 16.
>
> Coho salmon returns to Tustumena Lake tributaries were low in 1987; no early run was observed. Late-run fish were first observed at Indian Creek on October 1 and were present until the study ended in mid-November. Late-run coho salmon were also seen in Pipe, Glacier Flats, and Seepage Creeks.
>
> Estimating the spawning escapement of late-run chinook salmon would be difficult in this glacial system. Sonar surveys or a floating weir might prove suitable to enumerate escapement but associated cost may be prohibitive. A mark-recapture study may be more cost effective with tag recovery activities in the two identified spawning areas.
>
> Incidental Cook Inlet commercial catch probably includes late-run chinook salmon and early-run coho salmon bound for the

Kasilof River. However, harvest estimates cannot be made without better knowledge of the composition and harvest rates of the mixed stocks.

f. Resident Fish

Resident fish investigations in Tustumena Lake, Kenai National Wildlife Refuge, Alaska - Kenai Fishery Assistance Office, Kenai.

The results of this study, also conducted in 1987 became available in late 1990. An abstract of the study results are individual below:

> Gill nets and minnow traps were used to determine the relative abundance of resident fish at three locations in Tustumena Lake, Alaska, during the spring and summer of 1987. The food habits, length-weight relationships, relative condition, age structure, and growth rates of selected species were also examined.
>
> Dolly Varden Salvelinus malma and lake trout S. namaycush were the most recently caught species in gill nets. Dolly Varden and coast range sculpins Cottus aleuticus were the most frequently caught in minnow traps. The highest catches for all species except rainbow trout Oncorhynchus mykiss were consistently taken at Bear Creek.
>
> Lake trout and Dolly Varden had quite dissimilar food habits. Lake trout stomachs contained mostly fish (90%) while Dolly Varden stomachs contained mostly invertebrates (80%). Insects were the most commonly found invertebrates in lake trout and Dolly Varden stomachs.
>
> Fork lengths of lake trout ranged from 275-560 mm. Fork lengths of Dolly Varden ranged from 62-572 mm. Fork lengths of round whitefish Prosopium cylindraceom ranged from 172 to 375 mm. All three species had allometric growth. Ages of lake trout ranged from 4 to 26. Ages of Dolly Varden ranged from 1 to 13. Ages of round whitefish ranged from 3 to 11. Growth rates and condition factors of lake trout and Dolly Varden varied widely with age.
>
> Consistently higher catches of resident fish at Bear Creek indicate higher productivity at this site than at Clear or Nikolai Creeks. Since Bear Creek is one of two sites where sockeye salmon O. nerka fry are stocked in Tustumena Lake, higher productivity in this area may be due to enhancement activities.

g. Tustumena Lake Salmon

Tustumena Lake Salmon Investigators - Alaska Fish and Wildlife Research Center, Anchorage (James Finn, Dean Oramer and Carl Burger).

A draft executive summary of this study for 1989 and 1990 is included below.

> The Alaska Fish and Wildlife Research Center initiated a four-year study at Tustumena Lake in 1989 in cooperation with Region 7 and the Alaska Department of Fish and Game. Objectives were to:
>
> 1. Determine if lake spawning by sockeye salmon occurs within Tustumena Lake proper;
>
> 2. Establish the timing of emergence and migration of sockeye salmon fry from lateral tributaries into Tustumena Lake;
>
> 3. Determine if differences exist between the growth and survivability of wild and hatchery-reared sockeye salmon juveniles;
>
> 4. Assess the feasibility of using otolith microstructure to discriminate between wild and hatchery sockeye salmon; and
>
> 5. Determine if there are detectable genetic differences between various populations of sockeye salmon in Tustumena Lake.

A total of 375 adult salmon were radio tagged during two field seasons: 202 fish in 1989 and 173 fish in 1990. Of those, 100 fish (49 percent) in 1989 and 81 fish (47 percent) in 1990 were consistently relocated and radio tracked to spawning destinations within the Tustumena Lake drainage. Based on the criteria we developed, 31 fish (31 percent) were designated as beach spawners in 1989 and 38 fish (47 percent) were designated as beach spawners in 1990. Four areas of apparent lakeshore spawning were identified. Gill netting confirmed the presence of ripe fish in the areas of suspected beach spawning. These findings indicate that spawning by Tustumena Lake sockeye salmon is not limited to the lake's tributaries. Future research will attempt to determine the viability of sockeye salmon ova in some representative shoreline spawning areas. Also, we will attempt to confirm observations made in 1990 that suggest the occurrence of late run of sockeye salmon that spawn in the main-stem Kasilof River in mid-September.

> Fry migrations were monitored on two lateral tributaries (Bear and Nikolai Creeks). Peak fry catches occurred on 28 April, after which fry out migrations declined. Sockeye fry from several of the tributaries were sampled and preserved for future otolith analysis. Studies of the relationship between fry migration and environmental conditions (e.g., lake water

temperatures and productivity) will commence in 1991. The feasibility of measuring solar input and littoral water temperature on a continuous basis is being tested. If the test station is successful, more stations will be deployed during the spring of 1991.

An experiment to test the feasibility of inducing thermal banding in the otoliths of hatchery fry was conducted from 21 February to 12 March at the Crooked Creek Hatchery, Alaska Department of Fish and Game. Fish were exposed to alternating warm and cold water at 4-d intervals. Analysis of otoliths is continuing for both the hatchery fry and from wild fry collected during 1990. Quantification of banding patterns will occur after delivery of image analysis software and hardware ordered during spring 1991.

No progress was made on the genetic portion of this study due to previous budget constraints; however, genetic work will commence in 1991. Other plans for 1991 include: 1) continuation of adult radio tracking; 2) initiation of ground surveys to sample shoreline redds for viable alevins; 3) extensive beach seining in suspected shoreline spawning areas to collect fry; 4) continued monitoring of fry migrations in lateral tributaries; 5) sampling of fry from other tributaries for baseline otolith data; and 6) the establishment of shoreline stations to monitor littoral water temperatures.

6. Other

(a) Officer Automation Plan

Wildlife Biologist Loranger finalized the Office Automation Plan. The Refuge hopes to establish a network using IBM-Compatible PC's and network operational software. The plan was submitted to the Regional Office in February.

Key issues within the plan were the following: 1) Size of the Refuge staff related to the need for electronic communications between staff, 2) Printer resources, 3) Ability to access local experts for installation 4) Staff training, 5) Improved support and maintenance of network systems.

(b) Interpretive Planning.

Public use staff continued to edit materials associated with the Skilak Interpretive Project throughout the year. Supervisory Outdoor Recreation Planner Simpson served as the lead editor and liaison with the Regional Contracting Officer and the contracting firm, Fuller, Dyal and Stamper, Incorporated. Park Rangers Johnston and Ward Assisted with research and editing.

E. ADMINISTRATION

1. Personnel

Management:
Daniel Doshier (1). 04/91/JF

Management:
Mike Hedrick (2), Ted Bailey (8).

Management:
Jim Frates (11). 05/91/BW

Biology:
William Larned (4). 03/91/JF

Biology:
Ted Bailey (8), Win Staples (20), Andy Loranger (9),
Richard McAvinchey (21).

04/91/JF

Biology:
Liz Jozwiak (10).

08/90/WS

Public Use:
Rick Johnston (6), Cheryl Simpson (5), Candace Ward (7).
04/89/JF

Public Use:
Chris Johnson (19) Steve Hudson (23) 04/91/JF

Administration:
Brenda Marsters (17), Brenda Wise (18), Dee Nelson (16),
Vivian McCain (14).

Administration:
Bob Winkelman (15).

04/91/JF

Maintenance:
Dick Kivi (12), Al O'Guinn (13). 04/91/JF

Maintenance:
Bud Marrs (32), Brian Kemsley (31) 04/91/JF

a. Permanent Personnel

Assistant Refuge Manager Bob Richey signs his last office memo on his last day, June 1, 1990, following 26 years on the Kenai. 06/90/JF

Assistant Manager/Pilot Bob Richey, retired after 26 years of dedicated service to the Kenai Refuge, making his "final approach" as a Fish and Wildlife Service employee on June 1. Bob began his career on the Kenai as a seasonal aid during the summer of 1964, and was given an excepted career conditional appointment that fall as a recreational specialist. Bob's career was somewhat of an anomally in that it abridged the long standing policy that promotions are based largely on employee mobility. But for those of us who knew and worked with him, the names "Kenai" and "Richey", were inseparable. Not that he could not have done a creditable job anywhere with the Service, but Bob "belonged" to the Kenai. The Refuge stands a bit taller today because of his long standing effort and dedication.

After eight years at Kenai, Deputy Refuge Manager Mike Hedrick departed April 7 for the National Elk Range in Jackson Hole, Wyoming, where he will assume project leader duties. On April 6, a "going away" party was given for Mike at the Four Seasons Restaurant in Soldotna. Mike's leadership and dedication were a tremendous asset to the Refuge and those qualities will be missed greatly. Equally important, Mike's friendly demeanor and good sense of humor helped to get the rest of us through more than just a few Monday mornings.

Table 3. Listing of Permanent Personnel for the Kenai National Wildlife Refuge, 1990.

1.	Daniel W. Doshier	Refuge Manager	GM-14 PFT	EOD 05/27/86
2.	Michael B. Hedrick	Deputy Refuge Manager	GS-12 PFT	Transferred 04/16/90
3.	Robert A. Richey	Assistant Refuge Manager Oil & Gas (Pilot)	GS-12 PFT	Retired 05/31/90
4.	William W. Larned	Fire Management Officer (Pilot)	GS-12 PFT	EOD 08/21/83
5.	Cheryl L. Simpson	Supervisory Recreation Planner	GS-11 PFT	Transferred 07/02/90
6.	Richard K. Johnston	Outdoor Recreation Planner	GS-09 PFT	EOD 12/31/78
7.	Candace D. Ward	Park Ranger	GS-07 PFT	EOD 05/29/84
8.	Theodore N. Bailey	Fish & Wildlife Biologist	GS-12 PFT	EOD 09/12/77
9.	Andre J. Loranger	Wildlife Biologist	GS-11 PFT	EOD 02/26/89
10.	Elizabeth A. Jozwiak	Biological Technician	GS-07 PFT	EOD 08/28/88
11.	James E. Frates	Facility Manager	GS-11 PFT	EOD 01/30/77
12.	Richard D. Kivi	Equipment Operator	WG-10 PFT	EOD 10/31/74
13.	Elvin "Al" O'Guinn	Maintenance Mechanic	WG-10 PFT	EOD 03/13/84
14.	Vivian J. McCain	Budget Assistant	GS-07 PFT	EOD 02/03/88
15.	Robert B. Winkelman	Natural Resource Specialist	GS-09 PFT 06/22/88	EOD
16.	Deanne K. Nelson	Accounting Technician	GS-05 PFT	EOD 01/05/86
17.	Brenda E. Marsters	Refuge Clerk	GS-04 PFT	EOD 06/21/87
18.	Brenda B. Wise	Travel Clerk	GS-04 PFT	EOD 01/29/89
19.	Christopher G. Johnson	Refuge Officer	GS-06 PPT	EOD 07/29/90

In June Facilities Manager Jim Frates spent considerable time making the transition from the maintenance shop office to the headquarters building. Jim assumed his new duties as assistant manager in charge of administration, maintenance operations, and oil and gas management. Natural Resource Specialist Bob Winkelman now operates out of the shop office and assumed responsibility for many of the routine day to day maintenance activities, as well as assisting Jim with oil and gas operations.

Refuge Manager Daniel Doshier coordinated the Hidden Lake dedication ceremony, June 30, with Regional Office and local support. Despite several untimely speaker and entertainment cancellations, the two-hour event went off without a hitch. Approximately 75 visitors enjoyed musical entertainment, several short speeches, a "future development" display, and a well stocked refreshment table.

During May, Outdoor Recreation Planner Cheryl Simpson accepted a regional outdoor recreation planner position in Region 2 in Albuquerque. Cheryl's last day at Kenai was July 20 when Park Ranger Candace Ward and husband hosted a going away bash at their home. Despite pounding rain, the pot luck was enjoyed by all. Cheryl's hard work and project successes were greatly appreciated.

In August, Park Ranger Chris Johnson was hired as a permanent part time Refuge law enforcement officer. Chris' experience and skill is an asset to the Refuge's resource and visitor protection programs.

There was a hiring freeze in effect for October causing a slow down of filling our assistant refuge manager/park ranger position. As of the end of December the position was still unfilled.

Johnson began basic training for refuge officers on October 4 and returned to Soldotna by year's end. Refuge pilots Johnston and Larned, Volunteer Pilot Bob Richey and Winkelman attended the annual Pilot Ground School, December 4-7.

Ward attended the National Interpreters Association Annual Conference in Charleston, South Carolina, from November 26 thru December 2. The conference provided excellent workshops on brochure publishing, visitor center display fabrication, computer technology for interpretation, and high quality environmental education seminars.

Ward and Travel Clerk Brenda Wise attended the Alaska Natural History Association Branch Manager's Workshop on December 10 and 11. Ward presented the 1990 Kenai Branch accomplishments and the 1991 budget to the association board of directors. Ward and Wise attended training sessions in branch operations, budgeting, branch and board goal settings, sales techniques, effective display presentation and inventory selection.

b. Temporary Personnel

On June 6, a staff barbecue was held at the maintenance shop to kick off the summer and to welcome the new temporary employees and Student Conservation Association Interns (SCA). Employees from Kenai Fisheries Office joined in the festivities.

In September, Park Ranger Steve Hudson left to go to Umatilla National Wildlife Refuge to help with their law enforcement program. Biology Technician Richard (Mac) McAvinchey took several months off to return to the University of Alaska, Fairbanks, to complete work on his Master's thesis, and by mid-December was back in the office.

Park Ranger Denise White left for the season on October 6. Denise did an excellent job of monitoring the new Hidden Lake Campground.

Table 4. Listing of the Temporary Personnel for the Kenai National Wildlife Refuge, 1990.

	EMPLOYEE	POSITION	GRADE	EOD	TERMINATED
20.	Winthrop Staples III	Biol. Tech.	GS-05	02/14/88	
21.	Richard J. McAvinchey	Biol. Tech.	GS-05	05/21/89	
22.	Jay F. Shepherd	Biol. Tech.	GS-5	05/06/90	Intermit.
23.	Steven L. Hudson	Park Ranger	GS-05	07/02/89	Intermit.
24.	Christopher G. Johnson	Park Ranger	GS-05	06/18/89	Converted
			PPT	07/29/90	
25.	James R. Brickey	Park Ranger	GS-05	04/24/90	Intermit.
26.	Brent J. Richey	Park Ranger	GS-05	07/08/90	Intermit.
27.	Denise A. White	Park Ranger	GS-04	06/17/90	Intermit.
28.	Gregory M. Lewis	Park Ranger	GS-04	05/08/89	05/19/90
29.	Joey Koch	Laborer	WG-03	05/21/89	Intermit.
30.	James M. Farrar	Laborer	WG-03	05/20/90	Intermit.
31.	Brian A. Kemsley	Laborer	WG-03	04/22/90	Intermit.
32.	Albert "Bud" Marrs	Carpenter	WG-09	04/24/88	Intermit.
33.	Terrance Ferguson	Trainee	GS-04	07/01/90	07/28/90

Seasonal Carpenter Bud Marrs' appointment terminated on November 9. Bud completed a number of key Refuge projects during the year, including a handicapped ramp at the Visitor Contact Station. Laborer Brian Kemsley terminated on November 30.

Table 5. Staff Breakdown from Fiscal Year 1985 to Fiscal Year 1990.

Year	Permanent Full-time	Permanent Part-time	Vacant as of 12/31	Temporary	Volunteers
FY85	13	2	2	10	43
FY86	16	0	1	13	28
FY87	16	0	1	13	30
FY88	18	0	2	18	19
FY89	18	0	0	13	15
FY90	18	1	2	13	17

Full-time equivalent utilization for 1990 was 23.45.

b. Temporary Personnel

Table 6. Temporary Positions for 1986-1990

	1986	1987	1988	1989	1990
Biological Aids & Technicians	2	3	5	7	4
Laborers & Carpenter	4	4	5	4	4
Park Rangers	5	5	7	6	4
YACC/YCC Staff	2	0	0	0	1
Clerk/Typist	0	1	1	0	0
TOTAL	13	13	18	17	13

2. Youth Programs

a. People Count Program

Our 15 year old People Count Enrollee John "Iron Man" Williamson more than carried his own weight around the shop during his summer tenure. 07/90/BK

Fifteen year old John Williamson spent his second summer on the Refuge under the State-funded "People Count" Program. John was again assigned to the maintenance program where he performed a variety of duties, i.e., painting, lawn care, vehicle cleaning and washing, shop clean up and campground litter control. John's cheerful attitude, punctuality and excellent work ethic made him an ideal employee during his eight week assignment. Although he suffered a potentially serious work-related injury (see Safety) he returned to finish his final week of work. Luckily, he experienced no permanent damage but did have to under go-surgery to repair bones in the eyesocket.

b. Youth Conservation Corps

YCC staff paint the fence at the Russian River Campground. 06/90/SS

YCC's learn canoe safety at Headquarters Lake in preparation for their work on the canoe system. 07/90/SS

Sadly, the Youth Conservation Corps (YCC) program was absent from the Refuge in 1987 and 1988. The program was reinstated in 1989, but only with two enrollees participating. With such a small crew, the effort exerted by staff members to maintain the program's existence clearly outweighed the benefits provided to the Refuge. With the arrival of 1990 and a new crew of five, the YCC program has returned with a renewed sense of vigor and enthusiasm.

The Refuge's 1990 YCC staff included Group Leader Scott Slavik and enrollees, Holly Poyner, Jennifer Bleile, Eric O'Guinn, Dan Marsters, and Jeff Johnson. This year's field season ran from June 18 through August 10.

Table 7. Summary of 1990 Youth Conservation Corps Work Projects.

Project Classification	Hours Worked	Percent of Total Hours
Trail Maintenance	368	23%
Environmental Education	282	18%
Fence Construction	220	12%
Transportation	155	10%
Litter Pick-up	155	10%
Landscaping	105	7%
Painting	102	6%
Orientation	100	6%
Campground Rehabilitation	63	4%
Signing	25	2%
Fire Line Rehabilitation	25	2%
TOTAL HOURS	1600	100%

(1) Orientation

A thorough orientation and training session contributed to the success of the Youth Conservation Corps program. Orientation activities were designed to introduce the enrollees to the goals, objectives, and expectations of the YCC. It also provided an excellent opportunity to establish good working relationships between the enrollees and supervisors and a feeling of unity within the group.

(2) Spike Camps

Spike camps proved to be an integral aspect of the YCC program. The opportunity to become immersed into the Alaskan backcountry provided a necessary change from some of the crew's routine responsibilities.

Three spike camps were utilized during the 1990 field season, all of which were highly successful. They offered the enrollees a unique wilderness experience while providing a wide variety of work projects and environmental education opportunities.

1990 SPIKE CAMP DATES AND LOCATIONS

Spike I	July 9 - July 12	Moose Pens Research Center
Spike II	July 17 - July 18	Environmental Education Center
Spike III	July 30 - August 3	Swanson River Canoe System

The Swanson River Canoe System spike camp was the finale and highlight of the summer.

(3) Group Living

The enrollees were involved in as much of the planning and preparation of the work projects and spike camps as possible. This involvement seemed to foster an increased sense of responsibility, enthusiasm and concern. There were many logistical concerns that were taken on by the group, including meal planning, food and gear selection, and preparation and packing of personal and work equipment.

Working, playing, eating and living together in close quarters for an extended period of time was challenging. During spike camps, food preparation, washing dishes, wood gathering, and other camp chores were divided equally among the group. Partners for these tasks were decided on by the group. Everyone made a concerted effort to work successfully in a harmonious manner.

(4) Work Projects

A wide variety of work projects were taken on by this year's YCC. A broad spectrum of diverse and challenging work assignments were important in maintaining the interest of the enrollees.

Throughout the summer, it was learned that routine responsibilities like, litter patrol need to be interspersed between more interesting and challenging projects. Interestingly, the more difficult projects seemed to encourage creative thought and increased cooperation.

One of the most rewarding projects experienced by this year's YCC crew was the construction of a boardwalk over Egumen Lake Trail. The type of work involved in building a boardwalk (measuring, sawing, hammering, etc.) seemed to be compatible with the interests and skill level of the group. Additionally, enrollees were able to clearly see the benefits that the project was providing for the wildlife, the Refuge visitors, and the environment.

A brief brainstorming session before the start of a project encouraged comments and criticism from the group. In many cases, the collective thoughts of the group produced a more efficient and effective method of completing an assignment.

A debriefing session was conducted after completing each assignment to discuss the purpose and function of the work project. During this time, the crew was also asked to evaluate the quality of their workmanship.

A summary of 1990 work projects is listed on the following page. This year's work assignments were divided into eleven broad categories of job classifications. The table shows the number of hours spent on each job category along with the respective percentage of total available labor hours.

With five enrollees working eight hours a day for eight weeks, 1,600 labor hours were available for this year's program. The calculations below show how this figure was derived.

5 YCC enrollees	40 labor hours per day
X 8 hours per day	x 5 days per week
= 40 labor hours per day	200 labor hours per week

200 labor hours per week
X 8 weeks of the program
= 1600 total labor hours available

(5) Environmental Education

Environmental education and resource conservation was emphasized throughout the duration of the YCC program. During the eight weeks of the program, 18 percent of the enrollees time was spent engaging in environmental awareness activities.

Four methods were primarily used to convey environmental awareness to the enrollees: 1) field trips, 2) films and videos, 3) guest speakers, and 4) informal discussions.

This year the SCA resource assistants played an active part in programming environmental awareness activities. This proved to be mutually beneficial for both the volunteers and the YCC crew. It provided a greater variety of responsibilities for the resource assistants and a broader educational experience for the enrollees.

Understanding the purpose and function of the work projects also contributed to the environmental education aspect of the YCC program. After completing each project a debriefing session was held to discuss the following:

1) The overall benefit of the project to the Refuge.
2) Any direct or indirect benefits the project has for wildlife.
3) Both positive and negative environmental impact of the project.

(6) Safety

Safety is the first priority of the YCC program. Safety concerns were stressed during orientation and emphasized throughout the entire eight week program.

During the work day, enrollees were required to wear hardhats, gloves and sturdy work boots. Shin guards and tin man boots were recommended when working with a weed whip or pulaski. Crew leaders were sure the enrollees were aware of the proper usage of tool safety guards.

A presentation on canoe safety was given before the crew departed on the final canoe system spike camp. The lesson included information on proper strokes, portage techniques, and water safety. A skills test was conducted on Headquarters Lake to assess the ability of each of the enrollees. A water and canoe safety class was required of all groups participating on a canoe system spike.

Hopefully, the Refuge will continue to sponsor the YCC program for years to come. The program offers teenage youth an excellent opportunity to become actively involved in the management of their land, wildlife, and resources. The enrollees gained valuable work skills and professional contacts while experiencing a quality "hands-on" educational program. Furthermore, it provides long lasting benefits to the Refuge, the visitors, and the surrounding community.

3. Other Manpower Programs

Nothing to report.

4. Volunteer Services

Kenai's volunteer program, which involved 68 people and thousands of hours in 1990 is comprised of three components: local volunteers, seasonal volunteers, and (SCA).

a. Local Volunteers

Local volunteers are viewed as a vital component of the Refuge program since: 1) they are volunteers in the strictest sense of the word, and 2) they provide an invaluable link to the local communities and help to project positive values about the Refuge.

Kenai maintains a core group of about ten local volunteers, who meet our program's twelve-hours-per-month minimum requirement by operating the visitor center and the bookstore outlet as well as hosting our weekend wildlife film programs. If it were not for these volunteers, the Visitor Center's weekend and summer operating hours would be greatly reduced. Local volunteers contributed significantly to the high level of public service provided to the 27,000 plus people who visited the Refuge Center in 1990.

In return for their efforts, local volunteers received the following awards: 1) membership in the Alaska Natural History Association (ANHA) and a 15 percent discount on books, cards, posters, and other sales items sold at ANHA outlets thoughout Alaska; 2) awards based on hours of service which included KNWR T-shirts, posters, pins, wildlife books, and airplane trips over the Refuge; 3) specialized volunteer awards and certificates; and 4) volunteer recognition luncheons and pizza nights.

Local volunteer Linda Story helps out on week-ends in the Visitor Center 05/91/JF

b. Seasonal Volunteers

Seasonal volunteers commit to at least three months of continuous 40 hour per week service. Generally, these volunteers come from the volunteer recruitment program coordinated by Bill Kirk at the Anchorage Regional Office. Seasonal volunteers receive free housing and $450 per month for food and essentials. In 1990, graduate biology students comprised the majority of this volunteer force. These students devoted themselves to intensive wildlife projects, often the focus of their own master's projects.

In 1990, community and seasonal volunteers contributed 3,870 hours of service to the Refuge - the equivalent of almost two full-time staff member's work.

c. Student Conservation Association (SCA)

The SCA program is an important component of the Refuge's public use and biology programs. SCA's work with us for 12-16 week terms, completing a variety of operational tasks while learning about resource agency careers.

These resource assistants are not "volunteers" in the strictest sense of the word, since they receive a small stipend and travel allowance. Working with the SCA program since 1985, we have consistently had high caliber interns, who accomplish quality work.

In 1990, seven SCA collectively contributed over 4,656 hours towards Refuge projects. Their work included: visitor center and visitor contact station operation, conducting interpretive programs, wildlife education programs, public information programs, trail brushing and rerouting, patrol of foot and canoe trails, litter pick-up and maintenance projects, moose hunter check station operation, biological data collecting, and wildlife live-trapping and radio collaring.

Ranger Rick Johnston leads SCA/Seasonal Orientation to Kenai River Canyon. 06/90/JF

In the spring of 1990 a new SCA position was added to assist with the environmental education program and was so successful it was adopted as an integral part of the Refuge's SCA program.

d. Local Service Groups

During the summer of 1990 several youth service organizations volunteered for work projects associated with the canoe trails and campgrounds. Often groups visited the Refuge Visitor Center for training in minimum impact camping and bear safety prior to beginning their service projects in the backcountry. Boy Scouts on the Swanson River and Swan Lake Canoe Systems donated 380 volunteer hours gathering litter and restoring campsites.

e. Campground Hosts

A new volunteer program to the Refuge in 1990 began with one campground host couple at the newly renovated Hidden Lake Campground. Hosts acted

as the "eyes and ears" of the campground, assisted in campground fee collections, and helped to staff the visitor contact stations. Their role proved to be a necessity for the smooth operation at Hidden Lake Campground.

5. Funding

Table 8. Kenai National Wildlife Refuge funds, Fiscal Year 1985 through 1990.

	Fiscal Year				
Operating and Maintenance Funds (Thousands of Dollars):	1986	1987	1988	1989	1990
Wildlife Funds	953	1,087	1,324	1,181	1,093.3
Expense for Sales	59	82	82	82	81
Small ARMM*	169	130	0	0	0
Fire Presuppression and Preparedness	0	0	0	0	233
Subtotal	1,181	1,299	1,406	1,263	1,407.3
Specific Project Funds (Thousands of Dollars):					
YCC Funds	28	0	0	0	10
Large ARMM*	50	0	71	0	0
Refuge Resource Problem	20	75	50	40	30
Refuge Resource Problem	10	0	42	168	0
Maint. Management System	0	0	0	0	80.5
Skilak Wildlife Recreation Area	362	**1,500	**697	**0	**0
Subtotal	470	1,575	860	208	120.5
TOTAL	1,651	2,874	2,266	1,471	1527.8

*Accelerated Refuge Maintenance Management
**No Year Money (Held in Region)

Refuge Resource Project funds of $20,000 were used for monitoring PCB cleanup efforts, and $10,000 was used to remove and dispose of 23 barrels of contaminants at Skilak Guard Station. Maintenance Management System funds in the amount of $80,500 were used for deficiencies in the Swanson River/Swan Lake Campgrounds, visitor center and headquarters building. Five YCC youth and one leader were hired for $10,000 to perform campground and trail maintenance.

Table 9. Kenai National Wildlife Refuge position patterns, Fiscal Year 1986 through 1990.

Personnel	Fiscal Year 1986	1987	1988	1989	1990
FTE's (Person years)	20.8	25.0	22.0	22.0	23.45
PFT Positions filled	16.0	16.0	18.0	18.0	18.0
Vacant PFT 12/31**	7.0	7.0	2.0	3.0	5.0
PPT Positions filled	0.0	0.0	0.0	0.0	1.0
Vacant PPT 12/31**	1.0	0.0	2.0	1.0	0.0
Temporary	11.0	13.0	14.0	13.0	13.0
Temporary Intermittent	0.0	0.0	4.0	4.0	9.0
YCC Staff Positions	2.0	2.0	0.0	0.0	1.0
Vacant YCC Staff	0.0	0.0	0.0	0.0	0.0
YCC Enrollees	12.0	0.0	0.0	2.0	5.0
Volunteers	28.0	30.0	19.0	15.0	17.0

**Vacancies from Organization Chart.

6. Safety

Fire Management Officer/Pilot Larned conducts the June safety meeting at Headquarters Lake. 06/JEF

Ranger Steve Hudson demonstrated safe gun handling techniques in a bear safety orientation for seasonal staff. 06/90/CS

The first half of 1990 passed without incident. No accidents occurred until June 12 when Wildlife Biologist Andy Loranger lacerated his lower right leg (muscle above the achilles tendon) with a pulaski. The accident occurred while building fireline's in preparation for the Mystery Creek Burn. Because of the cut's nature, Loranger was fitted with a hard cast. He was able to return to work within a few days and only three time-lost days occurred. The hard cast was removed after one week and he was fitted with a walking cast which was worn for five additional weeks. Loranger underwent physical therapy treatment from October to December to help rebuild the atrophied muscle, and at year's end, was well on the road to recovery. However, he mentioned it would be quite some time before he is operating at the level of efficiency he was at prior to the accident. He was quick to point out his good fortune in that the situation could have been a lot worse than it was. With this accident, the "floodgates were open" so to speak, as seven additional accidents took place before the end of October.

Only one week later (June 19), Graduate Student Win Staples cut his lower thumb while padding traps with rubber hose. The injury required three stitches and no time-lost days occurred.

On July 20, fifteen-year-old "People Count" Enrollee John Williamson suffered a severe eye injury while cleaning the maintenance shop. John attempted to extract a pressurized air hose from a wall mounted terminal. He apparently did not have a firm grip on the hose end which snapped back striking him in the right eye. He was taken to the hospital emergency room and kept in intensive care overnight. On July 25, he underwent surgery to repair a broken bone behind the eyeball. The prognosis now appears favorable for a return to normal vision despite the rather traumatic injury. The wall mount connection has since been moved to a lower location (well below eye level).

While fire fighting in the McGrath area, Seasonal Biological Technician James Brickey fell and hit his ear on a backpack pump nozzle (five-gallon Fedco) August 4. Brickey was transported to Providence Hospital in Anchorage for treatment. Six stitches were required to close the wound and he was released the same day. Three time-lost days occurred as Brickey recuperated from his wounds.

On August 19, SCA volunteer Mark Majewsky sliced a finger on his left hand while preparing sandwiches. Five stitches were needed to close the laceration and Majewsky was given a week to recuperate.

Equipment Operator Dick Kivi injured his back September 25 while helping lift a bench in the carpentry shop. He bruised a disk and had to undergo therapy. Dick was off work until November 27 with 42 time-lost days resulting from the injury. At the end of the year, he was making progress in his recovery but his lifting was restricted not to exceed 25 pounds.

Win Staples was injured while handling a partially immobilized lynx on October 18. After the animal was darted, two hunting hounds jumped it and began biting it on the neck. When Staples pulled the lynx free, it turned on him, and before he could contain it, was bit on the thumb and clawed on the lip. Six stitches were needed to close the wound and no time-lost days resulted.

On October 29, Fish and Wildlife Biologist Ted Bailey also "fell prey" to a wild animal. After a lynx was treed by hunting hounds it was immobilized, but hung up on a branch about 30 to 35 feet up. While Staples and doghandler Darrell King pushed the lynx free with a long pole, Biological Technician Jozwiak and Bailey, holding a four to five foot square net, prepared to catch the immobilized lynx when it fell. The lynx hit the net, in an abrupt downward force, most of the impact was absorbed by muscles in Bailey's right arm. The arm began hemorrhaging under the skin and became very sore, then Bailey went to a doctor for treatment. The examination revealed a ruptured bicep muscle in Ted's right arm. He was released and returned to work the following day. Score two points for the lynx, zero for Biology.

The months of November and December were accident-free as we closed out the year in a safe fashion. The Kenai Fisheries Assistance Office chaired their first safety meeting in November by inviting Trooper Hughes from the Alaska State Troopers to come in and give a presentation on winter driving. In the future, Fisheries will designate a person from their office to chair the safety meetings once every third month.

Total time-lost days was 54, compared to two in 1989. Although there was a substantial increase in work-related accidents for Refuge employees, we were fortunate in that no fatalities occurred on the Refuge this year.

A private pilot and his passenger were killed when their rented Cessna 150 spiraled into a marshy area just off the Refuge boundary, northwest of Beaver Creek Field. Another Cessna made a forced landing in the northern portion of the Refuge for yet unknown reasons. The pilot was uninjuried and the plane later removed. This is one of the first years we have not written our annual "plane falls through the ice" story. Perhaps some of our visiting airmen are beginning to realize that gravity works on ice as well as in the air!

Johnston attended Arctic Survival Training at Eielson Air Force base from February 5-9. It was a cool -45 F during the field sessions. Kaliforsky Beach Firefighters/Emergency Medical Technician Terry Rude conducted CPR Training/Recertification class for public use staff on July 16. Nine staff members attended this well-organized session. Johnston attended two Search and Rescue operation courses held in Soldotna.

The Refuge experienced problems with the new radio system throughout most of 1990. Regional Office Radio Specialist Tim Miller and representatives of SouthCentral Radio (system installers) visited the Refuge on January 18, in order to trouble-shoot the situation, however, numerous "bugs" remained at month's end. Radio problems at Kenai often translate into serious safety problems, with crews afield in subzero temperatures without a reliable radio. Hopefully all the "bugs" will be worked out soon. After several problems were corrected the system seemed to be working quite well. A new telephone interconnect capability was also installed at the Refuge repeater site and should significantly enhance safety.

Refuge staff reviewed a proposed regional watercraft safety plan, circulated during November. Generally Refuge staff expressed approval with the plan, which is intended to enhance Region 7 boating safety operations.

Several personal floatation devices including float coveralls, floats and life preservers were ordered and received during November.

Refuge staff also reviewed the draft Bear Safety Plan during 1990. Several provisions of the plan needed modification but in general the Safety Plan will enhance employee safety. The new policy calls for course work in bear conflict avoidance, bear behavior and firearm proficiency and safety.

7. Technical Assistance

In May, Outdoor Recreation Planner Simpson conducted a two-hour session at the Basic Refuge Training Academy in Blair, Nebraska. The session covered "Volunteer Programs and Cooperating Association" on field stations.

Region 7 Uniform Co-ordinator Ward attended a meeting of the National Uniform Committee, March 26-30, to present Alaska concerns regarding specific safety and cold weather needs.

Outdoor Recreation Planners Simpson and Johnston conducted "Preventive Law Enforcement" sessions at two joint Region 2 and 7 Law Enforcement Refresher Training sessions in March 1990.

The Kenai Refuge hosted a basic fire management course the week of May 7 to 11. The course was attended by 22 trainees, who became qualified to participate in prescribed burning and wildfire suppression. A small prescribed burn was planned as a class exercise but was rained out.

YCC Enrollees assisted the Alaska Department of Fish and Game with fence construction at the Swanson River Moose Research Center.

Refuge Pilots provided radio tracking support flights for the U.S. Fish and Wildlife Fisheries researchers studying the migration of sockeye salmon.

Two groups of Civil Air Patrol cadets and the Anchorage wing of the Civil Air Patrol participate in winter training exercises. The Refuge cabins at Vogel Lake and Trapper Joe Lake were made available for the downed aircraft simulations exercise.

Seasonal Park Ranger Steve Hudson participated in a spring Bear Hunting Task Force on the Alaska Peninsula Refuges.

8. Other Items

Nothing to report.

F. HABITAT MANAGEMENT

1. General

The U.S. Forest Service (USFS), Chugach National Forest, proposed to construct several recreational improvements adjacent and within the Russian River. The Forest Service alleged such extensive angler generated bankside and in-river habitat damage that numerous in-river water diversion, bank stabilization, debris placement, and fill projects were needed.

The project began with several USFS meetings expressing alarm about the problem and alleging other problems so severe that up-river salmon migration was impeded. The project proposal culminated with an environmental assessment (EA) and several options decisions. The Forest Service's preferred alternative contained upland development including a new road, high standard trail, parking area, handicapped fishing platform, riverside restrooms, bank stabilizations and numerous in-river structures.

Refuge response to the proposal rejected in-stream structures as unnecessary and suggested new recreational developments remain in context with the actual problem. Alleged widening of the Russian River and reported siltations of fish habitat was rejected in the response letter as unsubstantiated with several proposed design responses being unnecessary. Several Forest Service suggestions, including tree replanting and resting stream side areas, were consistent with the actual resource problem in the area and were encouraged by the Refuge.

At year's end, the Forest Service was beginning to run into significant opposition from the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service (Ecological Services) and the U.S. Army Corp of Engineers regarding several in-river diversions and bank stabilization structures. The Refuge had previously expressed concerns regarding any riverbed disturbance or structures that might be placed in the Russian River.

Additionally, Cook Inlet Region, Inc., expressed concern about several upland developments as potentially damaging to cultural resources and/or their pending 14(h)(1) land claim to the Kenai-Russian River confluence area. Ecological Service's coordinated discussion among various research and Refuge staff regarding in-river structures and reviewed the Refuge's earlier comments on the U.S. Forest Service's EA. In addition to concerns about proposed river structures, State and Federal regulators were concerned about an unauthorized test structure which was placed in the river in September.

In an unprecedented development, an Alaska Fish and Wildlife Protection Officer investigated the structure built prior to State approval as an anadromous stream encroachment subject to criminal sanctions. At year's end, the State submitted an investigation report of the alleged violation to the district attorney with the Seward Ranger District's Project Leader and Forest Hydrologist as primary suspects.

At year's end the project was close to outright rejection by Federal and State permit reviewers as unnecessary and ill conceived.

Refuge Concessionaire John Galazia also appealed the Forest Service's decision to construct recreational improvements and called for a joint Forest Service and Refuge plan. He apparently feared an economic loss due to loss of appeal of the existing Kenai River Ferry as a result of the new trail.

2. Wetlands

Nothing to report.

3. Forests

Commercial timber harvest has been de-emphasized on the Refuge as a habitat management technique, in favor of prescribed fire and managed wildfire, for the following reasons:

a. Commercial timber stands on the Refuge are spotty, with generally low quality and volumes.

b. Lack of road access to otherwise suitable stands precludes their exploitation.

c. Timber access roads, skid trails, and other scars are persistent in the boreal forest, and are not biologically or visually compatible with other Refuge management objectives.

d. Local demand for timber products is low, especially with the currently-depressed Alaskan economy, and the limited capability of timber operators makes harvesting significant acreages a process requiring many years to complete.

e. Timber harvest removes a significant portion of the soil nutrients in a nutrient-poor environment such as the Kenai, which may have long-term impacts on forage production and palatability.

For these reasons, timber harvesting on the Refuge has been used primarily where safety or other special considerations precludes the use of fire, or as a pre-burn treatment to help accomplish burning

objectives. This situation may change somewhat in the near future because a newly constructed wood chip plant in Seward is expected to create a large demand for small diameter timber that previously had no market. This development may make timber harvest a practical technique for habitat improvement, particularly as a pre-burn treatment in areas where previously it was not given serious consideration.

In 1989, a small timber harvest was conducted as a site preparation for a future prescribed burn. The 23-acre parcel contains firewood-quality birch and white spruce and was bought by a local operator. In 1989 he could not complete the sale due to heavy snow and volcanic ash, so the permit was extended until April of 1991. Equipment breakdowns precluded him from making any progress during fall and winter of 1990, but he hopes to complete the sale in early 1991.

Public firewood areas serve the dual functions of low-cost habitat enhancement/fuel management and a source of heating fuel for local people. The Funny River Road cutting area was opened again with a $20 fee charged for up to five measured cords of firewood per family for personal use. This year the area was opened October 9, and dead seasoned spruce was in fair abundance thanks to the "overachievement" of the slash disposal prescribed burn conducted there in May of 1988. Fifty-two permits were issued in calendar year 1990, compared with 66 in 1989 and 50 in 1988.

Refuge lands were opened as usual for free personal-use Christmas tree cutting, and the 1947-burn spruce regrowth on Mystery Creek Road was available for commercial Christmas tree harvest at a permit fee of $1 per tree. Conditions were favorable for accessing the trees this year, and 180 trees were purchased by three permittees. In 1989 deep snow resulted in only one permit being issued for ten trees.

There has been a limited but persistent demand by Peninsula residents for fire-killed spruce poles for fences and other domestic uses, which we have accommodated by issuing free permits for pole cutting at a gravel pit access road near Mystery Creek Road turnoff on the Sterling Highway, and along Mystery Creek Road itself in conjunction with the seasonal opening of the road for the hunting season. Five permittees harvested an unreported number of poles this year, compared to six pole harvesters in 1989.

In July and August 50 vegetation sampling plots were conducted at each of ten permanent plot markers within the 1987 Skilak Loop II prescribed burn. Results of this effort indicate that birch seedlings are by far the dominant woody plant in the shrub layer, with a relatively uniform distribution, and an estimated density of 4228 stems per hectare. Aspen and willows reproduced vegetatively for the most part, in a more spotty distribution. The understory and ground cover is dominated by fireweed and mosses, with five other species also fairly abundant and nine other species or groups represented. Moose have not invaded this burn yet to the extent that they have the 1984 burn two miles to the west.

Three years of regrowth after the 1987 Skilak Loop II prescribed burn have yielded a high density of birch, willow and aspen seedlings. 8/90 WWL

A dense willow understory has developed in the 1988 Funny River burn where the slash treatment fire "overachieved" in an adjacent mature black spruce stand. 7/90 WWL

Table 10. Summarized results of vegetation regrowth measurements made during July and August, 1990, at 10 permanent plots (500 total sample points) within the Skilak Loop II habitat management area that was crushed in 1985 and burned in 1987, Kenai National Wildlife Refuge.

Shrub/sapling species	Frequency (%)	Stems/hectare (X)	height (cm.) (X)
Betula papyrifera	58	4228	53
Populus tremuloides	24	1892	66
Salix spp.	22	560	78
Rosa acicularis	1.4	52	49
Viburnum edule	0.4	16	45

Understory species	Frequency (%)	Canopy cover (%)
Epilobium angustifolium	92	15
Moss spp.	88	26
Betula papyrifera	30	5
Lycopodium spp.	24	2
Gramineae	21	5
Lupinus arcticus	18	10
Cornus canadensis	16	1.3
Equisetum pratense	4	0.3
Populus tremuloides	3	1.3
Vaccinium vitis-idaea	2	0.3
Linnaea borealis	1	0.5
Polemonium acutiflorum	1	0.1
Salix spp.	1	0.3
Viburnum edule	1	0.2
Rubus idaeus	0.4	0.01
Pyrola asarifolia	0.2	0.01

4. Croplands

Nothing to report.

5. Grasslands

Nothing to report.

6. Other Habitats

Nothing to report.

7. Grazing

Nothing to report.

8. Haying

Nothing to report.

9. Fire Management

Since 1982, the Alaska Division of Forestry has provided fire protection for the Refuge and surrounding lands under cooperative agreement with the Bureau of Land Management's Alaska Fire Service. Detection of fires is rapid due to the relatively high population and aircraft density, and suppression of fires, both on and off the Refuge, is accomplished quickly and effectively using helitack and engine crews.

The 1990 fire season was typical of recent years, with nine fires responded to from June 25 to September 4, with a grand total of slightly over two acres burned. Eight of these fires originated from neglected campfires, while the ninth was caused by an automobile fire which escaped a short distance into the adjacent forest. One of these fires was in an area designated for "limited" suppression (it was extinguished by a helpful tourist), three were in "modified", three in "full", and two in "critical". Refuge personnel and equipment were used on several of the fires, as local suppression resources were often scarce due to the unusually active interior fire season.

The one-acre Russian River fire was apparently started by an escaped warming fire left unattended by a careless fisherman. 7/90 RKJ

While the fire season on the Kenai Peninsula was not too exciting, that of the Alaskan interior was an entirely different story. Fire Management Officer/Pilot Bill Larned was called away for three assignments. The first was to the Tok River fire as a Fire Behavior Analyst in mid-July. Later in July he was called back to Tok to set up an aerial ignition operation utilizing the Refuge's two helitorches. Finally, in late August Bill was called to McGrath to fill in for a few days as Situations Unit Leader. Seasonal fire technicians Jim Brickey and Jay Shepherd spent even more time than Bill as "fire tourists" around the State. They served as all terrain vehicle (ATV) engine operators on two State fires, utilizing the Refuge Bombardier track ATV with Compressed Air Foam System, worked on hand crews at two fires, and spent considerable time at the Tok River fire as helitorch crewmembers, helicopter manager, and other helibase positions.

Our prescribed burning program was disappointing this year. For the second year in a row the carry over 4800-acre burn target area came into prescription in early July, just a few days after all the State's suppression forces became committed to the fire "bust" in the interior. Meanwhile we maintained our state of prescribed burn readiness in case the statewide situation should change -- so much so that we later heard that we had made the suppression folks a bit nervous thinking we might actually touch it off with the rest of the State burning up. This is the way it is with prescribed burning in this area: there is a very brief window, and it comes right during the interior Alaska fire season.

10. Pest Control

An ongoing spruce bark beetle epidemic in the Cooper Landing and adjacent areas, particularly on State and U.S. Forest Service lands, has caused a great deal of concern about increased danger to the Cooper Landing community from wildfire fueled by the abundant dead spruce trees. This year a task force led by the Forest Service and composed of other agencies and private individuals completed and began to implement a plan to reduce the fuel hazards by logging and prescribed burning in a strategically designed pattern. The Refuge identified and marked dead trees along the Sterling Highway within the highway right-of-way for removal by the state Department of Transportation, but it looks now like the project will be delayed until fall of 1991 due to insufficient funding.

Removal of hazardous beetle-killed trees was conducted this year on two Refuge campgrounds: Russian River and Jim's Landing. In late winter, local contract loggers completed the Russian River Campground sale, removing over 800 trees, and removed about two-thirds of the 600 marked trees at Jim's Landing before breakup conditions forced them to postpone completion of this sale until January 1991.

Elsewhere on the Refuge the epidemic appears to be running its course, with the majority of the trees that have been dead from five to ten years now being horizontal due to wind-throw, at least in the exposed lowland areas.

The Refuge, aside from removing dead and dying trees around recreational facilities where they constituted a hazard, has made no attempt to manage this cyclic forest pathogen. Most of the mortality on the Refuge has occurred in designated wilderness and other inaccessible areas where dead trees do not constitute a fire hazard to communities, nor is it practical to salvage them for commercial or personal use.

11. Water Rights

Nothing to report.

12. Wilderness and Special Areas

A Refuge patrol plane and officer inspects a campsite on Goat Lake within Kenai Wilderness just two days before freeze-up. 10/90/RJ

Annual work on several trails within Kenai Wilderness occurred during 1990, including maintenance conducted on Fuller Lakes Trail, Skyline Trail, Surprise Creek, Swan Lake and Swanson River Canoe Trails, Funny River Horse Trail and Emma Lake Trail.

The Refuge received a Freedom of Information request from Allen E. Smith of the Wilderness Society regarding a wilderness race which was conducted on the Refuge from 1981 until 1984. The response was sent out on September 26, 1990. Mr. Smith's primary concern appeared to be the

precedent of such activities on Refuge wilderness areas, particularly for prospective proposal to conduct such a race on wilderness sections of Arctic National Wildlife Refuge.

The Refuge received a request from Chugach Native Association to make multiple helicopter landings within the Refuge's southern addition. The lands are within Kenai Wilderness but also over selected portions of Chugach Native Association lands. The purpose of the landings was to collect ore samples that would assist them in choosing Refuge lands from the over selected lands made pursuant to their Alaska Native Claims Settlement Act (ANCSA) entitlement. Although no mineral authority could be found that allowed prospecting in Refuge and/or wilderness lands, the Regional Office advised that a permit was to be issued to conduct their requested activity. Cooperation "in the spirit" of the ANCSA was cited as the reason for issuing the permit. The activity was conducted without any known consequences or incidents, although no report or correspondence was given to the Refuge as a result of the project.

The Refuge received a proposal from Cook Inlet Aquaculture Association to conduct an egg take of Goat Creek bound sockeye salmon at Upper Russian Lake. The egg take would take place within Kenai Wilderness. The eggs were to provide hatchery stock for an early run of salmon at Bear Creek near Seward.

The Refuge gave approval for the proposed activity as a backup to the primary off Refuge site located at Big River Lake. The 1989-90 eruption of Mount Redoubt and its affect on nearby Big River Lake resulted in a request to utilize the Refuge alternative site. Tentative approval was granted although lessened volcanic activity rendered the Big River Lake site acceptable for the project. However, unexpected flooding conditions shifted the primary site back to the Refuge.

A permit was issued for the take of 3.03 million sockeye eggs. Permit stipulations were invoked to prevent conflict with wilderness values and brown bear in the area. The implications of removing spawning salmon and their eggs from the ecosystem within the most protected land use classification within the Fish and Wildlife Service i.e. (Refuge wilderness and research natural area) has yet to be determined. It is also unclear if Cook Inlet Aquaculture Association will seek future eggs from the area.

Refuge Manager Doshier responded to a question and answer inquiry regarding wilderness management issues affecting National Wildlife Refuges on behalf of Assistant Regional Director, Region 2 for participation in a BLM workshop.

Doshier responded that at this time at the Kenai Refuge the most significant resource issues in management of wilderness areas relates to access and salmon enhancement. Mechanized access allowed in Alaskan Wilderness (snowmachine and airplane) has the potential to negatively impact wildlife resources and may already be doing so.

Recreational snowmachine use in the Caribou Hills area may have significantly disrupted wildlife using the area. Unfortunately, funds have not been available to evaluate the impacts. The other area of concern, salmon enhancement, may be changing the genetic diversity of the natural salmon runs. The long term impacts of salmon enhancement is yet to be determined.

13. WPA Easement Monitoring

Nothing to report.

G. WILDLIFE

1. Wildlife Diversity

The only reports of uncommon species throughout the western Kenai Peninsula during 1990 were four to five red-breasted nuthatches at bird feeders in the Soldotna, Kenai Keys, and Kasilof areas. This species were not observed during the standard breeding bird surveys on the Refuge during June 1990.

2. Endangered and/or Threatened Species

No known endangered or threatened species were observed on the Refuge during 1990.

3. Waterfowl

Systematic surveys of waterfowl on the Refuge in 1990 included nesting, early productivity and late productivity aerial surveys of trumpeter swans and counts of waterfowl observed during winter bald eagle float surveys on two sections of the Kenai River. Refuge staff also monitored spring migration and staging of snow geese and other waterfowl on the Kenai River Flats, with emphasis on observation of neck-collared geese.

Northern pintails and mallards are among the first waterfowl species to arrive each spring on the Kenai River Flats. 4/90/AJL

Refuge staff coordinated with the Division of Migratory Bird Management in lieu of planned participation in the statewidé Waterfowl Production Survey. Survey plots for the Kenai-Susitna Production Area were randomly selected and mapped and survey cost estimates developed. Unforeseen personnel and funding problems ultimately led to dropping this production area from the statewide survey in 1990. We are hopeful that it will be included in 1991.

Fire Management Officer/Pilot Bill Larned participated for the fifth year in a study being conducted by Migratory Bird Management, aimed at deriving a visibility correction factor for various habitats throughout the State, surveyed during the annual waterfowl breeding pair surveys. He is in charge of the helicopter portion of the study, which compares waterfowl counts made from a helicopter with those made from a fixed-wing Turbo Beaver. This year's field work took place on the Yukon Delta National Wildlife Refuge in western Alaska.

a. Trumpeter Swans

The trumpeter swan nesting survey was conducted on May 29 and 30, the early productivity survey on July 2, 11 and 12, and the late productivity survey on August 22 and 23.

At least one cygnet hatched successfully at 26 of 36 active trumpeter swan nesting territories on the Refuge in 1990. 08/90/TNB

A total of 118 swans, including 34 nesting pairs, one single adult with nest, 18 non-nesting adult pairs, 7 single and six flocked adults (two flocks of three swans each), was observed during the spring nesting survey (Table 11). The early productivity survey consisted of surveying only those active territories discovered during the nesting survey. Of these 35 territories, 25 had paired adults with broods, seven had paired adults without young, and no swans were observed in three. Brood size ranged from 2-6 cygnets and averaged 4.28 cygnets for the 25 broods.

Table 11. Summary of nesting and early and late productivity swan surveys on and adjacent to the Kenai National Wildlife Refuge, 1990.

	Survey		
Attribute	Nesting	Early Productivity	Late Productivity
Single Swans	7	0	5
Pairs	18	7	20
Flocked Swans	6	5	15
Single + Nest	1	-	-
Pair + Nest	34	-	-
Tot. Nesting Territories	35	25	26[1]
Single + Brood	0	0	0
Pair + Brood	0	25	26
Total Broods	0	25	26
Total Adults	118	69	112
Total Cygnets	0	107	91
Avg. Brood Size	-	4.28	3.50
Total Swans	118	176	203

[1] Includes one nesting territory with pair + brood not observed during earlier surveys.

A total of 203 swans (112 adults, 91 cygnets; 45 percent young) was observed during the late productivity survey, including 26 pairs with broods, 20 paired adults, five single adults and 15 flocked adults (Table 12). One additional nesting territory was identified during the late productivity survey, bringing the total of active nesting territories on and adjacent to the Refuge to 36 in 1990. Nesting success (at least one cygnet hatched successfully and survived to date of early productivity survey) was 72.2 percent (26 of 36 nests).

Average brood size declined 12.5 percent between the early and late productivity surveys, from 4.28 to 3.50 cygnets. Reductions in the number of cygnets from early to late brood rearing occurred in 14 of the 25 broods (56 percent) which were observed during both surveys. The average cygnet loss per brood in these 14 broods was 1.5.

Table 12. Trumpeter swan nesting locations and productivity on and adjacent to the Kenai National Wildlife Refuge, 1990.

Location	Wilderness	1990 Active Territory	Early Prod. Adults	Early Prod. Cygnets	Late Prod. Adults	Late Prod. Cygnets
North of Kenai R. (Inside Refuge)	Inside	Angler/Kuguyuk Lakes	2	0	0	0
	"	Camp Island	2	5	2	5
	"	Grebe Lake	2	3	2	2
	"	Greycliff Lake	2	2	2	1
	"	Moose Lake	2	0	2	0
	"	Moose R (lower)	2	6	2	6
	"	Moose R (upper)	2	6	2	6
	"	Scenic Lake	2	4	2	3
	"	Warbler L. (lake S.)	2	0	0	0
	"	Moosehorn Lake	2	4	2	4
	"	Chickaloon River	2	6	2	4
	"	Diamond Lake	2	0	0	0
	"	Vogel Lake	2	5	2	2
	"	Fish Lake	2	4	2	4
Subtotal			28	45	22	37
North of Kenai R. (Inside Refuge)	Outside	Beaver Lake	2	3	2	3
	"	Curlew Lake (lake W)	2	5	2	5
	"	Donkey Lake	2	0	0	0
	"	Quill Lake	2	5	2	2
	"	Scaup Lake/Bogs	2	4	2	2
	"	Swan Creek	2	2	2	2
	"	Trapper Joe Lake	2	6	2	6
	"	Two Island Lake	2	0	2	0
	"	Woodpecker Lake	0	0	0	0
	"	Flat Lake	2	4	2	3
	"	Otter Creek (pond S)	2	4	2	2
	"	Krein Lake	2	0	2	0
	"	Bill Besser Lake (SE)	0	0	0	0
	"	Cow Lake	0	0	2	5
Subtotal			22	33	22	30
North of Kenai R. (Outside Refuge)	Outside	Bishop Creek	2	3	2	3
	"	Timberlost L. (S. of)	2	5	2	4
	"	Suneva Lake Bog	2	6	2	5
Subtotal			6	14	6	12
South of Kenai R. (Inside Refuge)	Inside	Fox Lake	2	4	2	3
	"	Fox River	2	4	2	3
	"	Harvey L./Killey R.	2	3	2	3
	"	Brown's Lake bogs	5	0	5	0
Subtotal			11	11	11	9

Table 12. Continued.

Location	Wilderness	1990 Active Territory	Early Prod. Adults	Early Prod. Cygnets	Late Prod. Adults	Late Prod. Cygnets
South of Kenai R. (Inside Refuge)	Outside	Bay Lakes Bogs	2	4	2	3
Subtotal			2	4	2	3
TOTAL			69	107	63	91

b. Wintering Waterfowl on the Kenai River

Table 13. Waterfowl observed on the upper Kenai River - Kenai Lake Outlet to Jim's Landing - during bald eagle boat surveys, 1990.

Date	Species				
	Goldeneye	Merganser	Mallard	Bufflehead	Unidentified
01-18-90	102	19	46	0	n.r.
02-22-90[1]	n.r.	n.r.	n.r.	n.r.	n.r.
03-15-90	45	54	83	3	0
11-15-90	42	16	95	3	0
12-13-90	66	15	65	0	0

[1]Aerial survey conducted due to river ice conditions.
n.r. - not recorded.

Common goldeneye, common mergansers and mallards are the most common wintering waterfowl on the Kenai River. Other duck species occasionally observed during winter bald eagle float surveys include bufflehead and harlequins. A single trumpeter swan was observed near the outlet of Skilak Lake on January 22, 1990. Historically, several swans commonly overwintered in this area. Five adult swans and two cygnets were observed in this area on November 14, 1990. Waterfowl observations during 1990 surveys are summarized in Tables 13 and 14.

Table 14. Waterfowl observed on the lower Kenai River - Skilak Lake Outlet to Bing's Landing - during bald eagle surveys, 1990.

Date	Species				
	Goldeneye	Merganser	Mallard	Bufflehead	Unidentified
01-25-90[1]	n.r.	n.r.	n.r.	n.r.	n.r.
02-22-90[1]	0	0	0	0	10-20
03-15-90[1]	150	0	0	0	0
11-14-90	563	1	97	0	0
12-13-89	n.r.	n.r.	n.r.	n.r.	n.r.0

[1]Aerial survey conducted due to river ice conditions.
n.r. - not recorded.

c. Snow Geese - Spring Migration and Staging on the Kenai River Flats

Snow geese were first observed by Refuge staff on the Kenai River Flats on April 15, and reports from the public indicate that the first snow geese arrived on April 14. Canada geese and mallards were present on April 9 (Table 15). Peak numbers of snow geese were recorded on April 18, when approximately 3,250 were observed. Concentrations exceeding several thousand geese have been documented in recent years on the Flats, where open habitat generally becomes available before that in other Cook Inlet staging areas. Rapid spring melt and drying of ephemeral wetlands in 1990 on the Kenai Flats were believed responsible for the relatively small numbers of snow geese observed. The largest concentrations of snow geese in Upper Cook Inlet in 1990 occurred on the Susitna Flats, where habitat conditions were more favorable.

The Service's Alaska Fish and Wildlife Research Center coordinated an effort to read collar codes of neck-banded snow geese throughout Upper Cook Inlet in 1990 for the International Snow and Ross' Neckbanding Project. Thirty collar codes were read by Refuge and Alaska Department of Fish and Game staff on the Kenai Flats. Snow geese staging in upper Cook Inlet are part of the Wrangel Island subpopulation, for which two distinct wintering areas have been identified. Through this effort, it was determined that most snow geese using Upper Cook Inlet during spring migration originate from the Skagit/Fraser rivers wintering area in Washington and British Columbia. Wrangel Island snows wintering in the Central Valley of California are believed to use an inland migration route through Canada.

Monitoring of snow goose behavior in upper Cook Inlet during spring migration indicates that over 75 percent of daylight hours are spent feeding. 4/90/AJL

Table 15. Waterfowl observed during spring migration and staging on the Kenai River Flats, 1990.

Date	Snow Goose	Canada Goose	Northern Pintail	Mallard	American Wigeon
9 April	0	50	0	25	0
10 April	0	200	2	42	0
11 April	0	250	30	5	0
12 April	0	400	70	55	0
13 April	0	530	340	100	0
15 April	300	710	600	100	0
16 April	878	900	650	300	0
17 April	2200	1500	500	450	0
18 April	3250	2150	1600	1050	0
19 April	1950	2800	3200	600	300
20 April	1700	1200	2050	50	110
21 April	1200	1500	1050	100	50
22 April	850	782	832	50	0
23 April	300	350	1050	205	200
24 April	50	62	670	85	125
25 April	0	45	650	125	60

4. Marsh and Water Birds

In response to the Exxon Valdez oil spill in Prince William Sound, an important loon wintering area, aerial surveys of Common and Pacific loons were initiated in 1989 and repeated in 1990 to assess possible impacts on Refuge loon populations. Data from these surveys were compared to similar data collected in 1979 and 1980.

A stratified random sampling design was first employed to estimate the number of Common and Pacific loons on the northern Refuge as a graduate student project in 1979 and 1980. The original sample of 184 lakes was resurveyed in 1989 and 1990. Strata were based on lake size (surface area of water), and the sample was comprised of 155 lakes from 2.5 to 20.0 acres, 18 lakes from 20.5 to 80.0 acres, and 11 lakes greater than 80 acres in size. Results of the 1989 surveys indicated decreases of 35.3 percent and 13.4 percent in the estimated number of total Common loons (adults + juveniles) and the number of adult Common loons, respectively, from 1980 results. Concurrently, estimated numbers of total Pacific loons (adults + juveniles) and adult Pacific loons increased 91 percent and 95 percent, respectively. Only one adult and one juvenile were observed in 1980; 23 adults and one juvenile were observed in 1989. Similar trends were noted in 1990 (Table 16). The 1990 population estimate for Common loons declined 20 percent from 1989. Totals of 25 adult and two juvenile Pacific loons were observed in 1990, and the population estimate for this species increased 12 percent over the 1989 estimate.

Table 16. Estimates of Common and Pacific loon populations in the northern portion of the Kenai National Wildlife Refuge, 1979, 1980, 1989 and 1990.

Species	Year 1979	1980	1989	1990
Adults + Juveniles				
Common Loon	1665 ± 643	1668 ± 381	1079 ± 114	861 ± 133
Pacific Loon	0	21 ± 13	241 ± 51	279 ± 63
Adults Only				
Common Loon	1452 ± 849	1453 ± 593	1037 ± 106	823 ± 121
Pacific Loon	0	11 ± 9	231 ± 51	263 ± 60

Productivity of Common loons was lower in 1989 and 1990 than either 1979 or 1980. Twenty-five juvenile Common loons were observed in both 1979 and 1980 (14 percent and 12 percent young in the observed sample, respectively). Only seven of the 158 (four percent) and 6 of 135 (four percent) Common loons observed in 1989 and 1990, respectively, were juveniles. Productivity was also poor for Pacific loons in 1989 and 1990 (four percent young in the observed sample).

A strong association between wetland size and use by Pacific loons was apparent from the survey data. Twenty-two of the 24 Pacific loons observed (92 percent) in 1989 and all 25 Pacific loons in 1990 were on wetlands from 2.5 to 20 acres in size, and most were on wetlands at the smaller end of this scale. Although this relationship has been noted on the Refuge in the past, this survey marked its first documentation with a respectable sample size. Common loons were also found on wetlands in this stratum, although usually on those at the upper end of the scale. This habitat partitioning may be the result of interspecific competition between Common and Pacific loons. Common loons defend nesting territories vigorously.

5. Shorebirds, Gulls, Terns, and Allied Species

The glaucous-winged x herring gull and cormorant colonies in the eastern end of Skilak Lake were surveyed with the Refuge Boston Whaler in July. A total of 209 gulls, including 75 juveniles (36 percent young) and 134 adult gulls were observed in the Gull Rock colony. On the Upper Skilak Rocks colony, 311 juvenile gulls were observed. Twenty-two cormorant nests containing 43 young were present in this colony. Fifty-four adult cormorants were also observed. The number of cormorant nests and juvenile cormorants observed increased 36 and 65 percent over 1989. Both the number of cormorant nests and total cormorants observed are the highest recorded since surveys were initiated in the early 1980's.

The total number of double-crested cormorants and cormorant nests in 1990 in the Skilak Lake colony were the highest observed since surveys were initiated in the early 1980's.
07/90/TNB

6. Raptors

a. Summering Bald Eagles

Nine new bald eagle nests were discovered during 1989, bringing the total number of known nest site locations (those active in recent years) on and near the Refuge to 77 (Table 17). Nests were searched for but not found at four of these locations, and may no longer be present. At the remaining sites, 48 nests were determined to be active (incubating adults or presence of eggs) during the aerial nesting survey conducted May 14-17. Thirty-one and 17 active nests were located on and off the Refuge, respectively. An early productivity survey, timed to coincide with the early brood rearing period, was conducted on July 2 and 6. Nest failure rate was high (62.5 percent) during the period between the nesting and early productivity surveys. Only 18 of the 48 nests active during the nesting survey remained active by early July. These nests contained a total of 29 eaglets. One of the formerly active nests was not found after intensive searching and was assumed to have blown down; none of the other nests contained eaglets. Seven of the nests still active contained one eaglet, and 11 nests contained 2 eaglets. The results of the 1990 surveys by nest site location are presented in Table 17.

Table 17. Bald eagle nesting locations and production on and near the Kenai National Wildlife Refuge, 1990.

Nesting Location	Survey: Nesting Status	Early Productivity Status	Early Productivity No. Eaglets	Late Productivity Status	Late Productivity No. Eaglets
I. Game Management Unit 15A (N. of Kenai River)					
A. On Refuge					
1. Outside Wilderness					
Torpedo Lake	A	I	-	-	-
Afonasi Lake	A	I	-	-	-
East Fork Moose R.	I	-	-	-	-
West Fork Moose R.	A	A	1	I	-
Coyote Lake	I	-	-	-	-
No Name Creek	DL	-	-	-	-
Big Indian Creek	I	-	-	-	-
Pincher Creek	A	A	1	A	1
Beaver Lake	I	-	-	-	-
North Beaver Lake	I	-	-	-	-
Mink Creek Lake	A	I	-	-	-
Campfire Lake	A	I	-	-	-
Chickadee Lake	I	-	-	-	-
Chickaloon R. Inh.	A	I	-	-	-
Quake Lake	DL	-	-	-	-
Akula Lake	A	A	2	A	2
Barabara Lake	A	I	-	-	-
2. Inside Wilderness					
Jim's Landing	A	A	2	A	2
Camp Island Lake	I	-	-	-	-
Loon Lake	A	I	-	-	-
Clam/Moosehorn Rdg.	I	-	-	-	-
Swan Lake	A	A	2	A	1
Rock Lake	A	I	-	-	-
Spruce Lake	A	I	-	-	-
Bear Lake	I	-	-	-	-
NE. Moose Lake	A	I	-	-	-
Grouse Lake	A	I	-	-	-
Bedlam Creek Bluff	A	A	2	A	2
Gene Lake	I	-	-	-	-
Sucker Lake	A	I	-	-	-
Camper's Lake	I	-	-	-	-
Kenai R./Gwin's	A	I	-	-	-
Juneau Creek	A	A	1	I	-

Table 17 continued.

Nesting Location	Survey: Nesting Status	Early Productivity Status	Early Productivity No. Eaglets	Late Productivity Status	Late Productivity No. Eaglets
B. Off Refuge					
Moose Point Lake	A	I	-	-	-
Otter Creek Outlet	I	-	-	-	-
Bishop Creek Outlet	ANB	I	-	-	-
Suneva Lake	ANB	I	1	1	1
Daniel's Lake	I	-	-	-	-
Kenai R./Bing's	A	A	1	A	1
S. Swanson R. mouth	A	A	2	A	2
Kenai R./up. Bing's	A	A	2	A	1
Seneva Lake	E	I	-	-	-
Kenai R./E. Juneau	A	I	-	-	-
II. Game Management Unit 15B (S. of Kenai R. and Skilak Lake, N. of Kasilof River and Tustumena Lake)					
A. On Refuge					
1. Outside Wilderness					
Headquarters Lake	I	-	-	-	-
Funny River	A	I	-	-	-
Lower Killey R. - N.	I	-	-	-	-
Lower Killey R. - S.	A	I	-	-	-
2. Inside Wilderness					
S. Shore Skilak Lake	A	I	-	-	-
Killey/Harvey Lake	A	I	-	-	-
Skilak Lake Inlet	I	-	-	-	-
Skilak Glacial Fl.	A	I	-	-	-
Russian River Burn	A	A	1	A	1
Bear Creek	DL	-	-	-	-
Killey Headwaters	A	I	-	-	-
Kenai R./downstream of Russian R. Burn	A	I	-	-	-
B. Off Refuge					
Kenai R./Ciechanski	DL	-	-	-	-
Kenai R./Salamatof	A	I	-	-	-
Kenai R./Browns Lake	I	-	-	-	-
Russian River	A	A	2	A	2
Kenai R./Beaver Crk.	I	-	-	-	-
Kenai R./Bluff	ANB	I	-	-	-
Kenai R./KPCC Isl.	I	-	-	-	-
Kasilof River/Bridge	I	-	-	-	-

Table 17 continued.

Nesting Location	Survey: Nesting Status	Early Productivity Status	Early Productivity No. Eaglets	Late Productivity Status	Late Productivity No. Eaglets
Coho Road/Gas well	A	A	2	A	2
Quartz Creek	A	A	2	A	1
Echo Lake Road	A	A	2	A	2
Moose Meadows Subd.	A	A	1	A	1
Kenai R./W. Killey R. mouth	A	A	1	A	1
III. Game Management Unit 15C (S. Kasilof River and Tustumena Lake)					
A. On Refuge					
1. Inside Wilderness					
Nikolai Creek	A	I	-	-	-
Upper Fox River	A	I	-	-	-
Mid Fox River	A	I	-	-	-
Lower Fox/Clearwater	ANB	I	-	-	-
Lower Fox/Powerline	A	DL	-	-	-
B. Off Refuge					
Sheep Crk./Fox River	A	I	-	-	-
Bradley River Outlet	A	A	2	A	2
Fox R. Flats - Rock	I	-	-	-	-

Key: New nest located in 1990 is underlined.
A = active; I = inactive; DL = searched, not located;
ANB = adult nearby; E = egg(s); NS = no search

Sixteen of the 18 nests active during the early productivity survey remained active on August 2 and 3, when the late productivity survey was flown. The fate of two eaglets in the two nests changing from active to inactive status between surveys is unknown. These and three additional eaglets in three nests which contained one fewer eaglet than in July may have fledged prior to August 2 or 3. The number of eaglets per active nest in 1990 decreased from 1.61 during the early productivity survey to 1.50 during the late productivity survey (Table 18). If the missing eaglets had not fledged, five broods were reduced by one eaglet each during the brood rearing period.

Table 18. Summary of bald eagle production by land-use classification on and near the Kenai National Wildlife Refuge, 1990.

	On Refuge			Off Refuge	
Productivity	Wilderness	Out. Wilderness	Total	Total	Total
Active Nests	19	12	31	17	48
Failed active nests	15 (79%)	9 (75%)	24 (77%)	6 (41%)	30 (63%)
Eaglets/active nest - early survey	1.75	1.33	1.57	1.64	1.61
Eaglets/active nest - late survey	1.50	1.50	1.50	1.50	1.50
Eaglets fledged/ nesting attempt[1]	0.32	0.27	0.30	0.94	0.52
Maximum number of eaglets fledged	7	4	11	18	29

1 Nesting attempts of known fate only (n=46), assumes 3 eaglets in broods which were reduced from 2 to 1 eaglet between productivity surveys did not fledge.

2 Eaglets present during early productivity survey.

Nesting success for bald eagles was poor in 1990.

8/90/TNB

Although most eaglets were near fledging on August 2 and 3, some were less developed and it is not known if all successfully fledged. The maximum number of successfully fledged eaglets from known nest sites on and near the Refuge, including the two nests of unknown fate, was 29 in 1990. The average number of eaglets fledged per nesting attempt of known fate (assumes that the three eaglets in broods reduced from two to one eaglets between early and late productivity surveys) was 0.52 (twenty-four of 46). This represents a 44 percent decrease from reproductive success documented in nineteen-eighty-nine (0.94 fledged eaglets/nesting attempt of known fate).

b. Wintering Bald Eagles

Wintering bald eagles have been surveyed by floating two sections of the Kenai River since 1979. When river ice conditions preclude boat surveys, the surveys are conducted with fixed-wing aircraft. In 1990, aerial surveys were flown for the lower Kenai River survey route in January, February, March and December and for the upper Kenai survey route in February. Results are summarized in Table 19.

Float counts of wintering bald eagles along the Kenai River were limited by ice conditions during 1990.
12/90/TNB

Table 19. Numbers and ages of bald eagles observed during boat surveys along the Kenai River during winter-spring and fall-winter months, 1990.

Survey Dates	River Route								
	Upper River*			Lower River**			Total		
	Ad	Juv	Unid	Ad	Juv	Unid	Ad	Juv	Unid
01/18&25/90	59	14	0	92	11	0	151	25	0
02/22/90	21	0	0	43	2	0	64	2	0
03/15/90	60	5	0	108	13	0	168	18	0
11/14&15/90	48	32	1	40	21	0	88	53	1
12/13/90	49	12	0	51	6	0	100	18	0

* Kenai Lake to Jim's Landing
** Outlet Skilak Lake to Bing's Landing

7. Other Migratory Birds

The Alaska Breeding Bird Survey was conducted along the two traditional survey routes on the Refuge in 1990 (Tables 20 and 21). The Seven Lakes Route consists of a section of the Skilak Loop Road, and the Swan Lake Route runs along the Swanson River and Swan Lake roads.

The Seven Lakes Route was surveyed on June 20. The most commonly observed birds were the Swainson's thrush (62), myrtle warbler (28), American robin (15), varied thrush (13), and white-crowned sparrow (11) (Table 19). A total of 217 identified birds of 32 species were observed along this route.

The Swan Lake Route was surveyed on June 19. Commonly encountered birds included the Swainson's thrush (42), alder flycatcher (34), myrtle warbler (33), slate-colored junco (26), and common redpoll (21) (Table 21). A total of 224 identified birds of 26 species were observed along this route.

Table 20. Birds recorded on the Seven Lakes Route, Alaska Breeding Bird Survey, June 1990.

Species	No.	Species	No.	Species	No.
Greater Yellowlegs	6	Sandhill Crane	2	Common Snipe	1
Red-necked grebe	3	Glaucous-winged Gull	6	Greater Scaup	1
Barrows Goldeneye	8	Common Loon	4	Olv.-sided Flycatcher	2
Alder Flycatcher	1	Tree Swallow	1	Gray Jay	13
Black-billed Magpie	1	Common Raven	1	Boreal Chickadee	1
Ruby-crowned Kinglet	7	Gray-cheeked Thrush	6	Swainson's Thrush	62
Hermit Thrush	1	Varied Thrush	13	Western Wood Peewee	2
American Robin	15	Yellow Warbler	2	Myrtle Warbler	28
Blackpoll Warbler	1	Townsend Warbler	1	Orange-cr. Warbler	1
Northern Waterthrush	4	Savannah Sparrow	1	Song Sparrow	1
White-crowned Sparrow	11	Slate-colored Junco	7	Common Redpoll	4

Table 21. Birds recorded on the Swan Lake Route, Alaska Breeding Bird Survey, June 1990.

Species	No.	Species	No.	Species	No.
Common Loon	10	Greater Yellowlegs	6	Sandhill Crane	1
Olv.-sided Flycatcher	5	Alder Flycatcher	34	Tree Swallow	2
Gray Jay	6	Boreal Chickadee	3	Ruby-crowned Kinglet	9
Swainson's Thrush	42	Varied Thrush	6	American Robin	8
Orange-crowned Warbler	4	Yellow Warbler	2	Myrtle Warbler	33
Blackpoll Warbler	1	White-wing Crossbill	4	Northern Waterthrush	5
Savannah Sparrow	1	Lincoln's Sparrow	1	Song Sparrow	1
White-crowned Sparrow	4	Slate-colored Junco	26	Pine Grosbeak	1
Common Redpoll	3	Bald Eagle	1		

A songbird survey using the variable circular plot method was conducted on June 26 in an area along the Mystery Creek Road scheduled for prescribed burning in 1990. A total of 264 birds of 23 species were observed in the 35 plots surveyed (Table 22). The most common species encountered were Swainson's thrush, white-crowned sparrow, gray jay, yellow-rumped warbler and ruby-crowned kinglet.

Table 22. Birds encountered in the Mystery Creek Road area using the variable circular plot method, June, 1990.

Species	No.	% of Total	Species	No.	% of Total
Swainson's Thrush	57	21.6	W-cr sparrow	47	17.8
Gray jay	27	10.2	Y-r warbler	25	9.5
Slate-colored junco	21	7.9	R-cr kinglet	20	7.5
Wood pewee	11	4.2	Robin	10	3.8
G-c thrush	8	3.0	B chickadee	6	2.3
Raven	5	1.9	C redpoll	4	1.5
Alder flycatcher	2	0.7	Song sparrow	2	0.7
N waterthrush	1	0.3	Tree swallow	1	0.3
Yellow warbler	1	0.3	G yellowlegs	1	0.3
Unid sparrow	1	0.3	Unid swallow	1	0.3
Unid thrush	1	0.3	Unid woodpecker	1	0.3

8. Game Mammals

a. Moose

Density surveys to generate moose population estimates in Alaska Game Management Subunits (GMS) 15A and 15B were conducted in late winter in cooperation with the Alaska Department of Fish and Game. Most of the

northern and central portions of the Refuge fall within these management units. The GMS 15A survey was conducted from February 14-20 and the GMS 15B survey from February 27 - March 9.

The population estimate for GMS 15A was 3432 moose (± 9.3 percent, $p < .20$), indicating a declining trend since 1982 when the last complete density survey was conducted (Table 23). Severe winter conditions had already caused significant calf mortality by mid-February. The estimated percentage of calves in the population (11.5 percent) was the lowest documented since density surveys were initiated in 1964. The GMS 15B estimate was 1039 moose (± 19.1 percent, $p < .20$), indicating a stable trend since 1982. The precentage of calves in this population was also extremely low at 9.5 percent.

Table 23. Moose population estimates in Alaska GMS 15A and 15B during late winter, 1982 and 1990.

	Alaska GMS 15A			Alaska GMS 15B		
Year	Pop. Estimate	80% CI	Calf %	Pop. Estimate	80% CI	Calf %
1982	4352	3267-5437	25.6	1024	710-1338	15.6
1990	3432	3114-3750	11.5	1039	841-1237	9.5

Moose calf mortality was high during the severe winter of 1989-90. 6/90/JEF

The 1990 fall moose composition survey was conducted in Alaska GMS 15A and 15B in November and December, also in cooperation with the Alaska Department of Fish and Game. The Department also conducted composition surveys in GMS 15C in the Caribou Hills. In addition, the Skilak Loop Wildlife Recreation Area in the northern Refuge was surveyed to determine the number of resident moose. The Service and the Alaska Department of Fish and Game have set a resident population objective for the Skilak Lake Wildlife Recreation Area of 130 moose.

Totals of 1580 and 407 moose were classified during composition surveys in GMS 15A and GMS 15B (Table 24), respectively. A total of 294 were classified in GMS 15C. The bull:cow ratio in the GMS 15A was 23:100 (Table 25), continuing the trend of slow improvement since harvest restrictions (only bulls with spike-fork antlers on at least one side or antlers with a 50" or greater spread or with three brow tines on at least one side are legal) were implemented in 1987. The overall bull:cow ratio in GMS 15A has increased from 17 bulls:100 cows in 1987 to 23 bulls:100 cows in 1990. Our objective for this area is 30 bulls:100 cows. In the most intensively hunted area within GMS 15A (1969 Burn), the bull:cow ratio remains at approximately 17:100. The bull:cow ratio was 36:100 in GMS 15C. The overall bull:cow ratio for GMU 15 was 26:100.

Table 24. Results of moose composition surveys in Alaska GMU 15, 1990.

Unit	Small Bulls	Large Bulls	Total Bulls	Cows w/0	Cows w/1	Cows w/2	Total Cows	Lone Calves	Total Calves	Total Moose
15A	34	194	228	686	289	28	1003	4	349	1580
15B	5	54	59	132	91	10	233	2	113	407
15C	29	39	68	148	33	3	184	2	41	294
GMU 15	68	287	355	966	413	41	1420	8	503	2281[1]

[1] 3 unknown sex and age

Calf:cow ratios were 35:100 in GMS 15A, 49:100 in GMS 15B, and 22:100 in GMS 15C. Calves comprised 22.1 percent of the observed sample in Game Management Unit 15A. This percentage is slightly below the long term average of 24.4 percent and may in part be the result of reduced production and/or calf survival in the 1990 cohort due to particularly severe winter conditions in 1989-90.

Table 25. Moose population composition in Alaska GMU 15, 1990.

Unit	Bull: 100 Cow	Yrl. Bull: 100 Cow	% Yrl. Bull in Herd	Calf: 100 Cow	Twins: 100 Cow w/ Calf	% Calf in Herd	Moose per Hour
15A	23	3	2.2	35	8	22.1	59
15B	25	2	1.2	49	10	27.8	46
15C	37	16	9.9	22	8	13.9	-
GMU 15	25	5	3.0	35	9	22.1	-

Serial stage habitat in the 136mi^2 1969 burn constitutes the northern Refuge's best moose habitat. The estimated wintering density in the Burn was 9.7 moose/mi^2 in 1990. Although comprising less than 10 percent of the total area within GMS 15A, it winters approximately 45 percent of this management unit's moose.

Refuge staff conducted browse surveys along 20 transects in the 1969 Burn in late May. Results are summarized in Table 26. Species composition of the 2000 woody plant sample was 71 percent paper birch, 16 percent willow and 10 percent aspen. These species are the primary browse species on the Kenai Peninsula. Dwarf birch, balsam poplar, alder and highbush cranberry comprised the remainder of the sample. Utilization of browse species was high. Ninety-one percent of all birches, 99 percent of all willows and 96 percent of all aspen plants examined had current annual growth browsed by moose. Twenty-three percent of all birch plants, 89 percent of all willow plants and 80 percent of all aspen plants examined were heavily browsed (more than 75 percent of current annual growth browsed). Twenty-one percent of all aspen plants were dead due to overbrowsing.

Stem breakage of aspen by moose was extremely pronounced in many areas on the Refuge during the winter of 1989-1990.
4/90/JEF

Table 26. Species composition and percent utilization of 2000 browse plants in the 1969 burn, Kenai National Wildlife Refuge, 1990.

Transect	Percent Species Comp.	Percent Live Plants Browsed	Percent Utilization*				
			0	Low	Mod	Hi	100
Oilfield (8 transects - 800 plants)							
Birch	63	94.4	5.6	31.6	26.2	34.8	1.8
Aspen	7	97.8	2.2	6.7	11.1	31.1	48.9
Willow	28	99.5	0.5	4.5	8.5	50.2	36.3
Dwarf Birch	2	100.0	0.0	18.2	0.0	36.4	45.4
Balsam poplar	1	100.0	0.0	33.3	66.7	0.0	0.0
Alder	1	100.0	0.0	50.0	50.0	0.0	0.0
Finger Lakes (4 transects - 400 plants)							
Birch	90	80.7	19.3	51.6	22.7	6.5	0.0
Willow	1	100.0	0.0	100.0	0.0	0.0	0.0
Alder	6	81.8	18.2	22.7	40.9	18.2	0.0
H. Cranberry	3	50.0	50.0	20.0	20.0	10.0	0.0
Elderberry	1	66.7	33.3	66.7	0.0	0.0	0.0
Sunken Island Lake (4 transects - 400 plants)							
Birch	57	93.8	6.2	34.0	27.7	29.9	2.2
Aspen	19	66.7	0.0	0.0	7.7	5.8	86.5
Willow	21	100.0	0.0	0.0	0.0	7.1	92.8
Dwarf Birch	3	75.0	0.0	0.0	33.3	44.4	22.2
Marathon Road (4 transects - 400 plants)							
Birch	83	93.7	6.3	46.5	31.8	15.0	0.3
Aspen	8	90.3	12.5	6.2	6.2	34.4	40.6
Willow	4	100.0	0.0	6.2	12.5	25.0	56.2
Balsam poplar	4	87.5	12.5	0.0	6.2	37.5	43.7
H. cranberry	1	100.0	0.0	100.0	0.0	0.0	0.0
All Transects (20 transects - 2000 plants)							
Birch	71	90.7	9.3	40.5	26.9	22.2	1.1
Aspen	9	95.5	4.4	5.9	8.9	21.5	59.3
Willow	16	99.7	0.3	3.7	6.5	37.6	51.8
Dwarf Birch	1	100.0	0.0	10.0	15.0	40.0	35.0
Alder	1	83.3	16.7	25.0	41.7	16.7	0.0
H. Cranberry	1	61.5	38.5	38.5	15.4	7.7	0.0
Balsam poplar	1	89.5	10.5	5.3	15.8	31.6	36.8
Elderberry	1	66.7	33.3	66.7	0.0	0.0	0.0

* 0 = no current annual growth twigs browsed
Lo = 1-25 percent current annual growth twigs browsed
Mod = 26-75 percent current annual growth twigs browsed
Hi = 76-99 percent current annual growth twigs browsed
100 = all current annual growth twigs browsed

b. Caribou

Two of the three caribou herds on the Kenai Peninsula, the Kenai Mountain herd and the recently reintroduced (1985-1986) Benchland herd, were surveyed in the fall of 1990. These surveys were conducted by the Alaska Department of Fish and Game on October 31 and November 2, respectively. In June, Refuge staff conducted a helicopter survey of the Benchland herd. Since caribou are more easily sexed in the fall, composition data is presented from the fall surveys (Table 27), with the exception of the Benjamin Creek area which was not surveyed in November.

A total of 303 caribou was observed in the Kenai Mountain herd, of which 286 were classified (Table 27). This total included 230 adults and 56 calves (19.6 percent young). The adult segment of the herd was comprised of 65 bulls and 165 cows. An attempt to survey this herd in early summer (June) turned up only 65 caribou.

A total of 209 caribou in 3 groups was observed in the Benchland herd, including 154 in the Tustumena group (GMS 15B) and 37 in the Truuli Creek group (Alaska GMS 15C). Calves comprised 23.4 percent and 27.0 percent of these groups, respectively. The bull:cow ratio in the Tustumena group was 82:100. In June, Refuge staff observed a group of 18 caribou north of the Killey River in GMS 15B (Benjamin Creek area). This observation marked the first confirmation of caribou use of this area since the reintroduction. It is hoped that this small group will exhibit a growth rate similar to that of the Tustumena group. Habitat in this area appears capable of supporting such an increase.

Table 27. Composition of the Lowland and Benchland caribou herds, 1990.

Herd	Bulls	Cows	Adults	Calves	Percent Calves	Total
Kenai Mountain	65	165	230	56	19.6	286
Benchland						
Tustumena	53	65	118	36	23.4	154
Truuli Creek	8	-	27 (19 uncl.)	10	27.0	37
Benjamin Crk.	-	-	14 (14 uncl.)	4	22.2	18
Subtotal	-	-	159	50	23.9	209

c. Dall's Sheep and Mountain Goat

The Alaska Department of Fish and Game conducted surveys of Dall's sheep in five count areas and mountain goat in six count areas on the Kenai Peninsula during the summer of 1990 (Tables 28 and 29). A regulation changing the definition of a legal Dall's ram from 7/8 to full curl was instituted in fall 1989 on the Peninsula. This change gathered much public support, especially among sheep hunting interests who wanted to see an increase in trophy rams in this heavily hunted population. The Service proposed this regulation to create a more balanced age structure

to address its mandate of managing for natural diversity and which in turn will enhance opportunities for both consumptive and nonconsumptive use.

Table 28. Dall's sheep surveys on the Kenai Peninsula, 1990.

Count Area	Date	Count Time (min.)	Legal Rams	Sub-Legal Rams	Ewes	Lambs	Unid.	Total
837	07/18/90	Unk.	3	6	9	0	0	95
843	07/18/90	130	1	6	32	7	0	46
855	07-19-90	125	8	27	48	11	0	94
856	07/20/90	120	1	72	75	24	0	172
856	08/08/90	142	8	36	85	17	0	146
857	07/19/90	Unk.	3	17	48	21	4	90

Table 29. Mountain goat surveys on the Kenai Peninsula, 1990.

Count Area	Date	Count Time (min.)	Adults	Kids	Total	Kids per 100 Adults	Percent Kids
837	07/18/90	Unk.	16	3	19	19	16
843	07/18/90	130	34	8	42	24	19
854	08/06/90	71	59	12	71	20	17
855	07/19/90	125	11	3	14	27	21
856	07/20/90	120	25	14	39	56	36
856	08/08/90	142	5	0	5	0	0
857	07/19/90	Unk.	37	11	48	30	23

d. Wolves

Seven wolves (five from three packs and two lone wolves which have not associated with any known packs) in the northern Refuge (GMS 15A) were captured during 1990 and fitted with radio transmitter collars for inventory purposes. Two wolves from the Elephant Lake Pack and one wolf from the Skilak Lake Pack were collared during helicopter darting operations in January. The two lone wolves and the single Point Possession and Bear Lake wolves were captured during spring-summer live-trapping.

Table 30. Wolves captured on the Kenai National Wildlife Refuge, 1990.

Pack	Sex	Age	Weight	Date of Capture	R/L Ear Tags
Skilak Lake	M	Adult	110	01-24-90	195/194
Elephant Lake	M	Adult	111	01-25-90	198/2003
Elephant Lake	M	Adult	121	01-25-90	196/197
Bear Lake	F	Adult	98	04-19-90	186/187
Point Possession	M	Subadult	68	04-30-90	99/100
Loner	F	Subadult	64	06-16-90	78/ -
Loner	F	Subadult	67	07-02-90	97/98

Biological Technician Liz Jozwiak and the Bear Lake Pack black alpha female wolf. This wolf was killed illegally on Swan Lake Road in November. 4/90/TNB

Monitoring of radio-collared wolves in 1990 documented a lack of cohesion in two of the four radioed packs in the northern Refuge. The collared Skilak Lake male remained in this pack's traditional territory through September, but then moved eastward into the Kenai Mountains. It was located exclusively east of the Mystery Creek Road through December, and was usually accompanied by three wolves. The other radio-collared wolf in the Skilak Lake Pack, a crippled female, apparently separated from the main pack and was located alone or with one other wolf (a radio-collared Point Possession wolf that dispersed in the fall). After capture of the subadult male in April, the Point Possession Pack contained three radio-collared individuals. Two of the three apparently dispersed by early fall. The subadult male collared in April joined the crippled Skilak Lake female, and an adult female wolf was located either alone or with one other wolf through December. The Bear Lake female wolf captured in April was believed to be the alpha female of this pack. She was killed illegally on the Swan Lake Road in November. Another radio-collared Bear Lake wolf was caught in an illegal snare in March and had to be euthanaized because of trap injuries. This pack contained only one radio-collared wolf at year's end. One of the male Elephant Lake wolves captured in January dispersed and was killed by other wolves in the Point Possession Pack territory.

Based on visual observations and radio locations, the four radiocollared packs on the northern Refuge (Point Possession, Elephant Lake, Bear Lake, Skilak Lake) contained 40 wolves in late fall 1990 (Table 31). One wolf had been killed illegally (no wolves had been harvested by trappers in the northern Refuge by year's end), bringing the fall population in the northern Refuge to 41 wolves. This total does not account for single or paired wolves not associated with known packs. Louse infestation was noted in the Elephant Lake and Bear Lake packs in 1990.

Table 31. Pack sizes of four radio-collared wolf packs on the northern portion (north of the Kenai River) of the Kenai National Wildlife Refuge in fall 1990.

		No. Wolves	
Pack	Late Fall	Harvested	Early Fall
Elephant Lake	14	0	14
Point Possession	12	0	12
Bear Lake	10	1[a]	11
Skilak Lake	4	0	4
TOTAL	40	4	41

[a] Illegal harvest

9. Marine Mammals

No take of walrus was reported to the Refuge in 1990. Refuge staff sealed 11 sea otters taken in Kachemak Bay near Homer. Two dead beluga whales were reported on beaches along Cook Inlet in 1990.

10. Other Resident Wildlife

a. Small Mammals

Small mammals are important prey for many mammalian and avian predators on the Refuge. Small mammal population status was assessed by setting museum special snap traps for 11 nights at each (49) grid station in the four snowshoe hare study grids in July and August, and by trapping in three traditional study areas in the Swan Lake Road area in October (Tables 32 and 33). Capture success for both red backed voles and masked shrews in 1990 increased over success in 1989. Capture success for red-backed voles remained significantly lower than during 1988, a year of peak small mammal abundance on the Kenai Lowlands.

Table 32. Small mammal trapping effort and success on Kenai National Wildlife Refuge lowlands, 1990.

Area	Habitat	Dates	Nights Set	Total Trap Nights	Total Captures: Red-Back Voles	Total Captures: Masked Shrews	Total Captures: Other	Trap Nights/Capture: Red-Back Voles	Trap Nights/Capture: Masked Shrews
Swanson River Rd.									
Hare Grid	1947 burn	6/15-6/25	11	539	8	27	0	67.4	20
Campfire Lake									
Hare Grid	1947 burn	7/13-7/23	11	539	10	42	4	53.9	12.8
1969 Burn									
Hare Grid	1969 burn	7/13-7/23	11	538	3	16	0	179.3	33.6
Funny River Road									
Hare Grid	1947 burn	8/ 9-8/20	11	535	29	22	3	18.4	24.3
Swan Lake Area	Combined[1]	10/4-10/7	4	1079	51	17	1	21.2	63.5
1990 Total			48	3230	101	124	8	32.0	26.0
1989 Total	-	-	-	2428	60	61	0	40.5	39.8
1988 Lowlands Tot.		-	-	840	234	29	11	3.6	29.0

[1]See Table 33.

Table 33. Small mammal capture success in fall 1990, Swan Lake Road Region of Refuge.

Habitat	Dates Trapped	Total Trap Nights	Total Captures: Red-Back Voles	Total Captures: Masked Shrews	Trap Nights/Capture: Red-Back Voles	Trap Nights/Capture: Masked Shrews
Mature Mixed Forest	10/4-7/90	360	18	5	20	72
1947 Burn Region North Forest	"	360	19	3	18.9	120
1947 Burn Tree-Crushed Forest	"	359	14	9	25.6	39.9
Total	"	1079	51	17	21.2	63.5

b. Snowshoe Hare

The snowshoe hare population on the Kenai Lowlands in the northern Refuge was monitored for the eighth consecutive year in 1990. Live-capture and pellet count data indicated the Refuge snowshoe hare population on the northern Refuge remained at extremely low levels (Table 33). Low snowshoe hare densities have resulted in reduced reproductive output by radiocollared lynx in the study area. Snowshoe hare populations last peaked in the mid-1980's. Student Conservation Association volunteers Cheryl Pendergrass and Sehoya Harris conducted hare live-trapping and marking and related fieldwork in 1990.

Table 34. Capture success and pellet densities in four permanent snowshoe hare study grids on the Refuge, 1983-1990.

	Swanson Road Grid				Funny River Road Grid				Campfire Hole Grid				69 Burn Grid			
	Indiv.		Total	Pellets	Indiv.		Total	Pellets	Indiv.		Total	Pellets	Indiv.		Total	Pellets
Year	Ad	Juv	Capture	M²	AD	Juv	Capture	M²	AD	Juv	Capture	M²	AD	Juv	Capture	M²
1983	23	11	64	65	27	76	232	60								
1984	34	20	85	51	47	79	216	35								
1985	30	10	113	52	49	25	159	44								
1986	23	8	95	28	19	15	115	20								
1987	10	2	31	14	16	15	63	9	13	11	77	20				
1988	4	5	11	11	2	2	5	7	5	7	39	10				
1989	2	2	4	5	1	2	3	2.1	5	4	18	3.2	1	0	1	7.5[1]
1990	2	1	6	1.9	1	0	3	2.6	4	1	12	4.1	0	1	1	3.1

[1]Cleared for the first time, other grids previously cleared of pellets.

c. Beaver

The Refuge's annual aerial beaver cache survey was conducted in October. Survey areas included the Swan Lake Canoe System (1947 Burn habitat), the Finger Lakes area (1969 Burn habitat), and the Vogel Lake area (mature forest habitat). Thirty, 28 and 23 active lodges were observed in the three survey areas, respectively (Table 35). The number of active lodges observed in the Swan Lake Canoe System increased 30 percent over 1989. Food caches were present at slightly over 80 percent of all active lodges observed in 1990. Ranges of the percent of active lodges that were identified by summer ground surveys and still present in October (verified by additional flights and ground checks) and observed during the aerial survey were as follows: Swan Lake Canoe System - 71-80 percent, Finger Lakes area - 50-58 percent, Vogel Lake area - 43-60 percent. As in 1989, considerable variation existed between status of lodges during summer and fall, i.e., lodges were abandoned, new lodges were built or former lodges reoccupied during the period between summer ground surveys and the fall aerial survey.

Table 35. Results of fall aerial beaver cache surveys on the Kenai National Wildlife Refuge, 1990.

Survey Area	Act. Lodges w/ Caches	Act. Lodges w/o Caches	Total Act. Lodges	Percent Change/1990
Swan Lake C.S.	25	5	30	+30
Finger Lake area	25	3	28	-
Vogel Lake area	16	7	23	-

d. Spruce Grouse

Early morning, roadside spruce grouse surveys were conducted along the Swanson River, Swan Lake, Skilak Loop roads in September and October. Data from all survey routes indicate that spruce grouse populations are increasing on the northern Refuge. Observed grouse densities were highest on the Skilak Lake route which is closed to firearms hunting.

Table 36. Results of early morning, roadside spruce grouse surveys on the Kenai National Wildlife Refuge, 1987-1990.

Year	Route	Length (miles)	Number Surveys	Total Grouse	Grouse/ Survey	Grouse/Survey Mile
1987	Skilak Loop	19.4	8	31	3.8	0.20
	Swanson River Rd.	15.6	6	0	0.0	0.00
	Swan Lake Road	12.8	6	0	0.0	0.00
1988	Skilak Loop	19.4	8	24	3.0	0.15
	Swanson River Rd.	15.6	10	2	0.2	0.01
	Swan Lake Road	12.8	10	22	2.2	0.17
	Mystery Creek Rd.	11.1	4	11	2.7	0.25
1989	Skilak Loop	19.4	18	160	8.9	0.50
	Swanson River Rd.	15.6	7	9	1.3	0.08
	Swan Lake Rd	12.8	7	25	3.6	0.28
1990	Skilak Loop	19.4	7	151	21.6	1.11
	Swanson River Rd	15.6	5	27	5.4	0.35
	Swan Lake Rd	12.9	5	19	3.8	0.29

11. Fisheries Resources

a. Hidden Lake

The 1990 return (77,959) of adult sockeye to Hidden Lake was approximately 7 times greater than the average return prior to enhancement and over 50 percent greater than the previous record return of 50,909 fish in 1988. A total of 2,485,000 eggs were taken from Hidden Lake sockeye and 231,325 and 47,408 sockeye and coho smolts respectively were counted migrating out of Hidden Lake during 1990.

Of concern is the impact of excessive returns of adults to Hidden Lake and the impacts of their rotting carcasses on the nutrient balance of the lake. Because a greater salmon return is expected in 1991, an environmental assessment is being prepared to consider actions to be taken to prevent excessive numbers of adults returning to the lake.

b. Russian River

The estimated number of late-run sockeye entering the lower Kenai River in 1990 was 659,500. The early run harvest of sockeye in the Russian River was 30,215 with 26,720 escaping to spawn. The late run harvest of sockeye in the Russian River was 56,175 with an escapement of 83,340 through the wier at Lower Russian Lake to spawn in additional 11,760 sockeye to spawned the mainstream Russian River.

c. Tustumena Lake System

A total of 144,200 sockeye were estimated by sonar counts to have entered the Kasilof River-Tustumena Lake system in 1990. A total of 89,245 stream spawners were counted by the Alaska Department of Fish and Game survey crews with the majority at Bear Creek (46,300), Moose Creek (18,800) and Glacier Creek (14,355). The estimated proportion of sockeye spawners along the beach in 1990 varied according to the technique used. Stream surveys by Alaska Department of Fish and Game suggested 26 percent were shoreline spawners, while U.S. Fish and Wildlife Service radiotelemetry studies indicated 47 percent. The reasons for the disparity are not known but USFWS research staff believe additional data for comparisons could help clarify the differences for the disparity.

12. Wildlife Propagation and Stocking

A draft manuscript summarizing the results of the 1985 and 1986 caribou transplants on the Refuge entitled "Reintroduction, Initial Distribution, and Social and Population Response of Caribou on the Kenai Peninsula, Alaska 1985-90 was prepared by T.N. Bailey and reviewed by the local ADF&G wildlife biologists. Plans are to incorporate their comments and finalize the manuscript for publication during 1991.

13. Surplus Animal Disposal

- Nothing to report.

14. Scientific Collections

- Nothing to report.

15. Animal Control

- Nothing to report.

16. Marking and Banding

Mammals and birds ear-tagged, radiocollared, or leg-banded during 1990 are presented in Table 37. This information was sent to the Migratory Bird Banding Laboratory, FWS Division of Law Enforcement and the Alaska Department of Fish and Game as a condition of the Refuge's 1990 collecting permit.

Table 37. Report of animals/birds taken under Federal Fish and Wildlife Permit #692350 and State of Alaska Permit 90-69 in 1990.

Wolf	01/24/90	Radiocollared	A	M	110.0 lbs	Released	Moose Pens
Wolf	01/25/90	"	A	M	121.0 lbs	"	Wolf Lake
Wolf	01/25/90	Recaptured	A	M	111.0 lbs	"	Wolf Lake
Wolf	04/19/90	Radiocollared	A	F	98.0 lbs	Released, shot	Fish Lake
Wolf	04/30/90	"	SA	M	68.0 lbs	Released	Nest Lake
Wolf	06/16/90	"	Pup	F	64.0 lbs	"	South Pipeline Road
Wolf	07/20/90	"	SA	F	67.0 lbs	Released	Finger Lakes Road
Coyote	04/21/90	Eartagged	A	M	26.0 lbs	Escaped	Portage Lake
Coyote	04/22/90	Recaptured	A	M	29.0 lbs	Released	Fish Lake
Coyote	05/21/90	Eartagged	SA	M	26.0 lbs.	Released	
Coyote	07/21/90	"	A	F	29.0 lbs.	Released	
Coyote	08/16/90	"	A	M	31.0 lbs.	Released	
Coyote	08/16/90	"	Pup	M	10.0 lbs.	Released	
Lynx	05/03/90	Recaptured	A	M	19.0 lbs	Released	Swan Lake Road
Lynx	10/18/90	"	A	F	20.5 lbs	Rehab & Released	Weed Lake
Lynx	10/19/90	"	A	M	21.3 lbs	Released	Teal Lake
Lynx	10/24/90	"	A	F	-	"	Moose River
Lynx	10/24/90	"	A	F	-	"	Mystery Creek Road
Lynx	10/26/90	"	A	M	25.0 lbs	"	Funny River Road
Lynx	10/29/90	Recaptured	A	F	22.0 lbs	"	Afonasi Lake
Lynx	10/31/90	"	A	M	29.3 lbs	"	Jigsaw Lake
Lynx	10/31/90	Radiocollared	SA	M	22.3 lbs	"	Grebe Lake
Lynx	11/01/90	Recaptured	A	M	27.3 lbs	"	South of Weed Lake
Lynx	11/16/90	Caught in Snare	A	F	24.5 lbs	Rehab & Released	Sterling
Snowshoe Hare		7/10/90-7/23/90	Live Trapped		- -	—	1 Eartagged/Released
Swanson Oilfield						0 Dead	
Snowshoe Hare		7/10/90-7/23/90	Live Trapped		- -	—	1 Eartagged/Released
Campfire Lake						4 Dead	
Snowshoe Hare		6/12/90-6/25/90	Live Trapped		- -	—	3 Eartagged/Released
Swanson River Rd						0 Dead	
Snowshoe Hare		8/07/90-8/20/90	Live Trapped		- -	—	1 Eartagged/Released
Funny River Road						0 Dead	
						12 Total Snowshoe Hare	
Small Mammal		10/04/90-10/07/90	Snaptrapped		- -	—	51 Red-Backed Voles
Swanson River/						1 Tundra Vole	
						17 Masked Shrews	Swan Lake Road
Small Mammal		06/12/90-08/20/90	Snaptrapped		- -	—	50 Red-Backed Voles
KNWR Hare Grids						107 Masked Shrews	
						157 Total Small Mammals	
Birds	07/13/90-08/20/90		Incidentally Caught			14 Songbirds	KNWR Hare Grids

17. Disease Prevention

Nothing to Report.

18. Injured Wildlife

In 1990, Refuge staff responded to 34 cases of injured, orphaned or dead wildlife, of 16 bird and 2 mammal species. This was a decrease from last year's total of 105 animals of 21 species.

Of nine bald eagles, five were found dead, one died a few hours after being found, one suffered from acute lead poisoning and was euthanaized, and another was in rehabilitation for six weeks but died unexpectedly one day prior to its scheduled release. One unreleasable eagle with a damaged wing was rehabilitated for six months and then transferred to the Audubon Zoo in New Orleans.

A raven with a broken wing had been in rehabilitation for 9 months at year's end. It is scheduled for transfer to a raptor rehabilitation center in Tennessee.

A saw-whet owl struck by a vehicle was rehabilitated and released. Two dead owls were turned in to the Refuge. Two injured gulls, a sandhill crane, a juvenile robin, two juvenile alder flycatchers, one mallard, and one pine grosbeak were successfully rehabilitated and released. Two mergansers, 2 common snipe, a tundra swan, a bank swallow and an alder flycatcher died while in rehabilitation. One trumpeter swan was found dead near the outlet of Tustumena Lake. It had apparently starved. A white-winged scooter with an injured wing was assigned to a rehabilitation permittee in Kasilof.

A yearling beaver was released on the northern Refuge after being rehabilitated for 10 months. Two lynx were successfully rehabilitated and released. One was captured in a snare by a landowner experiencing depredation of small livestock (a radiocollar prevented asphyxiation), and a second was injured during a live-capture operation using hounds for the Refuge's ongoing lynx telemetry study.

H. PUBLIC USE

1. General

The eruption of Mount Redoubt in late 1989 and periodically throughout the winter of 1990 provided a snowpack with several layers of volcanic ash. Renewed activity at Mount Redoubt put a damper on outdoor activities during January. Ashfall from an unpredicted eruption of Mount Redoubt on January 8 browned much of the Refuge, with many areas receiving 1/4 to 1/2 inch of ash. Cold dry weather exacerbated the problems associated with the ash. Central Peninsula schools shut down and Peninsula residents wore face masks for several days.

The last color of autumn near Hidden Lake and fresh snow on Hide Out Mountain provide a striking reminder of the scenic beauty of the Skilak Wildlife Recreation Area.
11/90/RJ

Until snow fell on January 13, ski trails were temporarily ruined by ash and snowmobilers were reluctant to risk engine trouble by operating in areas covered by surface ash. Popular snowmobile areas in the Caribou Hills were unaffected by ash. The Central Peninsula received heavy rain on January 15, which settled most of the fine volcanic dust. Subsequent snows, completely covered visible ash.

Snowmobilers, skiers and many others had to contend with the abrasive volcanic dust throughout the winter. After the snow melted, spring bear hunters and visitors left a trail of dust behind them as they walked through the ashen forests.

Public use on the Refuge during 1990 involved visitation to Refuge information and education centers, use of developed Refuge recreational facilities, and dispersed roadside recreational areas, and remote trail, boat-in and fly-in use.

Sportfishing provided the primary attraction at many locations. Facility over-crowding, facility conditions, regulation violations, and sanitation management problems were greatly influenced by public fishing activity.

Refuge visitors were treated to an example of what we hope most facilities will look like in the future with the opening of Hidden Lake Campground. Although many facilities will be redesigned, the challenge for management will be to bring these new visitor facilities into service while maintaining numerous other facilities of lesser priority.

There was no major shift in public use activities during 1990, although Kenai River salmon fishing closures appeared to significantly affect distribution of guided activity, both on and off the Refuge.

Estimated overall Refuge visitation increased slightly from 1989, with an estimated 522,500 visits occurring during 1990. Several aspects of Refuge visitation appeared to increase during 1990, including sportfishing, outdoor education, dispersed camping, fly-in fishing, boating, visitor center use and wildlife observation.

Several volumes (five years back) of the park practice design grists, news letters and hand-outs published by the National Recreation and Parks Association were ordered during early February and received during November. The Refuge will now receive quarterly updates of the publications.

2. Outdoor Classrooms - Students

Approximately 2,360 students participated in the Refuge's Environmental Education (EE) program in 1990. While fall use increased over 1989, April and May continued to be the busiest months. All available spaces for May field trips were booked by the third week in April.

A typical field trip to the Visitor Center runs from 9:00 a.m. to 12:00 noon. Students begin with an introductory wildlife film or videotape selected from the Refuge's extensive media library. After the film, students explore the exhibit area with questionnaires associated with the various exhibits. The questionnaires focus on concepts such as animal/plant adaptations, interdependence, natural communities and succession. There are four levels of quizzes for grades kindergarten/first, second/third, fourth/sixth and junior high through high school. Visitor Center activities are followed by lunch at nearby Headquarters Lake. Students then hike the three-quarter mile "Keen-Eye" Trail and do activities from accompanying trail guides.

Elementary school students investigate Refuge exhibits while participating in a field trip to the Refuge. 5/90/JF

Students participate in "hands on" nature activities at the OEC. 5/90/ZF

In 1990 the Refuge's Outdoor Education Center (OEC) (located off Swan Lake Road adjacent to the Swanson River and Swan Lake Canoe Systems) was utilized for 1,327 user days. The OEC provides an attractive outdoor site for overnight field trips and youth group retreats. Teachers and youth leaders utilize the facility free-of-charge to conduct environmental education field activities. Rustic accommodations - six cabins, two outhouses and a "commons" lodge (Bear Den) provide the "basics".

Kenai Peninsula teachers participate in an orientation session at the Refuge Visitor Center. Over the past six years, 370 teachers have attended teacher orientations and EE workshops. 10/90/DK

In July and October, the OEC experienced two vandalism incidents. In both cases, windows and buildings were damaged by repeated volleys of small and large caliber bullets. This vandalism combined with the leaking roof and rotting foundation of the "commons" lodge necessitate major maintenance in 1991. The Refuge is exploring assistance from ARCO through an environmental education grant for the purpose.

3. Outdoor Classrooms - Teachers

In 1990, thirty-nine new teachers were introduced to the Refuge's EE program through teacher-orientation sessions and in-service courses. Orientation sessions were scheduled for fall and spring when teachers showed the greatest interest in scheduling field trips. During an one and one-half-hour orientation, teachers experienced an abbreviated version of a sample class field trip, and also learned about the Refuge's purposes and commitment to EE.

Park Ranger Ward and Student Conservation Association Resource Assistance (SCA) Debra Novak distributed National Wildlife Week and Alaska Wildlife Week Materials to all Kenai Borough elementary school teachers. Teachers responded enthusiastically to these materials that helped them to prepare for Earth Day 1990.

Ward and Novak developed new school group activity guides, to synchronize with the boardwalk and lake loop additions to the Keen-Eye Trail. Materials included teacher's guides, student activity sheets and day packs with hands-on materials for students use on the trail.

In September and November, Ward led two Project Wild workshops for Boy and Girl Scout leaders. Forty-two youth leaders attended the six-hour sessions participating in a variety of hands-on activities. Participants received free Project Wild books for their troop.

In October, Ward attended and assisted in the Kenai Peninsula Borough teacher in-service program. Through local teacher response to the in-service's "Adopt-A-Stream" program, Alaska Department of Fish and Game State Biologist Dave Athons and Ward worked together assisting teachers in this program. Refuge support primarily included instructing teachers in the Project Wild Aquatic Environmental Education Curriculum.

4. Interpretive Foot Trails

In June, Carpenter Marrs routed and installed directional signs and trail numbering placards on the Keen-Eye Trail (located adjacent to the Visitor Center). Youth Conservation Corp (YCC) enrollees rerouted one trail section to divert a low lying springtime wet area. Ward and Volunteer Angie Okomato-Ong prepared a final draft of the general public Keen-Eye Trail guide to correspond to trail extensions and reroutes.

5. Interpretive Tour Trails

Nothing to report.

6. Interpretive Exhibits/Demonstrations

By far the greatest interpretive exhibit effort was the editing of over 150 interpretive panel texts, lay-outs and illustrations for the Skilak Interpretive Project. Begun in 1988, Outdoor Recreation Planner Simpson handled the bulk of the mammoth project with assistance from Outdoor Recreation Planner Johnston and Ward. Simpson completed final editing work on the project in mid-February. The project was terminated prior to completion due to many problems with the contractors. The text and illustrations on the master interpretive panels may be usable for future projects. Hidden Lake panels were treated separately and were completed as called for in the original contract. Simpson compiled a panel fabrication order for the newly renovated Hidden Lake Campground, after completion of the interpretive planning. By June 26 interpretive

panels were installed along trails on the observation deck, at the welcome kiosk and throughout the camping/day use areas of the Hidden Lake facility.

New interpretive panels were installed at Hidden Lake Campground during 1990. 06/90/RJ

In April, Simpson and Novak created a double panel free-standing display on "Alaska's Endangered Wildlife". The exhibit was used in a community wide Earth Day celebration on April 21-22 and remained in the Refuge Visitor Center through September 1990.

For the third consecutive year the Refuge public use staff participated in the Kenai Peninsula Sportsmen's Show. Simpson and Park Rangers Hudson, Johnson, and Ward along with Novak prepared and staffed an information booth April 20-22.

Simpson, Marrs, and Ward worked to upgrade the visitor contact station in spring 1990. Marrs installed a handicapped access ramp to the building. Ward and Marrs planned for and installed a new exhibit and a fiberglass embedment map of the Kenai Peninsula and Cook Inlet for the interior of the visitor center station.

In preparation for the September moose hunting season, Simpson, Marrs, and Ward worked to refurbish an elaborate mobile display depicting legal and illegal moose antler configurations. The exhibit built in 1989 was

so popular that it was displayed from July through September 1990, in the Kenai and Soldotna Malls. The public truly appreciated the display and enjoyed quizzing one another on "which racks were legal".

Ward and SCA Michelle Napoli completed a temporary exhibit on waterfowl for the Refuge Visitor Center. The exhibit highlighted the importance of wetland conservation, benefits of the Duck Stamp Program, and Alaska's upcoming conversion to steel shot in 1991.

7. Other Interpretive Programs

The year-round weekend wildlife film series continued to be one of our most popular programs, attracting 5,460 people in 1990. Adding several new titles to our film/video collection improved the quality of the series. Local media and radio stations offered excellent free public service advertising for the program.

During the summer, 1,800 people watched the Refuge video, "Wild Refuge: Fortune and Future of the Kenai". Nearly 1,900 people from community organizations used the Visitor Center for wildlife-oriented meetings and programs. These groups included Kenai Peninsula Audubon Society, Kenai Peninsula Community College, Alaska Bowhunters, Scouts, Campfire youths, 4-H clubs, summer youth camps, church youth groups, senior's organizations, mental health services, tour groups, and day care programs.

Volunteer Rebecca Architzel revised the Kenai Peninsula "Guru", an in-depth information guide for Visitor Center. Staff and volunteers benefited from the updated information on Kenai Peninsula resource activities and recreational opportunities.

SCA's Greg Harris and Michelle Napoli reinstituted Refuge summer interpretive programs with campfire, nature walk, and kids programs at Hidden Lake Campground. Four-hundred-fifty-four people attended their excellent wildlife programs.

Napoli and Harris initiated a new program through Soldotna Community Schools called Nature Day Camp. One hundred-twenty, first through sixth graders participated in nature activities utilizing the Keen-Eye Trail and Headquarters Lake. Daily themes included ecological principles, wildlife, freshwater lake ecology, and wildlife stewardship.

In addition to seasonal employee and SCA training, Refuge staff conducted a variety of interpretive and educational programs requiring in-depth preparation. These included assisting in the April "Snow Goose Watch" and providing slide show presentations for local Chambers of Commerce, University of Alaska courses, Audubon programs and Smithsonian tours.

Refuge Biologist Bill Larned and Andy Loranger assisted Kenai Peninsula Audubon in the annual "Snow Goose Watch" at the Kenai River Flats. 4/90 JF

During August, public use staff submitted several Challenge Grant proposals for 1991 resource management and biology projects. Projects included wetland rehabilitation of canoe trail portages, hiking trail rehabilitation, and wood frog research. Staff began contacting prospective volunteers to complete projects. Challenge Grant proposals match federal funds with volunteer labor to complete much needed resource management and biological research projects.

In September, public use staff submitted a concept paper to the Regional Office regarding upgrading and expansion of the Refuge Visitor Center and interpretive/EE facilities for 2005. In addition, Johnston prepared an option paper for location of interpretive/visitor facilities in the Sterling Highway Corridor of the Refuge.

8. Hunting

Small and big game hunting seasons attracted hunters at numerous Refuge locations, although moose hunting within Game Management Subunit (GMS) Unit 15A in the northern Refuge appeared to be significantly less than during previous years. A well-publicized winter die-off of moose, particularly in GMS 15A, discouraged many locals from hunting. Hunters may have chosen to hunt other management units that were less severely

impacted. Regulations restricting harvest during the general moose hunting season to bulls having a spike or forked antler on at least one side, or three brow tines on at least one side, or antler spread of 50" or greater remained in effect throughout the Kenai Peninsula in 1990. These regulations were first implemented in 1987.

A moose hunter check station was opened along the Swanson River Road during the archery-only (August 25-29) and general (September 1-20) moose hunting seasons, and at Captain Cook State Recreation Area in the Lower Swanson River during the general moose season. Seasonal employees and volunteers staffed the roadside station for fourteen days and the river landing station for three days. Totals of 24 and 408 vehicles were checked at the Swanson River Road Station during the bow and general hunting seasons, respectively. Eleven hunting parties were checked at the Lower Swanson River Landing. Totals of eleven legal and two illegal bull moose were checked during the archery-only and general moose hunting seasons at the two check stations. Field observations and hunter reports combined for an estimated harvest in the Lower Swanson River drainage of eight moose. Overall hunter effort was the lowest recorded since check stations were initiated and approximately 40 percent of that during the 1989 season.

Hunters on the northern Refuge reported seeing fewer legal bulls and the harvest reflected fewer numbers of available moose (Table 38). Total harvest of bull moose in GMS 15A in 1990 represented a 48 percent decline from the 1989 harvest. Harvest in GMS 15B-(West) also declined. Most of these declines in harvest were attributable to the absence of spike-fork yearling bulls in moose populations on the northern Kenai Peninsula, many of which perished as calves during the previous winter. In GMS 15C, where larger bulls generally comprise approximately 50 percent of the harvest, the number of bull moose taken increased slightly over 1989 levels.

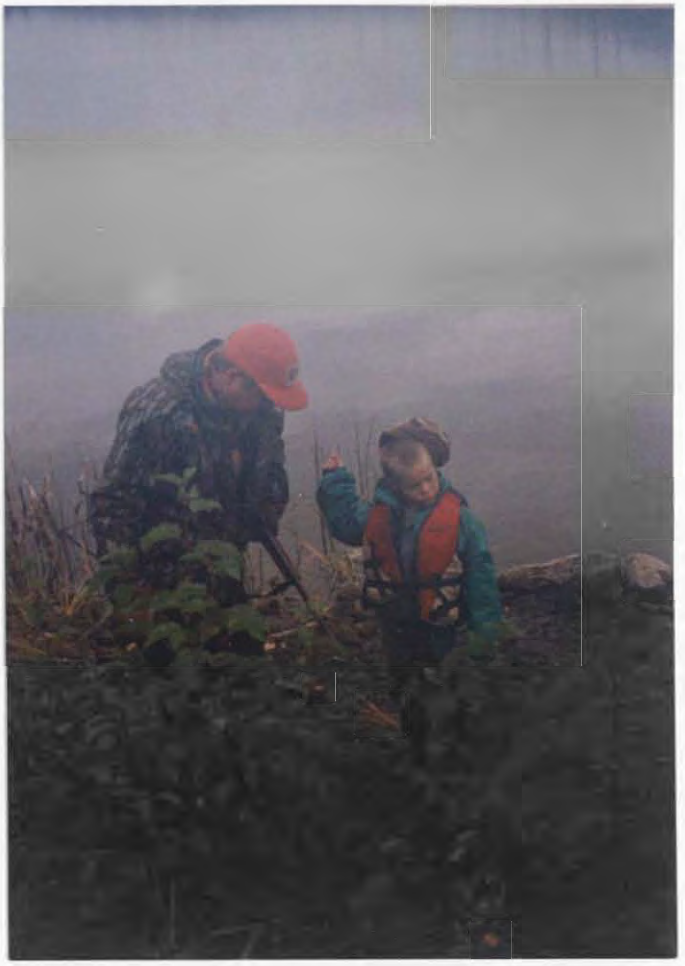
Table 38. Big game harvest on the Kenai Peninsula, 1990.

	Game Management Unit					Total
Species	15A	15B	15C	Total 15	7	Harvest
Brown bear	-	-	-	7	3	10
Black bear*	-	-	-	54	37	91
Caribou						
Mountain Herd	0	0	0	0	7	7
Lowland Herd	2	-	-	2	0	2
Dall's sheep	-	-	-	-	-	33
Mountain goat	-	-	-	-	-	98
Moose	95	79	176	340	103	443

*Spring harvest only
Source: Alaska Department of Fish and Game

The limited-entry (drawing permit) cow moose hunt in the Skilak Lake Wildlife Recreation Area in GMS 15A was held for the second year from September 21-30. As in 1989, the twenty permittees reported harvesting eight cow moose. A Refuge permit was also required for the localized hunt during 1990.

A total of 35 bulls were taken in the GMS 15B- 9East) limited-entry (drawing permit) trophy moose hunt. Harvest in this hunt is limited to bulls having antler spread of at least 50" or three brow tines on at least one side.



A young but anxious Refuge moose hunter gets some early morning safety instructions before a "Sneak" along the Fingers Lake shoreline. 08/90/RJ

Hunting effort in the Tustumena Lake Area appeared to be above average with over fifty vehicles at the Kasilof River Launch on Labor Day week-end. Hunters appeared to be equally split between the GMS 15B permit area and non-permit areas within GMS 15B and GMS 15C on the remaining shoreline of the lake. Several parties were observed in the Clear Creek and Crystal Creek areas of GMS 15C. Big game infractions in the Clear Creek alpine area have been a yearly occurrence and 1990 was no exception with a "failure to salvage the edible meat" case being made against an Anchorage hunter. He shot a 63-inch bull moose approximately three miles in with no reasonable possibility of harvesting the meat as required by regulations. Perhaps a registration permit should be required for the area.

Two of three permittees harvested bull caribou from the Lowland Herd in 1990. 9/90/JF.

Ten illegal bull moose were reported harvested on the northern Refuge in 1990. Mistakes by hunters in estimating antler width, number of brow tines or number of points of cervicorn antlers have apparently declined since the early years of this regulation's implementation. The Refuge continued its education efforts to increase compliance. The antler display constructed in 1989 depicting both legal and illegal antler configurations, was on display at the Soldotna Mall from August 1 to August 10 and at the Kenai Mall from early July to September 1. The exhibit has been extremely well received and may have contributed to increased compliance with the antler-restriction regulation.

A bowhunter proficiency card issued after completing a bow hunter proficiency course, which was required by State Regulations for moose hunters for the first time during 1990. Participation in the early season bowhunt for moose was contingent upon completing the course, presented by the Alaska Bowhunter's Association. Several sessions of this course were held at the Refuge Headquarters. Topics included basic wildlife management principles and life histories of several big game species, hunter safety, outdoor survival, tracking, and archery skills.

Two drawing permit hunts for caribou took place on the Kenai Peninsula in 1990. A total of 50 (bulls-only) permits were issued for the Kenai Mountain Herd. Seven bulls were taken (Table 38), for an overall hunter success rate of 14 percent. As in past years, three permits were issued for the Lowland Herd. Two hunters were successful.

Sheep, goat, and small game seasons opened on August 10 with sheep hunters targeting the Kenai Mountains at several Refuge locations. Full curl ram restrictions were in affect for the second year for sheep within GMU 7 and 15. A total of 33 full-curl rams were taken on the Kenai Peninsula in 1990, up from eight harvested in 1989.

SCA Ian Gamble and Ranger Brent Richey participated in a sheep hunter check camp on Round Mountain from August 9 to August 12. State Fish and Wildlife Protection Officer Titus apprehended a hunter who took a sheep in the Cooper Landing Closed Area on August 11 based on their relayed observations. Hunting on Round Mountain for sheep continues to be a problem with sheep being taken in the Cooper Mountain Closed Area on a yearly basis by hunters being unable to identify the location at the boundary. Existing regulations also allow for a population of sheep that live primarily in the closed area to be harvested by venturing on over the mid-mountain line. Closing all of Round Mountain to sheep hunting would protect the integrity of the sheep population and prevent yearly inadvertent sheep "take".

Ranger White and SCA Majewski also set up an observation camp at Green Lake. Several legal rams were recorded and hunters contacted. One over limit/sublegal ram was also seized.

State officers, in cooperation with Refuge officers, also contacted sheep hunters at Emma Lake and Ice Berg Lake. Five legal rams were reported taken in the Indian Creek drainage.

Goat hunters harvested 98 mountain goat on the Kenai Peninsula in 1990 (Table 38). This total included 60 males, 34 females, 2 of unknown sex and 2 illegal goats. The open registration mountain goat hunt in selected areas opened on October 15.

Black bear harvest during the 1990 spring season included 37 bears in Game Management Unit 7 and 54 bears in Unit 15 (Table 39). Fall harvest data is not yet available. Several groups of black bear hunters were contacted at Upper Skilak Campground, but no bears were reported taken during the October contacts.

Table 39. Black bear harvest on the Kenai Peninsula, 1990.

Season	Males	Females	Unknown	Total
Spring				
GMU 7	27	10	0	37
GMU 15	41	13	0	54
Subtotal	68	23	0	91

Source: Alaska Department of Fish and Game. Through June 1990.

The Refuge issued 44 Special Use Permits for the spring black bear baiting season in 1990. Thirty-eight permittees reported hunting activities, as stipulated in the permit. Twenty-one of the reporting permittees actually hunted, and six successful hunters harvested 10 bears (Table 40). This total included seven sows and three boars. Seven bears were taken by bow and three by rifle. The temporal distribution of the harvest was concentrated in the latter part of the season, with all harvest occurring from 26 May to 15 June.

Table 40. Black bear baiting hunt statistics by methods of harvest, Kenai National Wildlife Refuge, 1990.

Method	Total Hunters	No. Successful	Total Harvest	Avg. Days per Hunter	Avg. Hours per Hunter	Avg. Hours per Bear
Bow	17	4 (24%)	7	10.2	41.2	100.0
Gun	4	2 (50%)	3	7.3	28.3	37.6
TOTAL	21	6 (29%)	10	9.7	38.7	81.3

Grouse hunters reported excellent numbers of spruce grouse at several Refuge locations. Refuge officers received numerous complaints of grouse road hunting along the Swanson River Road and Skilak Road. Hunting along Skilak Road was of particular concern since most of the roadside areas are closed to hunting with a firearm.

Waterfowl hunters utilized both the inlet and outlets of Skilak Lake although success was believed to be limited. Several groups of waterfowl hunters traveled up Mystery Creek Road during September to gain access to Chickaloon Flats. Hunter success was only moderate for ducks and geese.

Effective July 1, 1990, the Federal Government took over the management of subsistence use of fish and wildlife resources on Federal public lands. This change from State of Alaska management came about because of an Alaska Supreme Court decision in December of 1989. The Court ruled that the laws used by the State of Alaska to provide a subsistence priority for rural Alaskans violated the Alaska Constitution.

Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA) of 1980 requires the Federal Government to provide a subsistence priority for rural Alaskan residents unless the State of Alaska provides subsistence priority to rural Alaskan residents through State Laws. The State operated a subsistence program which met ANILCA's requirements until the recent Alaska Supreme Court's McDowell decision placed the State out of compliance with this Federal Law. Since the State has been unable to return to compliance with the Law, the Federal Government is required to take over the management of subsistence use on Federal public lands as required by ANILCA.

What this means for the Kenai National Wildlife Refuge is unclear. The Refuge has contended that because Kenai's legislated purpose statement does not include subsistence, similar to that of other refuges, Congress did not intend for Kenai to be affected by the ANILCA Title VIII subsistence provision or considered "rural" under the definition and intent of ANILCA.

Title VIII, the subsistence section, of ANILCA, requires the Federal government to manage subsistence on Federal public lands unless the State of Alaska has a subsistence management program that meets ANILCA's requirements. One of ANILCA's requirements is that subsistence uses of fish and wildlife by rural residents be given priority over other uses of fish and wildlife on public lands. The State, until December 1989, had a subsistence management program that satisfied ANILCA's requirements. In December 1989 the Alaska Supreme Court ruled that the State Constitution does not allow a priority for fish and wildlife use based on where a person lives. Because the State can no longer comply with ANILCA's requirements, the Federal government must provide rural residents a priority for harvesting fish and wildlife on public lands.

On June 29, 1990, temporary regulations for the Federal management of subsistence including seasons and bag limits, were published in the Federal Register. The regulations cover the subsistence uses of fish and wildlife resources on public lands in Alaska managed by the Fish and Wildlife Service (USFWS), National Park Service (NPS), Bureau of Land Management (BLM), USDA-Forest Service, Bureau of Indian Affairs, Air Force, Army and various other Federal agencies. Hunting seasons on the Refuge were not affected by subsistence regulations changes during 1990.

If portions of the Refuge and/or communities nearby are determined to be "rural", it may mean that when and where there is not enough fish or wildlife for everyone, opportunity for subsistence uses must be provided for before non-subsistence uses. What this would mean for permit hunts on Kenai Refuge or for open hunts with antler restrictions is not clear.

9. Fishing

Sportfishing is one of the most popular activities occurring on the Kenai. As in the past, all of the Refuge's high use management situations and peak concentrations of visitors were associated with sportfishing,

particularly anadromous sport fisheries. While fishing occurred year-round during 1990, the most challenging management situations, congestion, facilities maintenance, and law enforcement situations occurred during peak summer weekends.

A lone ice fisherman strikes off for a favorite Hidden Lake fishing spot. Far right a new winter interpretive panel explains tips for winter outdoor safety. 10/90/RJ

Weak runs of Kenai River king salmon had the affect of slowing angler use on sections of the river open to king fishing. Fishing in the Kenai was restricted to "catch and release" only for king salmon, which increased guided and non-guided angler effort on other fish species at other locations along the Kenai River and on other Kenai Peninsula Rivers. Most dramatic of these was an increased effort on the Kasilof River targeting king salmon and the Upper Kenai River targeting rainbow trout. Guided fishing at these locations increased significantly when the Lower Kenai River was restricted.

The Upper Kenai River surge in use during July was believed to be due to several factors. When the Lower Kenai was restricted to king salmon fishing, due to a relatively weak run, sportfishing guides increasingly depended on the Upper Kenai River trout fishery for quality fishing opportunities for their clients. Associated with the increased drift boat use of the Upper Kenai River was an undetermined number of guides

utilizing the area without a permit, and permitted guides taking more clients than their permit authorized. Use by non-guided anglers was also noticeably up for June and July, also attributable to the Lower Kenai River closure.

The Kenai River experienced a 742,400 sockeye salmon run, which was less than the very large runs of recent years, but well above the recent historical average. Sockeye salmon limits were increased from three to six fish for 1990 due to an increasing average annual run strength.

Former Refuge Employee Bill Eickhoff was one of the many Refuge visitors who took advantage of increased sockeye salmon bag limits for the Kenai River. 09/90/RJ

Increased fishing effort and associated camping activities increased for the fourth straight year on the Kenai River below Skilak Lake. The large schools of sockeye salmon concentrated in the lower lake and Kenai River in 1988 and 1989 were significantly fewer, and less concentrated during, 1990 but angler effort was still high.

The early run escapement was 25,148. The early Russian River sport sockeye harvest was 30,215 with approximately 44,740 man days of effort. The catch-per-hour ratio during 1990 was .255. (Table 41) Another 1,572 sockeye would have been included in the spawning escapement but were removed for the Bear Creek enhancement project.

Table 41. Estimated sockeye salmon harvest, effort and success rates on Russian River, 1963-1990.

Year	Harvest			Total Effort (Man-Days)	Catch Per Hour	Census Period
	Early Run	Late Run	Total			
1963	3,670	1,390	5,060	7,880	0.190	06/08-08/15
1964	3,550	2,450	6,000	5,330	0.321	06/08-08/16
1965	10,030	2,160	12,190	9,720	0.265	06/15-08/15
1966	14,950	7,290	22,240	18,280	0.242	06/15-08/15
1967	7,240	5,720	12,960	16,960	0.141	06/10-08/15
1968	6,920	5,820	12,740	17,280	0.134	06/10-08/15
1969	5,870	1,150	7,020	14,930	0.094	06/07-08/15
1970	5,750	600	6,350	10,700	0.124	06/11-08/15*
1971	2,810	10,730	13,540	15,120	0.192	06/17-08/30*
1972	5,040	16,050	21,090	25,700	0.195	06/17-08/21
1973	6,740	8,930	15,670	30,690	0.102	06/08-08/19*
1974	6,440	8,500	14,940	21,120	0.131	06/08-07/30*
1975	1,400	8,390	9,790	16,510	0.140	06/14-08/13*
1976	3,380	13,700	17,080	26,310	0.163	06/12-08/23*
1977	20,400	27,440	47,840	69,510	0.168	06/18-08/17
1978	37,720	24,530	62,250	69,860	0.203	06/07-08/09
1979	8,400	26,830	35,230	55,000	0.136	06/09-08/20*
1980	27,220	33,490	60,710	56,330	0.245	06/13-08/20
1981	10,770	23,720	34,440	51,030	0.156	06/09-08/20
1982	34,500	10,300	44,820	51,480	0.261	06/11-08/04**
1983	8,360	16,000	24,360	31,890	0.117	06/08-08/09**
1984	35,880	21,970	57,850	49,550	0.238	06/04-08/19**
1985	12,300	58,410	77,710	50,770	0.286	06/13-08/16**
1986	35,099	30,813	66,012	51,400	0.240	06/14-08/20**
1987	154,189	40,575	194,790	113,012	0.431	06/08-08/20
1988	50,820	19,540	70,356	72,023	0.264	06/13-08/09*
1989	11,290	55,210	61,500	60,569	0.284	06/09-08/20*
1990	30,215	56,175	86,390	84,710	0.255	06/12-08/20

*Census period was not continuous during these years due to emergency closures required to increase escapement levels.

**Census period was not continuous during these years due to negligible fishing effort after completion of the early run and prior to arrival of late run.

The Kenai-Russian River confluence is the preferred spot for many Anchorage anglers. Use is restricted to day use and campfires are prohibited in order to minimize impacts. 09/90/RJ

Angler use on Refuge lands was relatively high during July with the Upper Kenai River, Skilak Lake, and Russian River receiving very high use. The first run of Russian River sockeye salmon spilled over into July. There was only a brief period of low use at the Kenai-Russian River facility prior to the second run of fish arriving in mid-July. Refuge officers worked many days at the Kenai-Russian River area managing the "crush" of visitor use. State officers were generally busy with the commercial fishery so Refuge officers carried a heavier then normal load of daily sportfishing regulations monitoring.

The late run sockeye salmon escapement was 83,176. The late run sockeye harvest was 56,175 with a recorded 39,970 man days of effort (Table 41).

The early salmon run was well above the historic average of the 51,740 escapement and a 17,843 harvest. The Russian River sportfish division management weir was operated through September 7.

A fisherman wastes no time departing the Kenai River Ferry. The 1990 late Russian River Sockeye run experienced a record amount of angler effort. 07/90/RJ

Interest in the Upper Kenai River trout and Dolly Varden fishery in 1991 was the highest ever. Both guided and non-guided anglers reported catching ten pound plus rainbows with previously unreported frequency. Several protection regulations and harvest restrictions designed to protect larger trout have begun to pay off with outstanding catches of large trout. Although Refuge officers made several cases against anglers not in compliance with various Kenai River Fishing Regulations, most guides and anglers continue to be supportive of trout conservation.

The State Board of Fish determination for the subsistence allocation of Kachemak Bay/Fox River silver salmon threatened to completely eliminate sportfishing for silvers at Clear Creek. Refuge Manager Doshier expressed his concern about the issue in a December 19, 1990, letter to the Regional Office. The issue of subsistence fishing both on and off Refuge lands and how it will affect existing sportfisheries is unclear.

The trend to adopt conservative fishing regulations for rainbow trout in the Upper Kenai River continued to receive support from many guides and anglers wanting a complete catch and release program for rainbows.

Three significant sport fishery regulations were adopted by the Board of Fish in late 1990 to go into affect in 1991: 1) The minimum size restriction on rainbow trout was increased from 20 inches to 24 inches; 2) a size limit and bag limit decrease was put in place for Dolly Varden Trout; and 3) a restriction on bait fishing was put into affect for a one-half mile area where the Kenai River flows into Skilak Lake.

The Kenai River inlet to Skilak Lake is a productive area for wildlife and fish and a popular area for fishermen and wildlife observers. In the fall of 1990 the fisheries board adopted bait restrictions for this area. 11/90/RJ

Ice fishing was quite popular during 1990. Hidden Lake Road was opened to ice fishermen on January 19. Although final work had not been completed on the new facility, it was determined that winter access to Hidden Lake via Hidden Lake Road would not be detrimental to the contract. Maintenance staff plowed the road on January 19, and a news release was distributed regarding the winter opening.

Table 42. Kenai Peninsula Freshwater Sport Fisheries, 1990.

	Days fished (non-guided)	Days fished (guided)	Est. % occurring on KNWR
Kenai River: (Soldotna Bridge to Moose River)	83,942	9,566	7%
Kenai River: (Moose River to Skilak Outlet)	50,781	2,354	15%
Kenai River: (Skilak Inlet to Kenai Lake)	28,051	3,511	70%
Russian River	53,588		70%
Kasilof River	39,318		5%
Swanson River	5,484		90%
Other Rivers	4,118		20%
Hidden Lake	1,152*		100%
Swanson River/Canoe Lake System	2,180		100%
Swan Lake/Canoe Lake System	3,570		100%
Moose River	1,200		90%
Other Lakes	8,548		40%
Tustumena	923		100%
Skilak	2,810		100%

The above statistics represent survey data for 1989, and were published during 1990.
*Road closed during 1989. Figure represents ice fishing only.

10. Trapping

Ninety trapping permits were issued for the 1989-90 furbearer season on the Refuge. This represents an increase of 30 percent over the number of permits issued for the 1988-89 season. Mandatory attendance of a Trapper Orientation Program, at which Refuge Trapping Permits were issued, probably accounted for the increase - many trappers attended the program who did not intend to trap in 1989-90 in order to fulfill this one-time requirement. Sixty-four percent of reporting trapping permittees did not trap on the Refuge during 1989-90. Twenty-one reported that they had trapped, continuing a downward trend in the total number of trappers on the Refuge. Probable reasons include: 1) continued closure of the lynx season throughout the Kenai Peninsula, a species whose pelt value provides significant incentive to trap; 2) additional trapping restrictions for wolverine, marten, fox and beaver; and 3) institution of a four-day trap check requirement on accessible portions of the Refuge.

Harvest of most land and aquatic furbearer species was well below historical levels (Tables 43 and 44). Overall trapper success rates for many species has declined steadily since the mid-1980's. Until less adverse weather conditions and a reopening of the lynx season occur, it will be difficult to assess the impacts of recently implemented

regulations such as the trap-check requirement, area restrictions, reduced season lengths and bag limits on trapping activity, success rates and overall harvest.

Table 43. Total reported land furbearer harvest and average per permit holder on the Kenai National Wildlife Refuge, 1960-1990.

		Land furbearer reported harvest									
		Lynx		Coyote		Wolverine		Weasel		Wolf	
Season	Total permits	Total	Mean per permit holder	Total	Mean per permit holder	Total	Mean per permit holder	Total	Mean per permit holder	Total	Mean per permit holder
1960-61	16	13	0.6	15	0.9	1	0.1	1	0.1	—	—
1061-62	24	23	1.6	30	1.2	4	0.2	13	0.5	—	—
1962-63	28	28	1.0	27	1.0	2	0.1	0	0	—	—
1963-64	33	28	0.8	39	1.2	1	0.1	6	0.2	—	—
1964-65	17	24	1.4	11	0.6	6	0.3	10	0.6	—	—
1965-66	16	17	1.1	16	1.0	4	0.2	2	0.1	—	—
1966-67	25	7	0.3	5	0.2	4	0.2	35	1.4	—	—
1967-68	—	—	—	—	—	—	—	—	—	—	—
1968-69	22	18	0.8	44	2.0	1	0.1	81	3.7	—	—
1969-70	53	62	1.2	23	0.4	3	0.1	35	0.7	—	—
1970-71	59	67	1.1	30	0.5	10	0.2	79	1.3	—	—
1971-72	61	181	3.0	13	0.2	14	0.2	35	0.6	—	—
1972-73	65	146	2.2	51	0.8	8	0.1	4	0.1	1	0.1
1973-74	81	245	3.0	58	0.7	7	0.1	149	1.8	0	0
1974-75	52	162	3.1	24	0.5	10	0.2	68	1.3	0	0
1975-76	70	113	1.6	32	0.5	6	0.1	16	0.2	1	0.1
1976-77	86	53	0.6	25	0.3	6	0.1	10	0.1	2	0.1
1977-78	86	43	0.5	34	0.4	4	0.1	14	0.2	8	0.1
1978-79	96	36	0.4	44	0.5	3	0.1	7	0.1	32	0.3
1979-80	104	12	0.1	64	0.6	3	0.1	58	0.6	19	0.2
1980-81	102	2	0.1	38	0.4	0	0	14	0.14	16	0.16
1981-82	104	17	0.2	66	0.6	4	0.1	70	0.7	44	0.4
1982-83	122	47[1]	0.4	80	0.6	2	0.1	43	0.3	39	0.3
1983-84	114	38[1]	0.3	87	0.8	2	0.1	29	0.2	30	0.3
1984-85	107	31[1]	0.3	107	1.0	2	0.1	17	0.2	38	0.3
1985-86	114	23[1]	0.2	110	1.0	4	0.1	3	0.1	33	0.3
1986-87	109	33[1]	0.2	43	0.4	5	0.1	2	0.1	17	0.2
1987-88	83	2	0.02	41	0.5	7	0.08	2	0.02	12	0.14
1988-89	63	1	0.02	15	0.24	0	0.0	1	0.02	12[2]	0.19
1989-90	90	1	0.01	28	0.31	8	0.09	15	0.17	7	0.08

[1]Includes lynx radiocollared and released for study.
[2]Includes 4 wolves radiocollared and released for study.

Table 44. Total reported aquatic furbearer harvest and average per permit holder on the Kenai National Wildlife Refuge, 1960-89.

		Aquatic furbearer reported harvest							
		Beaver		Otter		Muskrat		Mink	
Season	Total permits	Total	Mean per Permit holder	Total	Mean per Permit holder	Total	Mean per Permit holder	Total	Mean per Permit holder
1960-61	16	145	9.1	16	1.0	2	0.1	42	2.6
1961-62	24	79	3.3	19	0.8	0	0	69	2.9
1962-63	28	109	3.9	19	0.7	2	0.1	66	2.4
1963-64	33	150	4.5	26	0.8	0	0	83	2.5
1964-65	17	6	0.3	3	0.2	0	0	15	0.9
1965-66	16	17	1.1	4	0.2	0	0	13	0.8
1966-67	25	22	0.9	9	0.4	0	0	45	1.8
1967-68	—	—	—	—	—	—	—	—	—
1968-69	22	14	0.6	10	0.4	207	9.4	64	2.9
1969-70	53	33	0.6	32	0.6	75	1.4	82	1.5
1970-71	59	25	0.4	9	0.1	29	0.5	60	1.0
1971-72	61	23	0.4	8	0.1	18	0.3	9	0.1
1972-73	65	76	1.2	24	0.4	111	1.7	48	0.7
1973-74	81	40	0.5	26	0.3	334	4.1	160	2.0
1974-75	52	6	0.1	8	0.1	21	0.4	33	0.6
1975-76	70	34	0.5	13	0.2	82	1.2	25	0.4
1976-77	86	24	0.3	7	0.1	8	0.1	39	0.4
1977-78	86	19	0.2	9	0.1	140	1.6	33	0.4
1978-79	96	22	0.2	6	0.1	73	0.8	25	0.3
1979-80	104	83	0.8	17	0.1	127	1.1	57	0.5
1980-81	102	82	0.8	30	0.3	191	1.9	111	1.1
1981-82	104	61	0.6	26	0.2	183	1.8	119	1.1
1982-83	122	93	0.8	18	0.1	227	1.8	202	1.6
1983-84	114	43	0.4	18	0.2	39	0.4	268	2.3
1984-85	107	103	1.0	20	0.2	121	1.1	392	3.7
1985-86	114	86	0.8	24	0.2	209	1.8	322	2.7
1986-87	109	55	0.5	21	0.2	85	0.8	88	0.8
1987-88	83	50	0.60	11	0.13	14	0.17	44	0.53
1988-89	63	17	0.27	1	0.02	6	0.1	17	0.27
1989-90	90	5	0.06	7	0.08	0	0.00	45	0.50

As stipulated in the Furbearer Management Plan, attending the Refuge Trapper Orientation Program became mandatory for obtaining a trapping permit for the 1989-90 trapping season. Three orientation programs were held during the fall prior to the 1990-91 season. One of these sessions was attended by thirty-nine trappers.

The Trapper Orientation Program includes presentations by Alaska Department of Fish and Game Area Wildlife Biologist Ted Spraker, local trapper Art Horton and the Refuge Wildlife biologist. Topics include furbearer management principles, ongoing furbearer research and survey activities on the Refuge, life histories of Kenai furbearers, historical harvest data and their uses in management, State and Federal Regulations, governing trapping on the Refuge, and trapping techniques specific to Refuge furbearers. Instructors emphasized the importance of selective trapping to minimize the catch of non-target species, reduction of conflicts with other Refuge users, and active participation of trappers in managing furbearer resources.

Snares are a legal trapping method under Alaska State regulations and the Refuge Trapping Permit Stipulations are included to prevent catching non-targeted species. Snare marking requirements have increased the accountability of individual snares and abandoned snares have decreased in recent years. 02/90/RJ

11. Wildlife Observations

Many Refuge visitors inquire about wildlife observation and photography and are encouraged to be creative and try to get out early and stay late. Visitors are also given a hand-out describing specific tips for observing local wildlife.

After snow covered the volcanic ash, the Headquarters Ski Trail System was extremely popular throughout the winter, particularly on weekends. The ski trails were groomed twice during the month with the Refuge's new track-setter. Although the new track-setter makes excellent trails, it is very bulky and difficult to operate. Skiers reported seeing many moose on the ski trails and along Ski Hill Road. Moose were concentrated into areas where the snow was packed. Moose that ventured off packed trails often were seen foundering in deep snow. In many cases skiers had some concern getting by trail friendly moose.

Biologists Loranger, Larned and Biological Technician Jozwiak, in conjunction with the Kenai Peninsula Audubon Society, hosted the spring "Snow Goose Watch" at the Kenai River Flats on April 21. With Mount Redoubt puffing a plume of ash and a variety of waterfowl to observe on the flats, the public gained a deeper appreciation of Peninsula scenery and wildlife.

Mount Redoubt erupting during January 1990. Ashfall occurred at several Refuge locations. 01/90/RJ

YCC staff and Brent Richey completed a boardwalk plank project on Egumen Lake Trail. The previously intimidating trail should provide easy access to early summer wildlife observation in the rich habitat around Egumen Lake.

YCC and Refuge staff constructed a 250-foot section of boardwalk on the Egumen Lake Trail. The project will protect wetlands and aid day hikers on the short trail.
10/90/RJ

Gamble and Majewsky completed several trail projects during July, including portage work in the Swan Lake and Swanson River Canoe Trails, Tustumena Cabin cleanup, Hidden Creek Trail maintenance and Fuller Lake Trail cleanup and maintenance.

Wildlife observation became "up close and personal" with many bears frequenting Hidden Lake Campground during the visitor season. Wildlife sign of all types including, recycled berries, half eaten salmon and tracks were spread throughout the facility.

The combination of closed hunting seasons in Skilak Wildlife Recreation Area (SWRA) and enhanced salmon runs in Hidden Lake appear to be

increasing bear activity along Hidden Creek. The renovation of Hidden Lake Campground and increased bear activity significantly increased bear-human interaction situations.

Wildlife sightings in the Skilak Area have increased dramatically since the hunting and trapping restrictions within the 40,000-acre Skilak Area have been in place.

Three subadult brown bears frequented the new Hidden Lake Campground often during 1990, initiating several measures to discourage their habit of visiting the campground. Streamside fishing closures, removal of dumpster, and camper education programs were initiated. 07/90/PZ

Moose viewing opportunities continued to be enhanced by antler restrictions implemented in 1987. These recent restrictions have begun to produce bull moose in the sub-legal age class for Refuge visitors to observe.

Trapping restrictions have enhanced the viewability of beaver at several roadside and day trail accessible lakes where beaver activity had been declining. Beaver and beaver sign are particularly apparent along the Upper Kenai River, where they seem to be feasting on every streamside cottonwood. Considerable beaver activity was also observed at Jean, Kelly and Petersen Lakes. Metal mesh may be necessary to preserve certain campground trees.

Trail maintenance/enhancement continued to be a high priority on the Refuge, as trails provide optimum wildlife viewing opportunities. Park Rangers set up informational displays in all the trailhead bulletin boards. The Visitor Center and Visitor Contact Station were well-stocked with the Refuge's Hiking Trail Booklet (prepared by SCA Short in 1988). The relatively new booklet serves as an excellent guide, particularly for first-time visitors.

Hidden Lake Campground bear. 08/90/PZ

Hidden Lake Campground feature a new observation deck. The large deck installed at the water's edge, will enhance viewing of lake spawning sockeye salmon that concentrate in the area as well as water birds and eagles. A spotting scope will be installed on the deck.

Three observation scopes were installed at various Refuge locations including two at the Kenai-Russian River Access Area and one at Headquarters Lake along the Keen-Eye Trail.

The Refuge has a variety of roadside wildlife/wildland observation opportunities throughout the Refuge. Roads provide opportunities to view moose, beaver, eagles, swans and other wildlife.

In a cooperative effort with the Alaska Department of Transportation, magnetic loop traffic counters were installed at either end of Skilak Road and on the newly paved Hidden Lake Access. Data from the counters will give up-to-date and accurate information regarding Refuge visitation.

Generally, the Refuge will provide funds for the actual traffic counters and the State will maintain and monitor the counters.

Table 45. Annual Traffic Volumes and Daily Averages, 1990

Annual Traffic Volumes (1990)	Average Daily Traffic	Annual
Sterling Highway (Approx. Watson Lk.)	2,749	693,500
Sterling Highway (2 Mi. west of Russian River)	2,948	693,500
Skilak Rd-Sterling H.-L. Skilak Cpg.	130	44,800
L. Skilak-Upper Skilak	105	37,500
U. Skilak-Hidden Lk. Road	105	37,500
Hidden Lake Rd.-junc./Skilak Road	105	37,500
Hidden Lake Road	50	13,775
Lower Skilak Campground Road	60	21,900
Upper Skilak Campground Road	60	21,900
Swanson River (Refuge Boundary)	185	64,875
Ski Hill Road	50	13,775
Funny River Road	450	93,000
Tustumena Campground Road	55	23,725

Note: The above includes vehicles traveling both directions.

12. Other Wildlife-Oriented Recreation

The busy canoeing/boating season at the Refuge began in earnest in May with fishermen lining the shores of the major lakes, rivers and streams. Refuge boat launches and campgrounds were active, particularly on weekends, and the Swan Lake and Swanson River Canoe Routes supported heavy use (approximately 85 vehicles were parked at the three canoe route entrances on "Memorial Day Sunday").

Johnston reviewed a proposed Recreation Management Information System computer program which was sent for review by the Division of Refuges in Washington. Kenai Refuge and two other refuges in Region 7 were selected to test the new system. The program was an exact repeat (in an automated format) of the unpopular previous reporting system. Comments were sent to Bud Oliveria at Tetlin Refuge for consolidation.

The Swan Lake and Swanson River Canoe Trails were popular during 1990 with visitors willing to carry their own canoes and work for excellent wildlife viewing and wilderness opportunities. An estimated 5,500 visitors expended 27,000 visitor days within the Swan Lake and Swanson River Canoe Routes. Approximately 18,000 visitor days took place on the Swan Lake-Moose River Routes and 9,000 on the Swanson River Route. Canoeists generally participate in multiple activities during a single trip including camping, fishing, wildlife viewing, canoeing and hunting (in September).

13. Camping

An estimated 75,000 overnight visits occurred within Refuge Campgrounds and/or access areas during 1990. An additional 55,000 overnight stays occurred at dispersed non-developed and backcountry settings. Total campground visits and dispersed camping figures increased after the reopening of Hidden Lake Campground and Hidden Lake Access Road. Dispersed camping at Skilak Lake and the Kenai River bordering Skilak also increased.

Beetle-killed hazard tree salvage was completed at two sites near campgrounds in the Cooper Landing area, with approximately 1,100 trees removed. The loggers were given the first three weeks in April to complete slash cleanup and remove remaining logs and other property from the Refuge. The cleared areas have a very open look, but filled in again with grass and revegetation of spruce seedlings.

Refuge Manager Daniel Doshier addressing visitors attending the Hidden Lake Campground dedication. 06/90/CS

Hidden Lake Campground opened in June after being closed for a year for construction and redesign. The access road to Hidden Lake had been opened after the 1989 construction season and remained open for ice fishing until April 17, when it was closed for two months while M-B Contracting Co., Inc., finished the facility.

Doshier coordinated the June 30 dedication ceremony with Regional Office/local support. Despite several untimely speaker/entertainment cancellations, the two-hour event went off without a hitch. Approximately 75 visitors enjoyed musical entertainment, several short speeches, a "future development" display, and a well-stocked refreshment table.

Hidden Lake Campground supported substantial use throughout its first full month of operation. The three campground loops were filled to capacity on more than one weekend during the month. The new lakeside day use area proved to be extremely popular and appeared to be achieving congestion reduction, activity separation, and Skilak Road overflow camping opportunity goals.

Persons attending the Hidden Lake Campground dedication were treated to a father/daughter entertainment program. "Oh I've Been Working on the Refuge...All the Live Long Day... 06/90/CS

Outdoor Recreation Planner Simpson and Accounting Technician Nelson coordinated a fee collection system for Hidden Lake Campground initiated June 24. Signing, fee envelopes and other "tools of the trade" were developed. White was named "Chief Fee Collector".

The fee for a one night stay was $6.00. Golden Age and Golden Access cards discounting fees were accepted. The fees collected from the

campground were $8,652.00 from approximately 1,600 registered parties during the summer. Campground fee collection was discontinued on September 29, 1990. An estimated 3,500 other visitors utilizing the Hidden Lake Facility for non-fee day use and boating.

Kenai enlisted its first campground host at the new Hidden Lake Campground. Merle and Linda Mix were very helpful to the overall management of the facility. They assisted rangers with several aspects of campground management and visitors with information needs. They were orientated during June. By month's end, they were fully equipped with a two-way radio, uniform shirts and caps, a boat and motor, and a clear understanding of their responsibilities/limitations. They proved to be invaluable in managing/monitoring day-to-day operations at the 44-site campground. Unfortunately they resigned in mid-summer leaving the campground without a host for the remainder of the season.

Several incidents of bears coming into the facility raiding the garbage dumpsters and individual campsites occurred during July. Refuge staff removed the dumpsters and individual campers were given written notice to keep very clean campsites. Refuge staff monitored bear activities and took several steps to reduce the possibility of future bear conflicts at the facility. The enhancement of Hidden Lake/Hidden Creek salmon run and the associated large numbers of salmon returning to Hidden Creek is believed to be contributing factors to 1990 brown and black bear incidents at the facility. Brown bear activity at the campground appeared to be three sub-adult sibling cubs. No adult browns were observed.

Bear activity continued to be heavy in Hidden Lake Campground throughout September and October. Heavy bear sign between Skilak Lookout Trail, Skilak Lake Road, Hidden Creek and Hidden Lake Campground was consistently seen by staff and reported by visitors. Bears continued to visit camp units, which did not follow stringent Refuge guidelines for keeping clean camps at Hidden Lake. White prepared a report summarizing bear incidents at Hidden Lake Campground during 1990. The report included sightings, management response and recommendations for 1991.

Throughout June, Refuge public use staff coordinated Hidden Lake improvement projects. Directional signs were installed throughout the facility replacing inadequately-sized signs furnished by the contractor. Several prohibitive notices were either displayed on signs or stenciled on paved areas to inhibit illegal parking/camping/access trends. Twenty-six interpretive panels were installed along trails, on the observation deck, at the welcome kiosk, and throughout camping/day-use areas in the Hidden Lake Facility. (The maintenance staff did an outstanding job designing specialized holders for the panels).

Two loops of the Campground were closed for the winter during October with removable bollards. The public including picnickers, campers and boaters continued to use the remaining open area until December.

Johnston prepared a memorandum during 1990 outlining facility upgrade needs for the Kenai-Russian River Facility. Several traffic flow, safety and visitor management projects were discussed regarding the facility.

Correspondence received from the Regional Office in December conceptually supported the project and was optimistic about future funding. The primary feature of an upgrade would be a safe turnout lane from the Sterling Highway, a turn around loop prior to the main parking area, better delineation of parking/camping spaces and new restroom facilities.

The concession contract for the Russian River Access Area and Campground was awarded in 1989. The five-year contract was issued to the Anchorage-based Tawah Trading Company, Incorporated. Tawah Trading Company's second year of operation saw personnel management and visitor service improved markedly from 1989, although vehicle congestion and crowding was not eliminated. The new contractors were consistently putting more vehicles into the facility than it could reasonably hold. The facility was so crowded during June and July that, the contractors were rumored to be getting additional recreational vehicles into the places with an oversized "shoe horn".

The Refuge's Kenai-Russian Access Area operated at near capacity from June 13 until August 13. In late June, parking congestion, unauthorized campfires and unauthorized camping occurred almost on a daily basis, keeping park rangers and concession operators extremely busy. On June 6, Simpson met on-site with Regional Archaeologist Dieters to review the feasibility of creating a turn-around/short-term parking area within the Access Area to help alleviate traffic congestion. Dieters approved the plan with associated site-disturbance restrictions. A small turn-around was then constructed in July.

Refuge Maintenance Worker Jim Farrar, assisted by SCA, repaired and repainted the Russian River Entrance Road fence during July.

14. Picnicking

Developmental planning for the SWRA established day-use as an integral component of visitor services and facilities at new and/or rehabilitated facilities. Each campsite at the newly-developed Hidden Lake Campground was equipped with new fire grates and handicapped accessible picnic tables. Lakeshore camping facilities at Hidden Lake were reduced from 17 sites to five sites primarily to expand day-use facilities. Two new picnic shelters, complete with elevated barbecue grates and skylights, were constructed along the lakeshore. The new facilities were utilized often during the year.

15. Off-Road Vehicles

The 1989-90 snowmobile season opened on December 1, 1989, and remained open until April 16, 1990, when the snow level was no longer adequate to protect underlying vegetation. Snowmobilers had to contend with ashfall several times during early and mid-winter. Unfiltered snowmobile engines were particularly at risk from ash.

The Refuge was re-opened to snowmobile use on December 5, 1990. Several November snowfalls created an adequate snowcover to protect underlying vegetation.

The winter of 1990 marked the fourth winter that snowmobile operations were not authorized in the SWRA, excluding large lakes. A significant number of moose wintering in the large moose habitat improvement areas confirm the decision to restrict snowmobiling in these critical areas. Overall compliance with the Skilak snowmobile closures appeared good during 1989-90 and only a few warnings and no notices of violation were issued.

Unauthorized all-terrain vehicle use continued to occur during moose hunting season on the western side of the Chickaloon estuary. Again, during the fall of 1990 several miles of off-road vehicle ruts were left on the tidal flats marsh, during two weekends in September. Refuge officers patrolled the beach access route to the Chickaloon Flats with the new Refuge four-wheeler and were successful contacting several off-road recreational vehicle (ORV) users prior to them traveling onto the estuary at the Skilak Lake outlet. A sign was also posted.

ORV use of Skilak Lake continues to be a public safety hazard. A rider of a three-wheeler lost his vehicle and nearly met with tragedy when his vehicle went through the soft April ice.

Several tracks of full size vehicles were seen perilously close to open water on Skilak Lake and at least one full size vehicle went partly through the ice, just east of Upper Skilak Campground. Such incidents reinforce the Refuge restriction on public vehicular use of frozen Skilak Lake.

A letter was received in late 1989 from local resident Dennis Randa regarding use of the inholder access route to the Chickaloon River. The route followed the Mystery Creek Pipeline Road, then turned northwest to intersect with the Chickaloon River at approximately mile seven. This route was originally brushed out by John Mathison without authorization after the completion of the Alaska Gas Pipeline in 1961. Historical access was primarily by winter trail or water route on Turnagain Arm.

After the construction vehicular-use associated with the gas pipeline corridor was generally confined to the gasoline right-of-way, though unauthorized use of the overland route no doubt occurred. Initially, only hiking to the Chickaloon River was authorized. In the late 1960's, gates were constructed on the Mystery Creek Road and pipeline corridor, and public entry was either seasonal and/or allowed on a case by case basis by request. Indiscriminate moose poaching had been occurring and the State of Alaska requested control be placed on vehicular access to the area.

Although the Refuge has never specifically opened or closed the inholder access route originally constructed by Mathison, general Refuge Regulations for the area did not allow public ORV use. Legal opinions

regarding inholder access routes generally agree that special vehicle use privileges extended to property owners do not necessarily extend to members of the public wishing to utilize the same route. Never-the-less, Refuge management has ignored, via a non-enforcement policy, seasonal access by waterfowl hunters along the inholder route to the Chickaloon River. To date, if users do not leave the established route or continue ORV travel on to Chickaloon estuary, no enforcement actions have been taken. Overall use of the route has been quite low by both the inholder and members of the public. By 1986, alder vegetation had almost closed off significant portions of the route.

As evidenced by the Refuge's policy with regard to this access, the Refuge has been sympathetic to the basic access objectives of waterfowl hunters. The Refuge has, however, increasingly been concerned about other wildlife resource values in the area. The Kenai Comprehensive Conservation Plan completed in 1984 placed this particular area in a protective administrative land use category that generally does not allow vehicular access routes. No specific exceptions or provisions were made or requested for ORV access along this particular route during the comprehensive planning project. As a result of the resource evaluation process, the area has also been recommended by the USFWS for designation under the Wilderness Act.

To date, administrative action has not been taken to close the overland access route to the general public and Congress has not acted on the wilderness recommendation for the area.

The primary concern about the existing ORV access to the area is its potential to increase historically low visitor use in the area and the effect on brown bear use in the area. The Lower Chickaloon River's critical importance to brown bears is one reason for its suitability for wilderness status. A recently completed interagency study regarding the status of Kenai Peninsula brown bears identified the Lower Chickaloon River as <u>essential</u> brown bear habitat: a habitat determination that would recommend against ORV use or conflicting recreational use for such an area. In most instances, brown bears and other wilderness dependent wildlife do not fare well where ORV access or roads are introduced into an area.

Because past use by waterfowl hunters has been seasonal and relatively light, conflicts between users and brown bears have also been relatively few, but the potential for conflict is directly related to the amount of use. The Refuge estimates that only a few people have utilized the route annually since its establishment. Two years ago, an inexperienced waterfowl hunter wounded a curious brown bear with a shotgun, and during 1989, an active brown bear kill site was located several hundred yards from the Chickaloon River campsite at the route terminus. Other incidents have also occurred.

Although the USFWS strongly supports waterfowl hunting opportunities on the Refuge, the Refuge is mandated to protect wildlife species such as brown bear that are dependent on undisturbed ecosystems. This must take

priority over recreational access when such access develops into a conflict. Should conflicts develop or should the area be designated as wilderness, ORV access along the inholder route will necessarily have to cease and be confined to the pipeline right-of-way.

16. Other Non-Wildlife Oriented Recreation

Nothing to report.

17. Law Enforcement

The Refuge had four commissioned officers among the permanent staff and two seasonal officers during 1990. Refuge Seasonal Officer Chris Johnson became the first permanent Refuge officer in Region 7 in August. Refuge law enforcement officers from Regions 7 and 2 attended Law Enforcement Refresher Training in Marana, Arizona, during March. Simpson and Johnson attended the March 1-6 session. Johnston and Seasonal Ranger Hudson attended the March 15-20 session.

Commissioned Refuge officers participated in approximately 1,900 patrol hours at various Refuge locations utilizing highway vehicles, 4 X 4 vehicles, snowmobiles, 4-wheel all-terrain vehicles, aircraft and various watercraft. Johnson and Hudson, contributed significantly to the overall patrol and case load, as well as assists to the public and State enforcement agencies.

Refuge officers responded to nine incidents of illegally set traps during 1990. Infractions included trapping in closed season, violations of multiple personal stipulations, unworked traps or snares, failure to check traps and unauthorized take of a bald eagle.

The record number of successful resolved notices of Refuge regulation violations of 1989 was increased by 44 percent during 1990 (See Table 46 for break down of notice of violation issued).

Sportfishing infractions are by far the most abundant rule infractions on the Refuge and the issuance of violation notices follows that trend. The increase of sportfishing violation notices reflects Refuge officers responding to an increased load since State officers have been detailed to commercial fishing duties in the past several years.

Doshier and Soldotna City Manager Rich Underkoffer signed a Memorandum of Understanding authorizing Refuge officers to utilize the City of Soldotna Animal Shelter for domestic dogs found abandoned or loose on Refuge lands. The agreement established a procedure for the city to bill the Refuge. The agreement will alleviate officers not having adequate facilities for seized pets.

Refuge officers continued to increase enforcement efforts associated with boating safety. Officers made numerous contacts during the year with Refuge watercraft users. Refuge officers also worked cooperatively on several cases with Alaska Division of Parks officers, State Troopers and Fish and Wildlife Protection Officers.

Significant incidents and cases during 1990 were as follows:

1. Deputy Refuge Manager Hedrick and Johnston responded to a report of unauthorized traps being set adjacent to the Sterling Highway and the Kenai River. On January 16 and 18, eleven illegal traps were seized. A notice of violation was issued to the trapper and his trapping license was suspended.

2. Refuge Inholder Glen Wade was found guilty of three counts in State court for unauthorized construction and operation of heavy equipment below the mean high water line of Skilak Lake on Caribou Island. Wade was given a suspended sentence, but when he failed to restore the shoreline as ordered by the court, his suspended sentence was restored. Glen Wade was also found guilty on two felony counts on a misdemeanor count, including possession of stolen property (John Deere 350) alteration of VIN numbers and possession of an illegal type two-weapon. Johnston testified in State court regarding the search warrant issuance and activities which occurred in 1989.

3. Johnston and Johnson snowmobiled up the West Fork of the Moose River to inspect a trapline set via a snowmobile in an area closed to snowmobile use. Johnston seized seventeen unmarked snares located at two winter-killed moose carcasses. In early February, Hedrick confiscated a single illegally-set snare from the same area. The trapper was not identified by month's end. Johnson again located illegal traps at the site in March. No suspects were identified although several of the traps had evidence of the person being a former permit holder. Thirty-six traps and snares were seized during the three related incidents over the winter. The violator was trapping without a permit, in a closed season and in violation of several permit provisions.

4. A total of five illegal rams were taken during the sheep season. Refuge or State officers made cases in four of the five known incidents. Two sublegal sheep were taken in the Dinglestadt Glacier area during August. The incident was reported by two Homer residents and charges were filed by Alaska Fish and Wildlife Protection Officers.

5. One sheep was taken in the Cooper Mountain Closed Area and one hunter took two sheep near Green Lake. The Refuge-operated sheep hunter observer camps were instrumental in two of the four cases.

6. On March 14, Johnston testified at a National Transportation and Safety Board hearing regarding the Federal Aviation Administration's charges against Pilot Kirk McGee for reckless operation of his aircraft on Refuge lands during 1988. Mr. McGee was found guilty and assessed civil penalties.

7. Johnston apprehended an Anchorage hunter during September on Tustumena Lake. The hunter had taken a trophy moose from the Clear Creek Area and was leaving the area with less then 90 pounds of

meat. Mr. Bowlin's rifle, moose meat and antlers were seized. The case was turned over to State authorities for prosecution and was pending at year's end.

8. A radio-collared alpha female wolf was shot in the middle of Swan Lake Road on October 29. The hunter was attempting to take a second wolf when confronted by an off duty Alaska Department of Fish and Game biologist. After a field investigation by Refuge officers the hunter was issued a notice violation for unauthorized take of a big game animal.

9. State Protection Officer Chuck Rogers discovered an illegal wolf kill site on the Chickaloon Flats near a washed up Beluga whale carcass. Aircraft tracks at the site and other physical evidence indicated that an illegal "land and shoot" take of a wolf had occurred. At month's end, the incident was still under investigation although no suspect had been identified.

10. Extreme fire danger throughout Alaska and the Kenai Peninsula prompted a statewide fire ban for most of July. Refuge rangers and SCA,s notified countless visitors about the campfire restriction. Several were cited for non-compliance. Despite the closure, a half-acre wildland fire occurred approximately 1/6 mile up from the confluence of the Russian and Kenai Rivers. Fire crews extinguished the blaze which originated from an unattended campfire. Several other unattended campfires and associated ground fires were extinguished during July.

11. Refuge officers made several illegal-take of moose cases during September. On September 16, Johnson and Ward responded to a hunting violation report on Gruskka Lake. The hunting party had taken a moose with less than a 50" antler spread and without sufficient brow tines. The moose was donated to charity with the hunter receiving citations for illegal take on August 2, 1990. Several cases of hunters taking sublegal moose on Refuge lands were handled by State officers with warning citations. Although it is difficult to second guess State officers, Refuge officers are concerned about the minimal consequences developing for take of the protected moose.

12. Several Refuge rangers and volunteers participated in the search and rescue of a man missing in the Kenai River Canyon after his canoe capsized. The search and rescue involved two types of watercraft and several foot searches. Central Emergency Services personnel and Alaska State Troopers were also involved in the successful search.

13. On September 2, Ward responded to an overdue hunter report on Dolly Varden Lake. With the help of the party's friends and family, as well as State Protection Officer Ed Marsters, the party was located in a wetland area near Dolly Varden Lake and walked out to their vehicle without assistance. Refuge employees participated in three search and rescues during September. On September 4, park rangers assisted State Troopers in locating an overdue hunter on Mystery

Creek Road. On September 21, Johnston and Observer Gary Sonnevil responded to a request from Alaska State Troopers and a party of three hunters who reported an overdue friend. The hunter was located by Refuge plane after a two-hour aerial search near Willow Lake. The lost hunter was picked up by float plane and reunited with his group. He was approximately two miles from the last place he had been seen.

Table 46. Violations on the KNWR for years 1981 through 1990.

Violation	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90
Snagging of fish	27	24	26	23	10	1	15	14	20	26
Fishing in closed water	13	4	13	4	3	3	3	1	8	15
Overlimit of fish	3	3	6	3	4	1	4	8	4	24
Fishing without a license	12	4	1	1	2	1	1	10	14	8
Other fishing violations	--	--	7	4	2	0	2	1	29	51
Snowmobiling violation	0	4	6	2	0	0	2	1	0	0
Motor boat, prohibited area	0	0	0	0	0	0	1	4	2	0
Unauth. use of motor veh.	7	10	9	20	28	15	13	9	2	4
Parking in No-Parking Zone	19	13	2	12	2	0	3	3	2	5
Landing aircraft in prohibited area	1	4	6	0	0	0	4	2	0	1
Shooting fireworks/selling	0	1	4	2	2	0	2	0	0	1
Target shooting/weapons violation	--	--	--	--	2	6	3	1	0	0
Violation of State Game Regulations	3	0	1	1	0	0	4	0	7	7
Mig. Bird hunting violations	--	--	10	2	2	1	2	4	2	1
Littering	5	0	3	2	3	4	1	1	0	4
Illegal camp/boats/cabin	3	1	0	0	0	2	0	2	0	0
Unauthorized advertising	0	0	0	0	0	0	0	0	0	0
Illegal wood cut/green trees	3	4	5	2	9	3	4	4	0	1
Speeding	1	0	5	3	0	2	1	1	1	1
Reckless op. of machine	1	0	0	0	0	0	0	0	0	0
Unattended fire	1	0	0	0	0	0	0	1	1	2
Interference with employee	1	0	0	0	0	0	1	0	0	0
Destruction of government property	0	1	0	0	0	0	0	1	0	2
Failure to comply with ref. Special Use Permits	0	1	2	2	2	1	3	2	1	2
Violation of Coast Guard Regulations	--	--	5	0	0	0	0	0	14	8
Violation of other Refuge Regulations	--	--	--	--	2	1	5	0	3	5
Unauthorized trapping/ trapping permit violation					4	4	2		1	2
Bear baiting/ Interference/public theft						1	5	0	0	0
Violation of Traffic Code										5
TOTAL	100	74	111	83	74	46	83	69	114	165

Throughout the year, Refuge staff attended monthly coordination meetings of the Kenai Peninsula Search and Rescue Program. The Search and Rescue Program worked well during 1990, suffering only a few incidents of communication breakdown. State Trooper Sargeant Gene Callus remained the coordinator for 1990. Staff responded to several requests to assist with Search and Rescue operations. The staff responded with general manpower support, boat/aircraft support, and communications assistance.

Table 47. Kenai National Wildlife Refuge incidents (Nov-Nov) 1986-1990.

Incident/Violation	Number of Incidents				
	1986	1987	1988	1989	1990
Low flying aircraft	14	10	15	8	15
Violation of a Refuge SUP	4	18	12	8	8
Vandalism	22	23	28	23	26
Altercation/disturbance	9	5	3	-	-
Theft	12	9	6	2	7
Drunk and disorderly	1	7	2	-	3
Unattended or abandoned property	5	8	10	5	4
Unauth. taking of wildlife/in. wildlife	34	27	40	33	29
Violation of trapping permit	5	9	3	4	2
Violation of wood cutting permit	1	11	5	2	-
Assist to public involving injury	16	13	10	7	8
Assist to public not involving injury	26	35	45	48	60
Unauthorized use of motor vehicle	15	18	21	17	18
Coast Guard violation/boating	10	25	60	70	75
Animal trespass (grazing)	1	-	-	-	-
Unauth. cutting green trees/timber removal	9	17	27	10	15
Unauth. fireworks	1	3	1	3	2
Unauth. park./block. Refuge road/facility	29	35	17	30	35
Target shooting/unauth. use of firearms	17	10	7	5	8
Search and rescue	6	15	13	8	6
Drowning	0	2	3	-	-
Miscellaneous fishing violations	9	13	33	37	39
Unattended fire/wildfire/unauth. fire	14	20	24	10	12
Disposal of waste/littering	10	25	23	25	29
Other Refuge regulations	16	20	17	15	18
Assist to Ak State Troopers/traffic acc.	18	20	23	17	19
Assist to Ak F. & W. Protection Officers	18	21	18	28	23
Miscellaneous traffic violations	1	4	8	15	15
Bear baiting permit violation	4	5	4	2	2
Bear encounter	6	4	3	3	5
Aircraft violation	3	33	43	10	8
Assists to F. & W. Agents (Off Refuge)	5	7	30	25	27
TOTAL	341	481	562	470	578

The above incidents were either unsolvable or resulted in warnings issued. Violations which resulted in violation notices are generally included in the above list.

Over thirty illegal traps and snares were seized from an unmarked trapline in the Moose River Area. The unauthorized line was in violation of several permit stipulations, including provisions that prevent take of non-target species such as magpies. 02/90/RJ

Approximately 275 moose are hit by vehicles along the Sterling Highway between Soldotna and Cooper Landing. Salvageable meat is donated to charity or Peninsula residents who prequalify on the basis of need. 08/90/RJ

18. Cooperating Associations

In 1990, the Refuge's Alaska Natural History Association sales outlet experienced a final sales tally of $21,600. Sales declined from 1989 due to a drop in Peninsula tourist traffic caused by poor king salmon runs and a shortage of seasonal staff to operate the Visitor Center Station.

New sales items added to the outlet's inventory in 1990 including ten wildlife books and the 1991 Northern Lights Calendar.

Proceeds from cooperating association sales were used for volunteer awards, honorariums for outstanding volunteer contributions, resource books for the Refuge library, funding of teacher training, environmental education, and purchase of an Apple-Macintosh computer system for the public use program. Through acquisition of this system, we have begun to improve our ability to design quality brochures, environmental education materials, temporary exhibits, sales displays, Refuge bulletin boards, and volunteer training materials.

19. Concessions/Commercial Operations/Special Use Permits

Most Refuge Special Use Permits for various outdoor recreation services were issued by May 1, 1990. A total of 55 individuals or business' obtained Refuge Special Use Permits for commercial services. Permittees serviced 6,376 Refuge visitors for 11,091 total visits. Several new permittees were offering non-consumptive wildlife-oriented outings, although other permittees offered sportfishing services.

Permittee fees remained consistent with Region 7 policy regarding Refuge Special Use, however, an evaluation of the existing regional fee program was underway during November and December 1990. While several fee collection strategies were being reviewed, the primary thrust was to increase fees based on an accurate ratio-of-use.

Refuge staff prepared comments on various fee collection ideas. Refuge concerns centered around a desire to maximize field compliance regarding permittee and minimize permittee record auditing. Several fee collection strategies have the potential of significantly increasing administrative work load without any benefits. Refuge staff favored a flat fee format.

No new big game outfitter/guide permits were issued during the year, in compliance with the regional policy, freezing use at the 1988 level until the State reinstitutes a program to allocate outfitter/guide areas. Such a requirement was put into place after the Alaska Supreme Court ruled that the existing guide areas were unconstitutional in Owischek versus State of Alaska. Several inquiries were received during the year regarding big game outfitting/guiding opportunities.

Table 48. Guided recreational visits occurring on Kenai National Wildlife Refuge, 1990.

	Number Visitors	Total Visits
Upper Kenai River Sportfishing	1500	2333
Upper Kenai River Scenic Floats	2430	2909
Lower Kenai River Sportfishing	1467	1569
Fly-in Tent Camps	1023	2429
Outfitter/Guides/ Big Game/Transports	191	870
Other	656	883
TOTAL	6376	11091

The State released proposed regulations in July regarding the new formula for choosing guide areas. The public comment period closed in September. The Big Game Commercial Services Board met in December to consider adopting the new rules and consider public comment. Johnston reviewed outfitter/guide policy and maps in response to the State's solicitation of input for new outfitter/guide areas. Hedrick also reviewed several maps and suggested possible guide areas. The board adjourned without taking action. Regulations were expected to be finalized in 1991, however, a delay until 1992 would not be unexpected. The subsequent process of identifying and awarding all the guide use areas is expected to take several years with high priority areas considered first.

Region 7 had previously stated that if the State did not have a finalized contingency plan in place by January 1, 1991, the Service would implement its own contingency plan. At year's end, the Region had decided to extend the interim "moratorium" to 1992 on issuance of any new outfitter/guide permits.

The Peninsula Sled Dog Racing Association obtained a Special Use Permit to maintain several miles of dogsled trails, and conduct practice racing and competitive events. Weekend competitive races were sponsored by the Racing Association during 1990.

The Kenai-Russian River Access Area was under the second year of a five year contract to operate the Kenai River Ferry and the access area parking lot. The concessionaire, Tawah Trading Company began operation during 1989. Refuge staff met with the Regional Office Contracting Officer and Tawah in preparation for the 1991 season.

The new Kenai River Ferry in operation for its second year kept lines to a minumun and provided safe transit of the river. 07/90/RJ

Operation of the Kenai River Ferry went very smoothly during 1990. Visitors were able to avoid waiting in lines due to the increased capacity of ferry and loading area design improvements. During 1990 the ferry transported 43,398 people with gross receipts of $123,988.50. The ferry began operation on June 1, 1990, and ceased operation on August 13. Several complaints were received concerning the early stoppage of ferry service. The concern centered around fishermen not having a ferry service for August when fishing was still good.

The Kenai-Russian River Parking Area was also under concession. The Kenai-Russian River facility was operated by Tawah from June 1 to August 13. The contractor reported gross receipts of $124,723.00 with 15,231 vehicles paying the entry fee. An estimated 44,500 individuals participated in 66,000 visits at the facility.

Restrooms and other facility maintenance was good while vehicle management and congestion continued to be a problem. Campground traffic was improved in July when Refuge staff built a vehicle turn-around. Fewer complaints were received from visitors as Tawah employees were more experienced in 1990 than during 1989.

I. EQUIPMENT AND FACILITIES

1. New Construction

Maintenance Mechanic Al O'Guinn provided assistance to Refuge and Regional Office recreation personnel in designing and fabricating a number of metal bases for the recently rehabilitated Hidden Lake Campground Project. The metal bases provide permanent support for a variety of interpretive signs erected throughout the campground. Al also fabricated a metal molding strip to encase each of the fiberglass interpretive display panels. Al not only did his usual professional job, but his efforts resulted in a savings of several thousand dollars which were allocated to other needed phases of the Hidden Lake Project.

Carpenter Bud Marrs completed a number of wood-routed informational and directional signs for the "new and improved" Hidden Lake Campground and the Russian River Access Area. Informational signs were also completed for the Koyukuk and Kanuti Refuges. Other major projects completed during the year include construction of a handicap access ramp at the Visitor Contact Station (VCS), a handicap accessible viewing scope at Russian River Campground and a boardwalk near Egumen Lake. The latter project was done as a joint Youth Conservation Corps (YCC) Refuge project.

Al O'Guinn putting finishing touches on metal interpretive sign bases he fabricated for the Hidden Lake Campground.
8/90/JEF

Maintenance staffers Al O'Guinn and Dick Kivi installing aluminum borders on Hidden Lake interpretive signs.
6/90/JEF

New handicapped access ramp at Visitor Contact Station.
2/90/BM

New handicapped railing at VCS. 3/90/BM

Installation of new culvert on Swan Lake Road near Willow Lake. 6/90/BM

Two 20 foot X 24 inch culverts were installed in a low area near the base of "Mukluk Hill" on the Swan Lake Road. Several loads of gravel were hauled from the Finger Lake Pit to this site as well as to other low spots along the road.

New boardwalk on Egumen Lake Trail - a joint Refuge YCC project. 1/90/BM

The maintenance staff spent considerable time in May and June helping to prepare Hidden Lake Campground in time for the June 30 dedication ceremonies. Thanks to the combined efforts of a lot of people, ribbon cutting ceremonies came off as scheduled, complete with music by a local band, keynote speech by Kenai Borough Mayor Don Gilman, as well as remarks by "Challenge Alaska" and Refuge Manager Daniel Doshier. While we still have a few "bugs" to work out, the new campground, at least in the first few months of operation, proved to be remarkably "maintenance friendly".

2. Rehabilitation

The new Refuge Bombardier all terrain vehicle underwent an extreme "facelifting" by O'Guinn. Al fabricated a 3/16-inch steel deck to provide a support base for a 300-gallon foam tank, fabricated and installed a steel heavy duty extended tree guard, and installed a hydraulic winch. The existing roll protection system was also strengthened. We now have a totally contained and functional field unit for use in our fire management program.

New Bombardier "Muskeg Plus" was fitted with steel bumper, hydraulic winch, reinforced cab protection and steel deck to hold 300-gallon foam tank. 1/91/JEF

Thanks to the Division of Engineer's Regional Office "SWAT Team", a new centralized dust control system was installed in the carpentry shop. The unit has several stations, and can be used in practically any location within the building. While some modifications are yet needed, the system should help to alleviate the rather severe dust problems experienced the past few years.

3. Major Maintenance

The $80,500 in Maintenance Management System (MMS) funds received in Fiscal Year 90 provided, for the first time in several years, the resources to attack a critical backlog of maintenance deficiencies. The

MMS funding was allocated in the following categories: (1) Refuge Office/Visitor Center - $7,000, (2) Swanson River/Swan Lake recreational facilities - $41,000 and (3) other administrative facilities - $32,500.

Accomplishments included: (1) painting entire interior of Refuge Office/Visitor Center, (2) heating system calibration and repair to office/Visitor Center climate control system, (3) bearing and gasket replacement for circulating pumps in office, (4) handicap ramp construction at the VCS, (5) correct backlog of maintenance deficiencies in all campgrounds/trailheads in Swanson River Swan Lake Area and (6) completion of a number of electrical projects - rewiring to Code, residence number four at Old Headquarters in Kenai, exhaust fan in welding shop, rewire switches for compressor and machine lathe, install security light at the bunkhouse and residence and install warning light exterior of oil house. Most of the electrical work was done by Ray Guathier from Division of Engineering. The Skilak Guard Station was also rewired to Code to interface with the portable generator which provides the sole source of power at that location.

In a combined effort among YCC, Fisheries Assistance Office and Refuge personnel, the old Kenai Office, residence and eight-stall storage building was sandblasted and given a fresh coat of paint. Nothing had been done to the structures since the headquarters location was moved in 1979. Three additional structures (meat house, oil shed and bunkhouse) were sold and removed from the premises as part of a continuing effort to "spruce up" the original five-acre administrative site in downtown Kenai prior to that city's Bicentennial Celebration in 1991.

"The end of an era"...The Old Kenai Refuge Bunkhouse was put out for bids and later put up on blocks and moved from its familiar location in downtown Kenai. The small structure housed seasonal employees for nearly 30 years. 8/90/JEF

O'Guinn provided assistance to the Fisheries Assistance Office by completing a detailed inspection of all their vehicles as part of the MMS reporting requirement.

He also provided assistance to local Alaska Department of Fish and Game (ADF&G) personnel by retrofitting a post pile-driver on our John Deere 350 backhoe. The hydraulically operated unit was later used at the Moose Research Center (MRC) as part of an extensive re-fencing project.

Equipment Operator Dick Kivi was assigned to the Cordova District of the U.S. Forest Service from April 5 thru 18 to operate the Refuge Hydro-Ax as part of an experimental moose habitat improvement project in the Copper River Delta Area. With the help from the U.S. Army detachment at Fort Richardson, the Hydro-Ax was transported to Valdez by truck and then shipped via ferry to Cordova. Despite the rather complex and unique logistical problems of moving the Hydro-Ax from Soldotna to Cordova, the operation went exceptionally well.

ARCO, who maintains the Swanson River Road, trimmed back dense growth of alders in several locations along the road in December. The effort greatly improved visibility on a number of hazardous curves as well as widening the road to permit safer vehicular traffic passage.

4. Equipment Utilization and Replacement

In April, the Refuge took delivery of a Bombardier Muskeg-plus Industrial tracked vehicle to be used as an integral component in our fire management program. This unit replaces a similar carrier heretofore leased from the Alaska Division of Forestry.

This "new and improved" model is rated for an additional 2,000 cubic yard payload, has an 18 inch rear deck extension and the power plant consists of a 110 horsepower (HP) Perkins Turbo Diesel compared to the Standard 78 HP Perkins Diesel. The unit was retrofitted with a 3/16 inch steel rear deck plate, steel frontal "tree guard", hydraulic winch and reinforced steel cab protection. A 300-gallon foam tank will be mounted on the rear deck.

We continued to cooperate with Chugach National Forest Service personnel by sharing equipment and manpower in maintaining the Schooner Bend Field Camp. Refuge maintenance personnel also provided assistance to the ADF&G by installing a hydraulic post pounder on our John Deere 350 backhoe for use in setting steel fence posts at the MRC. The Refuge also provided assistance in hauling several tons of steel drill pipe from the Swanson River Oil Field to the MRC. The pipe was donated by SRF unit operator, ARCO.

5. Communications Systems

Our new repeater was unreliable for most of the year. New parts were received by year's end, and should improve its performance. Fifteen reprogrammable King radios were purchased in September. This brings the

total to 34, making it possible for each person required to carry a radio to have a King. The intention is to apply to the Federal Communications Commission to have our transmit and receive frequencies spread farther apart. With the new frequencies we should get better radio coverage and will preclude purchasing a second repeater for the sourthern end of the Refuge. Having King radios for everyone will make it easier to program the radios to the new frequencies and give them access to a telephone patch for emergencies.

On November 27, a request was submitted for installation of Federal Telephone System 2000 lines. As of the end of the year we had not heard when we could expect them. A substantial decrease in the telephone bill is expected whenever the lines are installed.

6. Computer Systems

Wildlife Biologist Andy Loranger spent several weeks writing the Office Automation Plan (Plan), and by mid-February it was in the mail to the Regional Office. The Plan was approved by June 1. However, due to funding constraints we were unable to put the Plan into effect in 1990. We continue to hope the Wang Word Processing System does not die before we are able to replace it.

Computer System Analyst Barry Dearborn and Jerry Minnick from the Region Office came in January to install the ARC/INFO software and to get it operational. During the last week of August Computer System Analyst Barbara Boyle from the Regional Office came to give Biological Technicians Liz Jozwiak and Winthrop Staples hands on training using ARC/INFO. It was a week well spent with lots of questions answered pertaining to our GIS setup.

7. Energy Conservation

Table 49 shows a comparison of energy consumption between calendar years 1989 and 1990.

Table 49. Energy-use comparisons.

Product	Unit of Measure	Comparison 1989	Comparison 1990	Comparison % Change with 1989
Electricity	Kilowatt Hours	166,219	171,791	+3.4
Natural Gas	100 Cubic Feet	12,346	12,424	+0.6
Vehicle Gas	Gallons	12,656	13,458	+6.3
Aviation Gas	Gallons	4,504	4,124	-9.2
Propane	Gallons	383	252	-52.0
Diesel Fuel	Gallons	2,204	2,237	+1.5

Other than aviation gas and LP gas (propane), no noticeable change in energy-use occurred in 1990. The 9.2 percent decrease in aviation fuel reflects the decrease in hours flown by the super cub (207 hours in 1989 versus 196 hours in 1990) and the C-206 (180 hours in 1989 versus 169 hours in 1990). The decrease in LP gas is due to shorter time of occupation of the Skilak Guard Station.

8. Other

Nothing to report.

J. OTHER ITEMS

1. Cooperative Programs

a. Kenai River Water Quality Study

Resource Specialist Winkelman continued water quality work with Alaska Department of Fish and Game and State Parks personnel through 1990. Water sampling resumed in April after the river became ice-free, and continued on a monthly basis through November. Extremely cold conditions prevented sampling in December.

1) Study Purpose and Funding

The study was initiated in November 1989 after State Parks received a $100,000 Legislative Allocation to collect baseline data for monitoring and maintaining the water quality of the Kenai River. A reimbursable Service Agreement was then signed with the Alaska Department of Fish and Game because of their capability to provide or contract out all the necessary sample testing. The study will continue until funds are expended, some time in 1991.

2) Study Plan

The original draft plan was submitted by Brighwater Consulting Services, Baltimore, Maryland, and was funded by contributions from Trout Unlimited (Brighwater affiliate) and State and Federal agencies. The draft plan was then evaluated by Alaska Department of Fish and Game Principal Limnologist Jeff Koenings and University of Alaska Chemistry Professor John Kennish. In addition, comments were received from Alaska Department of Environmental Conservation and Environmental Protection Agency personnel.

3) Sample Sites

Samples were collected at ten mainstream sample sites and seven additional major tributaries:

a) Mainstream Sample Sites

Sites were selected based on three criteria:

1) location with respect to major tributaries.
2) population concentrations.
3) site accessibility.

The primary concern was to situate sites above and below major tributaries. Mainstream sites (listed below) were sampled on a monthly basis, requiring approximately two days effort:

- Kenai Lake Bridge (river mile 82)
- Jim's Landing (river mile 69.5)
- Skilak Lake Outflow (river mile 50)
- Bing Brown's Landing (river mile 39.5)
- Morgan's Landing (river mile 31)
- Swiftwater Landing (river mile 23)
- Kenai River Bridge at Soldotna (river mile 21)
- Poacher's Cove (river mile 17.5)
- Eagle Rock (river mile 11.5)
- Mouth of Kenai River (river mile 0)

b) Major Tributaries

Tributary sites were selected to provide an indication of their contribution to the system. They were sampled initially in November 1989 and seasonally thereafter, in 1990. One additional sampling day was necessary when the following tributaries were sampled:

- Russian River
- Killey River
- Moose River
- Funny River
- Soldotna Creek
- Slikok Creek
- Beaver Creek

4) Sample Parameters and Analysis

The Alaska Department of Fish and Game laboratory in Soldotna conducted all necessary tests except for hydrocarbons and metals. These tests are performed by labs under contract to Alaska Department of Fish and Game. Following are the sample properties and schedule:

a) Chemical Properties

- dissolved oxygen (percent saturation, BOD)
- hardness, calcium, magnesium
- phosphorus (total, ortho, organic, inorganic)
- nitrogen (nitrate, nitrite, ammonia, Kjeldahl, urea)
- pH
- acid neutralizing capacity (including carbonates)
- turbidity, including effective turbidity (light penetration)
- hydrocarbons*
- metals (dissolved, suspended)**
- periphytin (chlorophyll A, phaeophytin A)
- color

b) Physical Properties

- temperature
- bankfull width***

- bankfull depth***
- sinuosity***
- slope of water surface***
- particle size distribution of bed materials***

c) Biological Properties

- fecal coliform bacteria
- fecal streptococci
- benthic macroinvertebrates (species diversity index)****
- fish population distribution*****

*Hydrocarbon analysis conducted by National Marine Fisheries lab in Juneau.
**Conducted bi-monthly.
***Conducted several times during 1990.
****Conducted initially and quarterly thereafter.
*****Compiled from existing ADF&G data.

5. 1990 Results and 1991 Sampling Schedule

a) Water Sampling

Results for 1990 indicate very low bacteria levels and as only fecal coliform is regulated, continuation of sampling for only fecal coliform is recommended. Total Petroleum Hydrocarbon (TPH) analysis provided very limited information because of the high detection limit characteristic of this analysis. In the future, hydrocarbon analysis will consist primarily of Volatile Organics Analysis (VOA) which is more costly, but capable of detecting much lower concentrations of individual compounds. To date, VOA has provided differences in hydrocarbon levels between the Lower and Upper River. In 1991, hydrocarbon sampling will be concentrated in the Lower River and will be conducted during peak boat traffic periods and periods of high runoff.

b) Benthic Sampling

Only minimal benthic invertebrate sampling was achieved in 1990 and investigations will be expanded in 1991. Increased sampling will provide a more representative collection of organisms. This will require more time on the river in the early spring but will serve to confirm and expand knowledge gained in 1990. In conjunction with the benthic invertebrate study, a bottom sediment size classification will be conducted. This will allow correlation of results of benthic population sampling with habitat. Bottom sediment samples will be collected in the early spring as soon as snow and shelf ice disappear to expose the gravel sediment.

2. Other Economic Uses

a. Oil and Gas

(1) Swanson River Field (ARCO Alaska, Inc.)

Grace 154 rig working on re-drill project on well pad 21-E SRF. Alaska Range in background. 10/90/JEF

The Swanson River Field (SRF) continued to produce slightly more than 5000 barrels of oil per day in 1990. Total production for the year was 1,878,090 barrels of oil from 29 wells within the Hemlock Pool.

Some of the more significant events occurring within the field in 1990 include the following:

--- Redrill activities took place at seven well sites, the following six wells were plugged and abandoned: 1) SRU-31-15, 2) SRF 312-22, 3) SCU 13-3, 4) SRU 12-34, 5) SRU 34-10, 6) SCU 31A-16.

Coil tubing unit being affixed to well head 31A-16 during "plug and abandon" operations at that site. 9/90/JEF

--- A new drum and equipment washing facility was completed and became operational in late 1990 (located at Tank Setting T-33).

--- A replacement four inch crude oil line was installed across the Swanson River just north of the compressor plant. This line replaced a 25-year old three-inch line and was encased in a six-inch line for additional protection. To minimize potential threat to the Swanson River, emergency isolation shutoff values were installed on both sides of the river. Shoreline areas were stabilized following construction.

Construction of drum and equipment washing facility at SRF. Replaces old skim or "snake pit" at tank setting T-33. 9/90/JEF

New drum and equipment washing facility near TS-133 at SRF. This "high tech" unit separates impurities from crude, and then pumps it back into production pipeline. Other wastes are trucked to a solid waste disposal site, which became operational in December. 1/91/JEF

Uncovering old 4-inch crude line across Swanson River. This line was replaced with new 4-inch line with isolation valves located on both sides of river for added protection against leakage. 11/90/JEF

--- ARCO Alaska, Inc. (ARCO), was granted approval to use treated water (from PCB contaminated soils) for dust suppression on the ash pit near the combuster plant. ARCO was required to install a down-line filtration system to prevent sediments from being dispersed with the liquids.

--- Facilities Manager Frates and ARCO's Cook Inlet Operations Manager Brett Allard arranged a brief tour of the SRF for ten visiting Russian scientists on August 8. The group were members of the Siberian Branch of the U.S.S.R. Academy of Sciences. While the language barrier presented some obvious problems in communication,

they appeared to take exceptional interest in the PCB remediation project. The group was accompanied by Refuge Manager Daniel Doshier, Wildlife Biologist Ted Bailey and Deputy Regional Director John Rogers.

--- ARCO began their 1990 winter seismic program on January 23 using a total of eight crews to drill mini-holes on selected shot lines north, south and through portions of SRF. Shooting and recording began in late February, and continued through most of March.

--- The Ogden Environmental Service (OES) Circulating Bed Combustor (CBC) at SRF continued processing PCB contaminated soils on a 24-hour basis throughout the year. Of the total of 87,000 tons of material excavated, 57,000 tons had been processed as of December 31, 1990. The last known PCB contaminated area was released as clean, based on final soil samples taken in September. This was the culmination of a long and painstaking "Search and Destroy" mission dating back to 1986. ARCO is to be commended for their tenacity, vigilance and commitment to identify and clean up all known sources of PCB contamination. Also, kudos to OES personnel for the high level of professionalism and technical skills in maintaining the CBC at a high level of operational efficiency.

Resource Specialist Bob Winkelman discussing Swanson River pipeline crossing with VECO contractors and ARCO Field Foreman Ted Foreman. 7/90/JEF

Group of Russian scientists on tour of SRF on August 8. All were from the Siberian branch of the U.S.S.R. Academy of Sciences. 8/90/JEF

Ecology and Environment, Inc., technicians taking subsurface soil samples for possible PCB contamination at Pipe and Supply (P&S) Yard at SRF. 7/90/JEF

"Mamma" moose and her two youngsters feeding in Swanson River just below North Bridge within SRF. 6/90/JEF

Winkelman and Field Manager for Ecology and Environment, Inc., Bill Heber discuss strategy for sampling PCB-contaminated soils at P&S Yard, SRF. 7/90/JEF

Winkelman and Ecology and Environment, Inc.,
Safety Specialist Karen McRoberts test
for volatiles prior to release sampling
for PCB's, at SRF. 7/90/JEF

--- Discussions were held with ARCO on several occasions concerning the (BTEX) remediation proposal for the pipe and supply yard at SRF. ARCO is in the process of developing a procedure which meets standards imposed by the Environmental Protection Agency as well as the Department of Environmental Conservation DEC. ARCO hopes to have the remediation plan activated in the spring of 1991.

(2) Beaver Creek Oil/Gas Production Facility (Marathon Oil Company)

Beaver Creek continued to produce an average of 30 million cubic feet of natural gas and 500 barrels of crude daily throughout the year.

Events of major significance occurring throughout the year include the following:

A new, single-module, four-cell solid waste disposal facility at Marathon Oil Co.'s Beaver Creek Field (BCF) near completion by late October. 10/90/JEF

One of four 90-foot by 90-foot waste disposal cells constructed at Marathon Oil Co.'s BCF. 9/90/JEF

--- A public hearing on Marathon's application for a solid waste disposal site at the Beaver Creek Facility was held on June 5 in Kenai. As expected, there was opposition and the required permits were approved by the DEC. Construction for the two-module, eight cell site began in mid-August and was completed in late fall.

--- Marathon's efforts to remediate petroleum-contaminated soils from a tank farm spill in 1988 met with only limited success in 1990. A prototype mobile incinerator was to be in place and operational by mid-summer, however, the unit did not arrive until September 10, and then was plagued by a myriad of technical problems which prevented any substantial clean-up of the estimated 5,000 to 7,000 cubic yards of contaminated soil. Freeze-up in early November halted all further attempts at remediation. The unit will undergo major modifications during the winter of 1990-91, and hopefully, remediation efforts will get underway by late spring 1991.

Portable Thermal Unit brought in to destroy hydrocarbon contaminated soil at Marathon Oil Co.'s BCF Production Facility. Unit was plagued by numerous problems during first field season. 9/90/JEF

(3) Oil and Gas Activities Outside Unitized Areas

(a) Birch Hill (BH) Proposal

ARCO, following review of 1989-90 seismic activity north of the SRF, formalized their request to drill an exploratory gas well in the Northwest 1/4 of section 35, T9N, R9W on land which had previously been conveyed to the Tyonek Native Corporation (TNC).

Winkelman discusses proposed BH wildcat well site with ARCO, Alaska exploration representatives. 6/90/JEF

ARCO's interest in the project was not only the result of positive seismic data, but further evaluation of a known geologic structure (KGS) that produced more then 65 million cubic feet (MMCF) from Standard Oil Company of California Birch Hill Unit No. 22-25 in 1965. The well has been shut in since that time.

ARCO proposed to construct a three-mile-long 24-foot-wide all weather road from the northern end of SRF to the proposed drill site in section 25. Approximately 1.5 miles would cross refuge land. At year's end, ARCO was still in the process of finalizing an environmental assessment (EA). The Fish and Wildlife Service will then conduct a sixty-day public review and comment period. ARCO has also made formal application for a right-of-way permit as mandated under 43 CFR Part 36 (Transportation and Utility Systems and Facilities on Federal Lands).

A number of long-term resource concerns have been raised throughout the Federal permitting process as well as in development of the EA. Perhaps of major concern is the construction of an all-weather road in a remote section of the Refuge with the potential to connect with other private and borough roads within the Graycliff Subdivision in Upper Cook Inlet. The TNC has also expressed a keen interest in this road as a critical link to the Sterling Highway for transporting timber to a mill in Seward. It is the Refuge staff's opinion that an all weather road will

put us in a politically vulnerable position and that the road will remain, resulting in a wide variety of collateral uses which will result in detrimental long-range cumulative impacts.

In addition, the Birch Hill Project addresses the interesting precedent-setting question of committing refuge resources for oil and gas development on private lands (TNC), with private subsurface, Federal surface control (22g) while at the same time the entire area is subject to Federal lease-hold provisions. Decisions concerning the Birch Hill project will likely establish a precedent for future conflict resolution as we look toward accelerated oil and gas exploration and development within the Refuge over the next few years.

Proposed location of BH drill site by ARCO. The pad, and three-mile access road into this pristine area has Refuge staff concerned about cumulative, long-term impacts.
14/90/JEF

(b) Galena Wildcat Number 1

Because of recent (1989-90) geophysical surveys in the Swanson River Area, ARCO developed a renewed interest in the previously-plugged and abandoned Finger Lake Well Southern California 22A-32 (1963). At year's end, the permitting process was nearing completion. The Plan of

Operations has been received, and Spill Contingency Plan approved. The existing pad will be slightly enlarged to accommodate the large Grace 154 rig, and drilling is expected to begin in late April or early May 1991.

Field surveying proposed drill-site for Galena No. 1 in Finger Lakes Area. 6/90/JEF

(c) Cook Inlet Region, Inc., Westfork 1-21

The Cook Inlet Regional Corporation (CIRI) completed a shallow (5500 foot) gas well in December on Kenai Native Association lands (22g lands) in the Sunken Island Area. At year's end, the gas potential of the Sterling Formation was being tested for sustained commercial quantities. CIRI plans to market any produceable quantities of gas into an existing Enstar Natural Gas Company pipeline which traverses the project area. Of immediate concern is the potential drainage of an adjoining 160 areas of Federal subsurface estate, and may result in renewed negotiations with CIRI for inholdings they control in the Tustumena Lake Area.

CIRC's Westfork shallow gas well near Sunken Island Lake. Commercially marketable resources were still being evaluated at year's end. 1/91/JEF

3. Items of Interest

(a) Contaminant Cleanup - Skilak Storage Facility

Contents from all but four of the forty-one 55-gallon drums identified for disposal in 1989 were processed by: (1) hauling to Soldotna Waste Water Treatment Facility, (2) burned as heating fuel at the Alaska Department of Transportation's maintenance shop or (3) transported to Palmer, Alaska, for incineration at Alaska Pollution Control's Facility. Of the remaining four drums, two contain the hazardous wood preservative "Penta". These will be trucked to Portland, Oregon as soon as the shipper completes a consolidated manifest from Alaska. Contents of the other two drums have yet to be identified although they have been analyzed as non-hazardous. Soil samples will be taken at the Skilak facility following spring break-up to see if any hazardous substances may have leaked from the drums.

Alaska Pollution Control, Inc., had contracted to dispose of the contents of a number of drums stored at the Skilak Lake Storage Facility. 10/90/JEF

(b) Underground Storage Tank (UST) Removal

The removal of five UST's (four at the Old Refuge Complex in Kenai and one from the Kenai Hangar site) was completed by R-L Construction Company in September. Initial vapor release sampling indicated no contamination of the four sites at the Old Headquarters Complex. The results were too good to be true, as later results of soil samples from two sites indicated total petroleum hydrocarbons exceeded minimum levels set by DEC. These areas will have to be re-excavated and re-sampled early in 1991.

The 2,000-gallon aviation gas tank at the Kenai Hangar had been in place since the mid-1970's and had apparently been leaking for sometime, as high levels of hydrocarbons were detected along the sides and directly beneath the tank. Several hundred cubic yards of contaminated soil was excavated and stockpiled on-site. Unfortunately, freeze-up occurred while we awaited tests for Benzene, and, therefore, the excavation site would have to remain open until the spring of 1991. Soil samples taken from the excavation showed acceptable levels of total petroleum hydrocarbons. We may be able to back-fill the site with original material rather than shipping it to Anchorage for incineration - and considerable costs!

Excavating 2000-gallon fuel tank at old Kenai Refuge Headquarters. No leakage detected! 8/90/JEF

Excavating for 2000-gallon aviation gas tank at Kenai Hangar. Long-term leakage required removal of approximately 3000 cubic yards of contaminated material. Method of disposal is yet to be determined. 10/90/JEF

Stockpiled contaminated soil from fuel leak at old 2000-gallon aviation gas tank at Kenai Hangar. Final disposal still uncertain at year's end, but whatever happens is likely to be expensive! 11/90/JEF

(d) Passing of an era.

" THE PASSING OF AN ERA"

As the Refuge's Cessna 206 floats broke water from Anchorage's congested Lake Hood on May 30, 1991, there was the usual cockpit chatter coming through our radio headphones between tower and a myriad of other aircraft in various stages of landing, departing and taxiing from this Alaska hub of floatplane activity. Having shared the cockpit with Refuge Pilot Bob Richey on numerous occasions over the past 14 years, this was, in many ways just another "typically Richey" flight - - thorough pre-flight, detailed passenger briefing, checklist, professional radio decorum and in general a no-nonsense approach for man and machine about to again defy the law of gravity. But this was, however typical, no ordinary flight.

After 26 years of flying Service aircraft over the Kenai National Wildlife Refuge, as well as other parts of Alaska, this was to be - the final hop - the last leg - the "final approach" - the final log book entry - to a career that had already amassed some 6,500 hours as "Command

Pilot", above a sometimes unforgiving and not always hospitable environment. I felt privileged to have been along to write the last few paragraphs in a manuscript of memories.

Refuge Pilot "extraordinare" Bob Richey bids farewell after 26 years on, and 6500 hours over the Kenai Refuge.
08/90/G. Hyatt

A right break after departure took us out over Anchorage International's parallel runways 6 and 24 as we climbed on a southerly heading toward the Kenai Peninsula and toward our eventual destination - Headquarters Lake near Soldotna.

As the panorama of hundreds of small freshwater lakes, surrounded by vast expanses of spruce unfolded beneath us, my thoughts focused on Bob's upcoming retirement and the impending end of the Refuge's "Richey Era - 1964-1990". With some simple mental multiplication, it seemed staggering that of the 26 years with the Refuge, over three years were actually spent in the air driving Super Cubs, Dehavilland recip and turbine Beavers, Cessnas, Beech Barons and the Gruman Goose. Most of these flights were not the "Sunday after Church" excursions under ideal weather conditions, but instead hours of low level wildlife inventories, search and rescue (often in mountainous terrain), forest fire patrols, ferrying field crews and equipment to and from remote sites, darting, tagging and monitoring telemetry, as well as frequent VIP trips on the

Refuge and throughout the State. Of course there were the various configurations-wheels, ski-wheels, skis, floats and amphibfloats as well as everything in the "weather blender" that the arctic and sub-arctic environments have to offer. Bob's terminal flight log entries were redundantly boring - "mission accomplished, passengers home safely, aircraft intact". That was a Richey hallmark.

Simple arithmetic also reveals the fact that if Bob spent three complete years in the air, he obviously spent a lot of time on the ground. Bob's approach to his work paralleled that of his flying - a meticulous blend of order, thoroughness and completeness. He provided stability and most importantly a historical perspective as well as continuity through seven refuge managers, the "boom" years of oil and gas exploration and development, the Alaska Native Claims Settlement Act (1971), the Alaska National Interest Lands Act (1980) and development of the Refuge Comprehensive Conservation Plan (CCP) in the early 1980's. To list all of Bob's accomplishments would be futile, however, his leadership in developing and implementing life-saving Refuge Aircraft Regulations and providing guidance to a then fledgling Alaska oil and gas industry with a poor "stateside" environmental track record will be lasting achievements of the Richey legacy.

As we began our descent onto Headquarters Lake the thought occurred to me that it would be fitting to fly down Soldotna's main drag at cartop height with full power, "buzz" the Refuge Headquarters a couple of times, do a few fancy tight turns and maybe cap it off with a loop or two. The finesse with which Bob set up the approach and landing soon replaced fantasy, and within minutes the floats made gentle contact with the shoreline and with the master switch off the only sound in the cockpit was the diminishing whine of the still rotating gyro compass. So this was it - the end of the flight - the end of a career - both completed in a typical "Richey Fashion" - with precision , style, and grace. Just another entry in the logbook - - -. "Mission Completed, passengers safe, plane intact".

Oh, just a post-script to the last entry in my own mental logbook ..." Job well done, thanks for the memories Bob. End of flight".

Jim Frates

BOB RICHEY NIGHT

The Refuge staff hosted a "Bob Richey Night" at the maintenance complex on June 1, complete with a locally traditional Cotton Moore Barbecue. Attendees (total about 60) included a number of Regional Office personnel including, Regional Director Walt Steiglitz and Associate Regional Director John Rogers. Other guests included representatives of Office of Aircraft Services, Fisheries Assistance Office and Alaska Department of Fish and Game as well as friends, former refuge employees and former Refuge Manager Dave Spencer (retired) who initially hired Bob back in 1964. The evening was capped off with a number of "roasts", presentations of gifts and a slide program highlighting Bob's Refuge career.

Pilot-Instructor Bob Richey gives some pointers to a fledgling student. File Photo

"Okay Guys, Miller Time". Bob admits that in 26 years, this was the first time he ever "propped" his feet on his desk. We told Bob not to worry, not a "sole" would ever see the picture. 06/90/JF.

Flying to Richey, was just a Piece of Cake". 06/90/JF

Bob Richey and wife Tilda chow down for the "last supper" to commemorate the final hours of a 2,277,600 hour career. 06/90/JF

Some of the 60 or so guests that attended "Bob Richey Night" barbecue and roast. 06/90/JF

We suspect we will see Bob back in the cockpit as a volunteer pilot in the near future, but in the interim he and his wife Tilda plan on taking an extended trip to the "lower 48" in their new motorhome. See page 28 for more on Bob's retirement.

4. Credits

Most staff members were involved in preparation of the 1990 annual narrative report, either during the writing, typing or editing phases of production.