KENAI NATIONAL WILDLIFE REFUGE

Soldotna, Alaska

ANNUAL NARRATIVE REPORT

Calendar Year 1991

U. S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEW AND APPROVALS

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Refuge Manager _____ Date

Refuge Supervisor Review _____ Date

Regional Office Approval

3/23/93
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 (ANILCA) 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. Most of the addition is mountainous terrain, including of approximately 150,000 acres at the southern tip of the Refuge and about 90,000 acres of formerly adjacent Forest Service lands to the extreme northeast near the Chickaloon Flats. At the same time, passage of the Alaska National Interest Lands Conservation 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 1.97-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) provide opportunities for fish and wildlife-oriented recreation. In addition to establishing new boundaries, new purposes, and a new name, ANILCA formally designated 1.35 million acres of the Refuge 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 2148 square miles (5563 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 the 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. Most of the lakes 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 4500 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, goats, wolves, bald eagles, trumpeter swans, caribou, moose, loons, four species of salmon, and a wide variety of furbearers occur on the Refuge.

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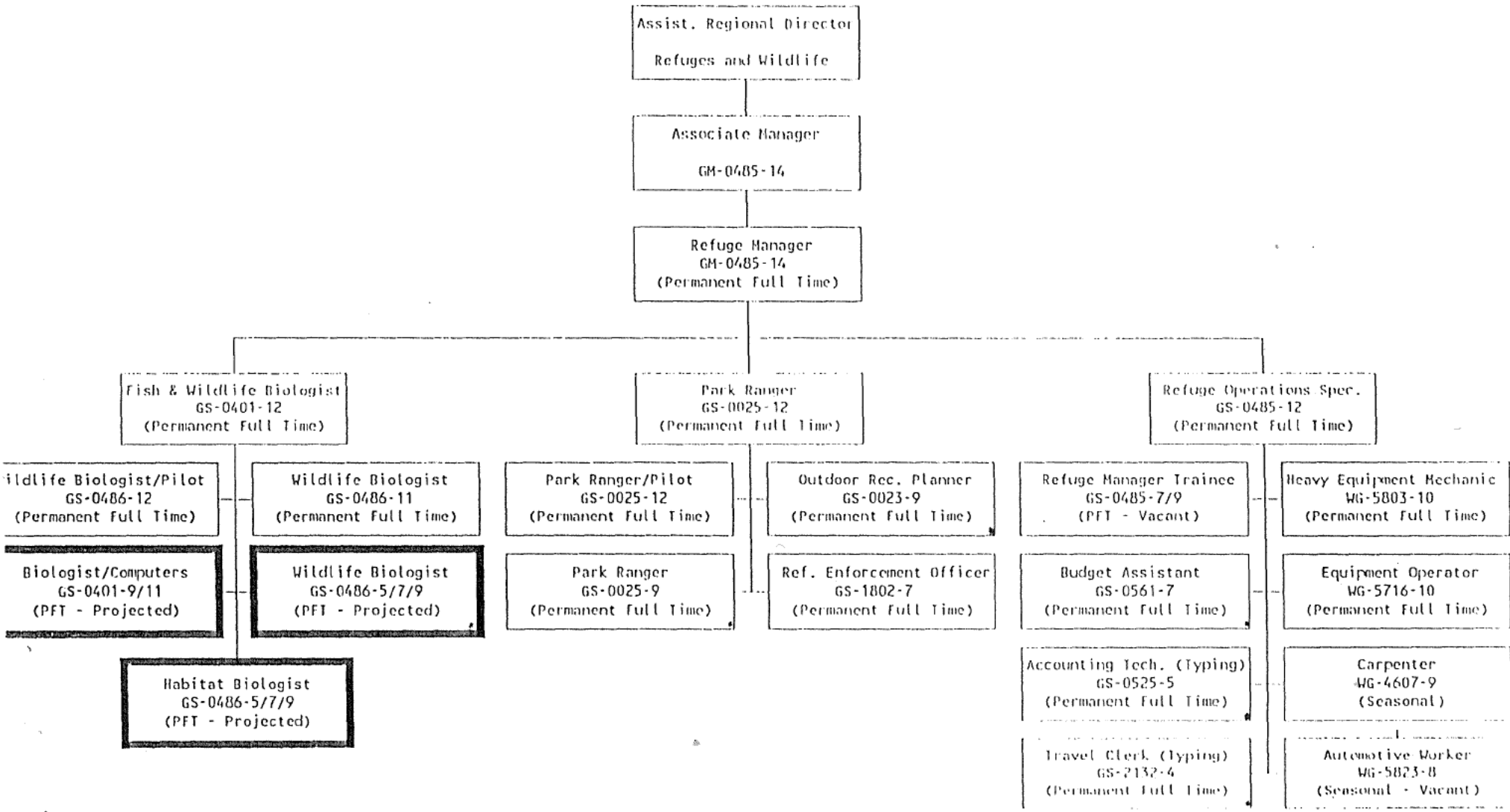

10/18/91

Associate Manager

Date

10-31-91

10/31/91

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J. OTHER ITEMS

A. HIGHLIGHTS

- Pothole Lake Fire burns 8500 acres.

- Personal use dipnet fishery at Hidden Creek requires long hours by Refuge staff and volunteers.

- Extensive rehabilitation work completed on Portage trails canoe system.

- Natural Resource Specialist Bob Winkelman transfers to Yukon-Delta National Wildlife Refuge.

- Walker hounds used to capture and radio-collar lynx.

- Oilfield clean-up of PCB-contaminated soils nears completion.

B. CLIMATIC CONDITIONS

With temperatures consistently above normal with the exception of July, August and October, and above normal precipitation we enjoyed an exceptional year. Our average temperature for 1991 was 35.26° Fahrenheit (F.). With the normal temperature being 32.9°F., the average temperature was 2.36°F. above normal.

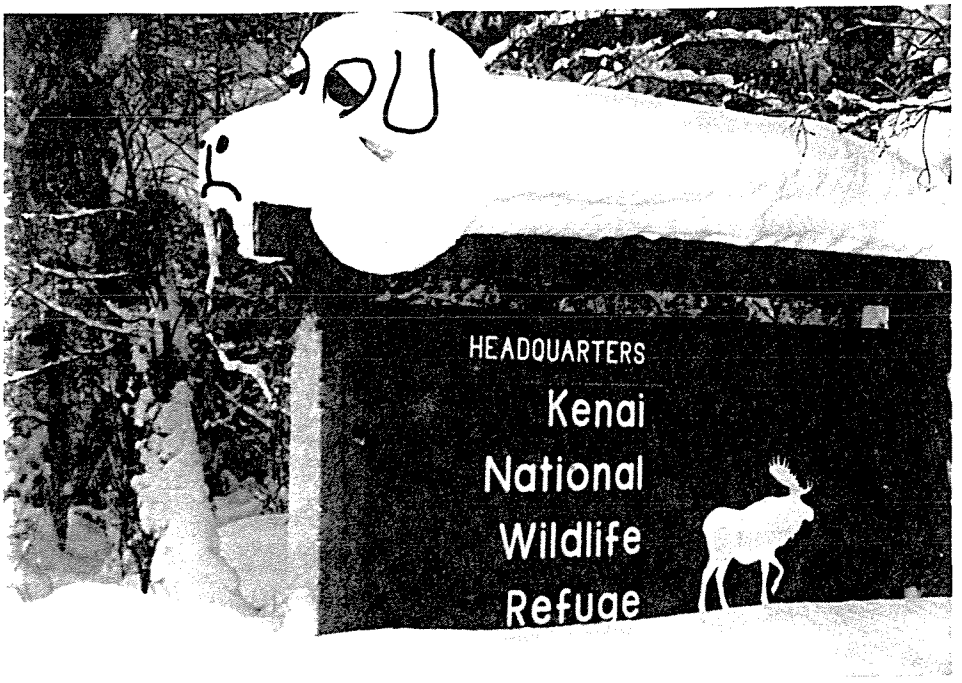
Snowfall for the past year has been above normal also. The year started out with snowfall levels slightly below normal. From January through April we received 33.6 inches of snow. Normal for the beginning of the year is 34.9 inches. With the arrival of October, snowfall started and continued to fall in abundance throughout the remainder of the year. From October 1 to the end of the year, we received 55.10 inches of snow. The normal for this three month period is 24.4 inches. Normal snowfall for the year is 59.3 inches, but for the 1990-91 season (October 1990-May 1991) we received 66.6 inches of snowfall. For the 1991 (January-December) year we received 89.20 inches of snow. Total precipitation for the year was 21.94 inches, 3.92 inches above normal. Our weather is warming up and we are receiving more moisture than normal.

Table 1. Monthly temperatures (averages) and precipitation data.*

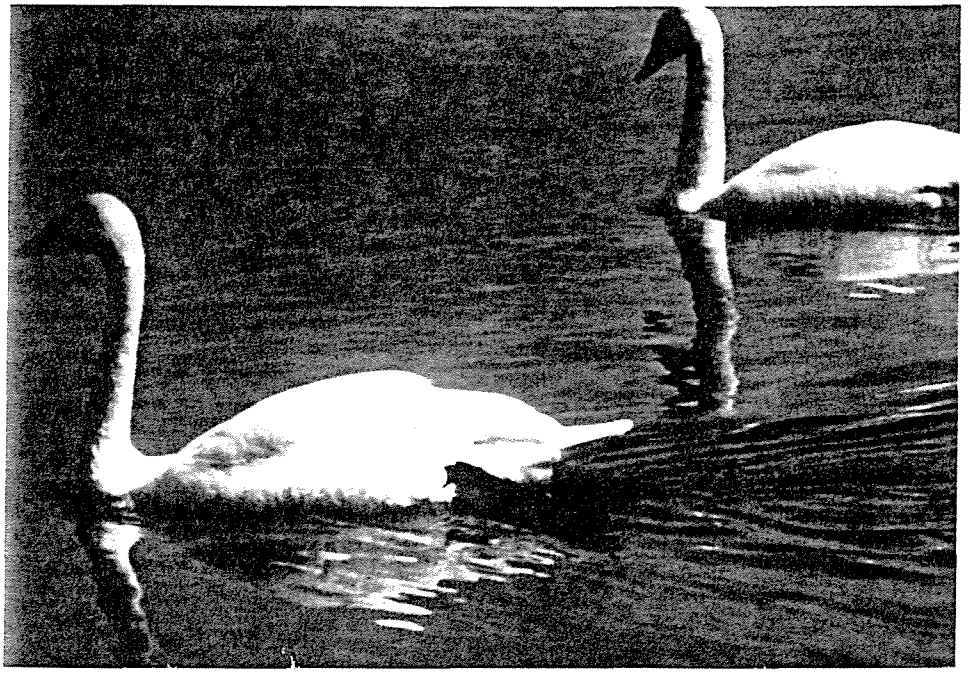
	Temperature (Fahrenheit)		Precipitation		Snowfall**	
	Normal	Average 1991	Inches Normal	Inches 1991	Inches Normal	Inches 1991
January	10.2°	14.9°	.71	.90	10.7	4.3
February	16.1°	17.9°	1.08	1.41	9.8	8.2
March	20.6°	21.8°	1.04	2.13	9.3	21.1
April	33.4°	36.7°	.90	.27	4.7	.5
May	43.4°	45.0°	.07	.92	0.4	--
June	50.0°	50.9°	1.29	.74	--	--
July	54.2°	53.5°	2.02	2.02	--	--
August	53.6°	52.4°	2.56	2.77	--	--
September	47.0°	49.6°	3.30	3.75	--	--
October	35.0°	33.4°	2.21	2.31	3.4	9.8
November	21.5°	26.3°	1.51	1.19	8.6	19.3
December	10.1°	20.7°	1.33	3.53	12.4	26.0
Totals	32.9°	35.26°	18.02	21.94	59.3	89.20

*Information obtained from monthly Climatological Reports and the Federal Weather Service at (907) 271-5105.

**Information obtained from monthly Climatological Reports and State Climatologist at (907) 257-2737.



"Darn These Dog Days of Winter" Near record snows fell on the Refuge in 1991. 12/91/JF



"Spring arrivals" We always look forward to the arrival of our seasonal guests.

"**Summer in The Kenai Lowlands**" with the Kenai Mountains the in background. 7/91/JF

"**Indian Summer Day**" near Kenai River Canyon with 2890' Hideout Hill in background. 9/91/JF

C. LAND ACQUISITION

1. Fee Title

a. Alaska Native Claims Settlement Act

(1) Kenai Native Association, Incorporated (KNA)

Preliminary discussions began during 1991 regarding a possible trade of subsurface Federal lands (West Fork Tract) which are being drained by Cook Inlet Region Incorporated's (CIRI) new gas field in the Sunken Island Lake area. Initial discussion involve some type of land trade that would consolidate CIRI subsurface for CIRI and Kenai Native Village lands being returned to Refuge ownership. Property values and specifics were not discussed during 1991, but appraisals and further discussions were anticipated during 1992.

KNA continued to seek relief from Alaska Native Claims Settlement Act (ANCSA) Section 22g restrictions on their lands. Correspondence from KNA indicated a renewed interest in a land trade. The Refuge identified certain lands which it would be willing to consider in the context of such a trade. While the Regional and Refuge Offices were working toward a land swap that would result in KNA getting lands without 22g restrictions, KNA was working with members of Congress to get 22g removed from their land.

Cook Inlet Region Inc. rehabilitates a well pad on Kenai Native Association lands in Section 22 near Sunken Island Lake. 5/91/RJ

(2) Salamatof Native Association Incorporated (SNA)

A new road was developed to Elephant Lake across several miles of lands previously inaccessible by roads. The road passed within ¼ mile of a wolf den in the Elephant Lake area that has been in continuous use for several years.

Several subdivisions were plotted in the Konovalof Lake area during the year despite land prices that were quite low. Some forty-acre parcels were selling for as low as $150.00 an acre. At year's end, negotiations continued regarding final transfer to the United States of the non-development easement along the Kenai River.

(3) Tyonek Native Corporation, Incorporated (TNC)

On February 22, 1991, Tyonek Native Corporation asked if the U.S. Fish and Wildlife (USFWS) would be interested in acquiring 25,000 of the 33,000 acres they own within Kenai National Wildlife Refuge. The remaining 8,000 is apparently optional to the Native Lands Group for a potential consolidated land trade. The TNC lands were acquired in April 1979 as part of their ANCSA entitlement.

In correspondence, TNC indicated it was pursuing contacts with oil exploration and production companies, timber concerns and the Kenai Peninsula Borough for a possible hazardous waste disposal facility.

According to the Alaska Priority System (APS) ranking the value of the TNC lands within the Refuge includes low, medium and high Trumpeter Swan habitat, medium furbearer and bald eagle value, high black bear and wolf habitat value, and medium to high Refuge management consolidation value. It also has a medium threat rating.

(4) Point Possession Native Group, Incorporated. (PPNG)

The Point Possession group which received substantial ANCSA, 22g lands at the northern tip of the Refuge, listed their lands for sale. A headline article ran in the Anchorage newspaper regarding the listing. The Kenai National Wildlife Refuge may have first right of refusal, but the highly inflated asking price by the native group complicates the situation. It is unknown if they have had any serious inquires. The Point Possession lands previously within Kenai Wilderness are among those identified in land protection plan meetings and correspondence for possible acquisition.

(5) Cook Inlet Region Incorporated (CIRI)

Refuge staff met several times with CIRI representative and consultant Chip Dennerlein regarding a request by CIRI Production Company to bring a (25)KV single-phase line into their now natural gas well along Sunken Island Road. Discussion went as far as discussing potential routes before CIRI Production Company dropped their request in lieu of an on-site power

generator. Apparently their desire to drill several new wells into their subsurface lands made on-site generation economical.

CIRI began rehabilitation at the well pad site south of Sunken Island Lake in Section 24 with excess topsoil available from development of their new gas well.

CIRI representative Dennerlein expressed CIRI's willingness to enter into discussions, including a three way trade of the Federal West Fork subsurface lands near their well for KNA and CIRI inholdings.

The Service continued to oppose a CIRI request for a secretarial waiver of the selection deadline of ANCSA 14(h)1 sites in the Kenai/Russian River area. If the waiver were granted the CIRI selections in the area could substantially increase. The waiver, if granted, could also have implications for other land selections. A State fact finding meeting was held at the Bureau of Land Management (BLM) State office regarding the status of CIRI's ANCSA 14(h)1 Russian River land selections. Joe LaBae of BLM said that adjudication for the parcel was being delayed due to a CIRI request for a waiver on a regulatory deadline for filing new land claims. Attendees were Sharon Janis, Bill Mattice, Paul Schrooten, Rick Johnston and LaBae. The discussion involved various aspects of the likely outcome of the land adjudication, as well as which Refuge lands were legally available to be conveyed. Only vacant and unappropriated lands are available, but it remains unclear what standard of vacant and unappropriated will prevail. Which lands will remain in Refuge ownership is uncertain until an adjudication is complete.

b. Native Allotments

Correspondence was received in June from land broker Dave Becker on behalf of native allotment inholder George Miller. The parcel was made available for purchase at $93,000 cash or a trading of the 80 acre parcel for other available lands.

The Interior Board of Land Appeals (IBLA) set aside the entire Alec Dolchok Native Allotment Claim (AA8272) within Kenai Wilderness at Harvey Lake on the strength of the new evidence that the claim was unsubstantiated and based on false claims. They remanded the case to BLM for a contest hearing of the facts regarding the claim. The hearing was scheduled for August 1991, but was stayed when Alaska Legal Services, on behalf of Dolchock's heirs, sued in District Court to have the entire 100-acre claim revalidated. They filed a lengthy brief of several arguments primarily involving procedural questions. They clearly did not want the actual facts of the case heard in a contest hearing. At year's end legal briefs were being traded. The Refuge is confident that a hearing of fact, as called for by the IBLA, would dismiss the unsubstantiated claim.

2. Easements

Fishermen fishing from the Moose Range Meadows public use easement during July. Vegetated banks have been significantly impacted by the increased use. 7/91/RJ

Moose Range Meadows private property owners expressed alarm at shoreline damage on the public use easement by erecting a "no trespassing" sign. 7/91/RJ

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 impacted by several incidents of encroachment. Updated investigative reports were prepared for the solicitors office regarding various easement violations.

Shore fishermen use of the twenty-five foot public use easement adjacent the Kenai River within Moose Range Meadows Subdivision continued to grow significantly from 1990. Significant vegetation and shore line damage occurred at several locations due to heavy stream side foot wear by large numbers of anglers. At year's end, final transfer of the non development easement did not appear imminent despite considerable efforts by the Regional Realty Office.

Salamatof President Jim Segura made inquires during 1991 regarding selling land adjacent to Funny River Road to a Soldotna business interested in subsurface disposal of sewage. The Refuge retains subsurface ownership in the area and was not supportive of the concept during preliminary discussion. No formal proposal was received from Salamatof.

Several complaints were again received during 1991 regarding Moose Range Meadows landowners or their representatives trying to prevent public access on the 25-foot easement. On one occasion an elderly couple reported being verbally abused and harassed and that "no trespassing" signs were placed in the de facto trail along the river. A Refuge officer investigated the incident, removed the signs and warned the subjects who attempted to prevent rightful public access to the easement. Conflicts between landowners and the public will no doubt occur as use increases on the easements. Bank damage has been significant and appears to be a primary concern of displeased landowners.

3. Other

a. Inholders

A request by Burnt Island private landowner Hiram Wells to purchase the remaining portion of Burnt Island (less than four acres) from the BLM was rejected in 1990 on the strength of input from Kenai National Wildlife Refuge (NWR) that acquisition of these particular Federal lands would not be in the best interest of the Refuge. Burnt Island has historically been thought to be just outside the Refuge. During the investigation a BLM adjudicator questioned whether the entire island was even within BLM jurisdictions. Burnt Island appears to have been within Chugach National Forest all along and perhaps should have transferred in 1980 to Kenai NWR with the Big Indian Creek addition. In any case, the statute of limitations has passed and Mr. Wells now owns property on the island. Whether the property is legally a Refuge inholding or Chugach National Forest land remains an unanswered question.

In a related project Chugach Electric Corporation (CEC) employees airlifted a 500-pound transformer potentially containing PCB's from the Wade inholding. CEC volunteered to remove the transformer which is believed to have been stolen by former employee Wade.

The State utilized emergency funds to prevent imminent contamination of Skilak Lake from poorly stored drums of unknown substances and from a large uncovered trough with petroleum products in danger of spilling. Inholder Glen Wade was in Federal prison for weapons violations and awaiting State prison time for violations, including several at his Refuge inholding and was not present at the inholding.

Chugach Electric Association retrieved an old transformer which potentially contained PCB's from the Wade inholding on Caribou Island. 6/91/RJ

Refuge staff prepared an affidavit regarding imminent spillage of contaminants into Skilak Lake from a Caribou Island inholding. Department of Environmental Conservation (DEC) staff were than able to obtain an

inspection warrant. Refuge staff assisted Alaska Department of Environmental Conservation officers with the court ordered inspection and DEC's actions to stabilize the potential contaminants.

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, damage along the route and use of the same route by non-permittees remain problems with the program. Subdivider Art Thompson has 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.

b. Land Acquisition

The Refuge provided input into development of the Refuge Land Protection Plan as well as development of a priority ranking system (APS) for inholding acquisition Region-wide. The priority system ranks lands according to wildlife and other values as well as potential threats. Several new subdivisions, roads, and structures were developed during the year on various Refuge inholdings.

c. Rights-of-way

During January 1991 Park Ranger Johnston drafted a letter to the Regional Realty Office (RO) requesting assistance in evaluating and appraising the status of oilfield access roads which are on Special Use Permits. The Federal Land Management Policy Act of 1976 requires that the U.S. Government receive a fair cash market amount for use of rights-of-way across Federal lands. At year's end actions had been taken to bring various roads under new right-of-way permits.

The Refuge received a draft feasibility study prepared for the Alaska Energy Commission for a transmission intertie. The intertie proposal included an option to locate a powerline through the Refuge. The route would require a new right-of-way parallel to the Enstar gas pipeline right-of-way. Previous correspondence from the Refuge has discouraged such an intertie on Refuge lands.

D. PLANNING

1. Master Plan

Nothing to Report

2. Management Plans

a. Moose Management Plan

A step-down Draft Moose Management Plan (Plan) for the Refuge was completed in 1991 and submitted to the Regional Office for review. This Plan details specific management actions for moose to be undertaken by the Service on the Refuge, including habitat management and monitoring the status of moose populations using aerial surveys, habitat evaluation, and direct animal assessments. It outlines area-specific moose population composition objectives for the Refuge. Options for regulating harvest to meet these composition objectives are presented for consideration. It addresses predation and roadkills, two important mortality sources for moose on the Refuge. The Plan identifies several informational needs and research priorities related to moose management on the Refuge. Lastly, the Plan gives a history of Refuge moose management and discusses the implications of recent moose population dynamics. The Plan is accompanied by a Technical Supplement, which provides a comprehensive review of moose population and habitat data and an assessment of factors influencing moose population dynamics on the Refuge since its establishment.

b. Public Use Management Plan

Preliminary efforts were directed toward the initiation of the Public Use Management Plan (PUMP). Recruitment for an Outdoor Recreation Planner began in the spring and we anticipated having someone in that position by summer. However, the individual selected did not meet the criteria for selection as final graduate level work had not been completed, as we were assured it had been. Back to square one. Another recruitment effort resulted in a certificate from which none of the candidates met our needs. Finally, an individual with reinstatement eligibility, a planning background, and a local resident came to our attention; an interview confirmed that information and we requested that a reinstatement action be initiated. Emily Fiala will enter on duty on January 13, 1992, and begin work on the PUMP by having initial meetings with Refuge staff and Regional planners.

We do not want the PUMP process to deteriorate into a rehash of issues covered in depth during the development of the Comprehensive Conservation Plan (CCP). Rather, we expect the PUMP to confirm decisions made in the CCP, to discover new issues and concerns, and generate management decisions that reflect the spirit of the decisions made in the CCP. We expect the PUMP process to be long and not without controversy. Kenai Refuge is the most heavily visited refuge in Alaska and that distinction virtually guarantees we will be engaged in a lively process of public participation.

3. Public Participation

A Land Protection Plan public meeting was held April 9 seeking input on the priorities for Refuge inholding acquisition. The meeting was sparsely attended.

Refuge Manager Doshier participated throughout the year in the Kenai River Special Management Area Advisory Board. Doshier was also President of the Advisory Board throughout the year. The board advises the Division of Parks regarding management of the Kenai River.

Refuge staff participated in several public meetings held in Cooper Landing during and after the Pothole Lake Fire. The community of Cooper Landing was very concerned about the status of the fire, particularly considering the spruce bark beetle killed forest surrounding their community.

Park Ranger Johnston attended a public meeting on October 10, which concerned trespass cabins on State lands in the Caribou Hills. The State had been posting the cabins with "move it or lose it" notices. After a change in Director of Natural Resources leadership, a hold was instituted on these efforts until a land management plan is developed for the area. The Refuge is interested in this matter because of increased public use in nearby parts of the Refuge. It is quite obvious the increased use is directly related to the increased number of cabins over the past five to ten years. A second public meeting was attended by Doshier during December regarding the trespass cabin and other Caribou Hills issues.

4. Compliance With Environmental and Cultural Resource Mandates

During 1990 Refuge staff commented on a consolidated group of Chugach National Forest facility, trail and design improvement proposals for their adjacent facilities at Russian River. Also combined with the formal service project were various in-stream stabilization projects, many of which appeared to have unknown consequences to the Refuge side of the Russian River. Additionally, most of the projects did not seem justified.

On March 1, 1991, Doshier met with representatives of the Environmental Protection Agency (EPA), Alaska Department of Fish and Game (ADF&G) Habitat Division, and Larry Dugan of Ecological Services - Western Alaska to discuss the Forest Service in-stream proposal for the Russian River. Everyone was in agreement that what the Forest Service was proposing for bank stabilization and in-stream work was not justified. Although tentative plans were made for a site visit and future discussions, EPA representatives indicated they were going to deny the Forest Service permit request.

In a related matter the U.S. Forest Service was coming under fire for building several "experimental" stream diversions/bank stabilization structures without Corp of Engineers, wetland or State waterway permits. State Troopers had gone as far as preparing a criminal investigative report on the matter.

During suppression activities on the Pothole Lake wildland fire, Regional Archeologist Chuck Diters was consulted regarding the possible location of "cat" lines and other disturbances. Diters was consulted over a period of several days regarding compliance with the Archeological Resources Protection Act and other appropriate laws.

Refuge Law Enforcement Officer Steve Hudson attended a one week training on the Archaeological Resource Protection Act (ARPA).

Regional Office (RO) Engineers Rudy Berus and Bruce Sherwood met with Doshier, Johnston and Department of Environmental Conservation Field Officer David Johnson regarding State recreational vehicle dumping status guidelines. It was decided at the meeting, with general concurrence from the State to construct a master dump station along Skilak Road rather than build one at each campground. Waste removal technology was also discussed, as well as concerns about recreational vehicle waste. Engineering staff had tentatively located the required dump station and were hard at work on an appropriate design at year's end.

Refuge staff reviewed an Archaeological Resource Protection Act permit application submitted by Alan DePew of Washington State University. The request to conduct activities was found to be consistent with the Refuge Comprehensive Conservation Management Plan and in compliance with 43CFR7.6 and 7.8. The curatorial facility at Washington State University met the requirements outlined in the Service's final Procedures for Issuance of Archeological Permits. Although activities were planned in Kenai Wilderness, they were reviewed and found to be in compliance with the Wilderness Act.

A Special Use Permit was issued to Dwight Bralley of the U.S. Geological Service (USGS) to conduct mineral assessment work in the Chernof, Dinglestadt, Truuli, and Tustumena glacier areas. The areas to be surveyed were within Kenai Wilderness and stipulations were included to protect the wilderness resource. The permit was issued under ANILCA Section 1010.

A permit was issued to Richard D. Reger of the Alaska Department of Natural Resources (ADNR) Division of Geological and Geophysical Surveys. Soil and sediment samples were taken at several locations including some within the Kenai Wilderness. An appropriate ANILCA Section 1010 authority was cited allowing the survey. Bob Olson, of USGS National Mapping Division was also issued a Refuge Special Use Permit for surveys in the Two Indian area.

An environmental assessment, as required by the National Environmental Policy Act, was completed for the proposed harvest and harvest method of excess sockeye salmon at Hidden Creek. Several alterative harvest strategies and their associated impacts were discussed.

The Refuge also sought approval and maintained compliance with ADF&G Habitat Division for in-stream activities associated with conducting the Hidden Creek Dipnet Fishery (AS16.05.87). Fish Habitat Permit FG91-II-0417 was issued by the State and included several guidelines for stream and

stream bank protection. The permit met the standards of the Alaska Coastal Management Program and the Kenai Peninsula Borough Coastal Management Plan.

The Refuge commented on a draft feasibility study prepared for the Alaska Energy Commission for a 125KV transmission intertie. The intertie proposal includes an option to locate a powerline through the Refuge. The route would require a new right-of-way parallel to the Enstar gas pipeline right-of-way. Previous correspondence from the Refuge has encouraged such an intertie to be built off of Refuge lands. Comment on the feasibility study was completed in February. Several habitat, wildlife, and compatibility concerns were pointed out to the Alaska Energy Commission. An entirely off-Refuge location of any intertie was being considered during earlier Refuge boundary adjustments. This was clearly described for the commission.

5. Research and Investigation

a. Beaver

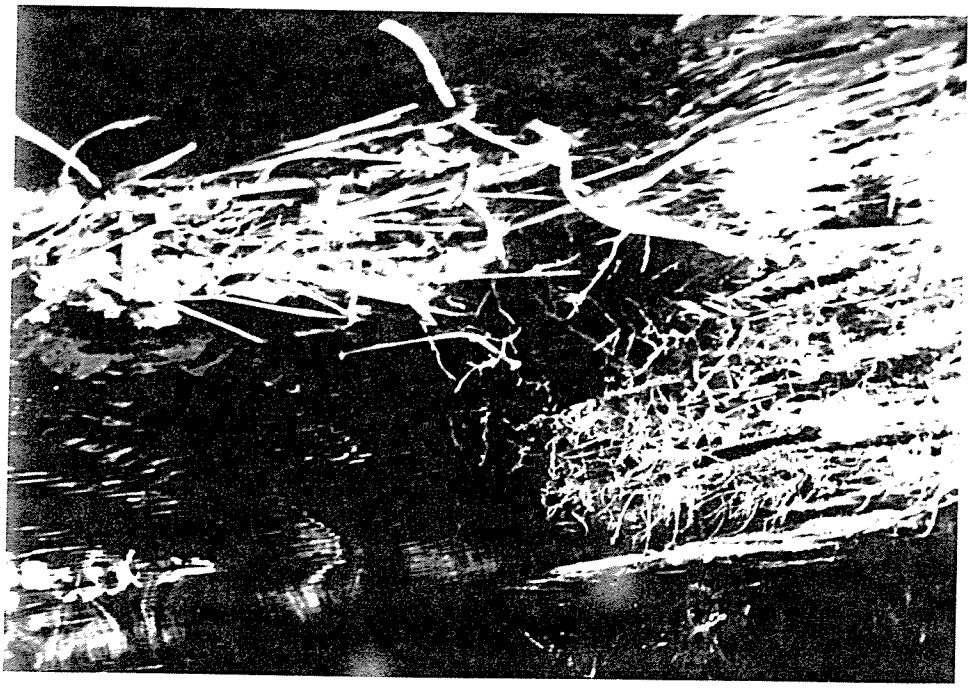
Title: Beaver (*Castor canadensis*) numbers, population characteristics, harvest impacts, and habitat relationships on the Kenai National Wildlife Refuge.

A summary of the progress on this project is taken from the 1991 Progress Report.

SUMMARY

A total of 82 lakes and ponds in the Finger Lakes area of the 1969 burn and 32 lakes in mature forest in the Point Possession area were surveyed on the ground for beaver use between June 25 and August 30, 1990. Beaver habitat data were collected at each lake. In addition, 22 of the 31 lakes in the Swan Lake Canoe System area of the 1947 burn that had active beaver colonies in 1989 were resurveyed for beaver use during late summer 1990. All lakes except 2 lakes in the Finger Lakes area were accessed by canoe, the other 2 by float plane. These ground surveys found: 26 active lodges in 15 lakes in the 1969 burn study area; 21 active lodges in 14 lakes in the mature forest study area; and 16 active lodges in 10 lakes in the 1947 burn study area. An aerial transect survey, with pilot and observer both unaware of the results of the summer survey, was flown October 3 and 4 in the 1947 and 1969 burn study area, and October 9 in the mature forest study area. They found: 10 active lodges, all with fresh food caches, in 10 lakes in the 1969 burn study area; 8 active lodges, 6 with food caches, in 8 lakes in the mature forest study area; and 26 active lodges, 21 with food caches, in 20 lakes in the 1947 burn study area. Subsequent verification aerial surveys on October 4 and 10, 1990, found: 17 active lodges, 15 with food caches, in 16 lakes in the 1969 burn study area; 16 active

lodges, 10 with food caches, in 11 lakes in the mature forest study area; and 34 active lodges, 27 with food caches, in 24 lakes in the 1947 burn study area. Of the active lodges, 88 percent, 62 percent, and 79 percent had visible food caches by October 10 in the 1969 burn, mature forest, and 1947 burn study areas, respectively. The standard aerial survey, therefore, found 66 percent, 60 percent, and 78 percent of the active lodges with caches, and 59 percent, 50 percent, and 76 percent of the total active lodges, in the 1969 burn, mature forest, and 1947 burn study areas, respectively. Mean (+ one standard error of the mean) lake size used by beavers was calculated for each study area for current use and past beaver use. Cache materials were collected from caches under construction in October 1989, and were analyzed for nutrient content. Data collected in the summer surveys are being prepared for entry into a computer data base for analysis.



Roots and stems of the yellow pond lily are an important food item of some beavers on the Refuge.
6/91/TB

b. Wolverine

Kenai Peninsula Interagency Wolverine Investigation - Alaska Department of Fish and Game, National Park Service, U.S. Fish and Wildlife Service, U.S. Forest Service.

An interagency agreement was signed by the above agencies in 1991 with the following objectives:

Phase I

1) To determine relative abundance of wolverines by geographic area:

a) location and extent of refugia;
b) seasonal distribution.

2) To identify and map suitable wolverine habitat and assess food resources.

3) To examine wolverine harvest levels and patterns.

4) To examine the feasibility and effectiveness of different capture methods to ensure an adequate sample of wolverines.

5) To develop a habitat capability model by determining the following for wolverines on the Kenai Peninsula, based on success in meeting objectives 1-4:

a) habitat preferences;
b) home range characteristics;
c) seasonal habitat requirements;
d) effects of human disturbance.

Phase II

6) To understand the demographic processes of wolverines on the Kenai Peninsula by estimating the following:

a) annual production and recruitment;
b) sex and age ratios;
c) population size;
d) mortality and dispersal.

Each agency will conduct or financially support aerial wolverine snow track surveys over the entire Kenai Peninsula during the 1991-1992 winter and the results of that survey will be summarized in the 1992 Annual Narrative.

c. Lynx-Coyote Relationships

Graduate Student Winthrop Staples from the University of Alaska, Fairbanks completed all field work associated with this project during 1991 and began

summarizing and analyzing data. A major portion of his work during 1991 was the analysis of scats of lynx and coyote for prey remains and data input into a computer-based Geographic Information System (GIS). A summary of the field work accomplished and status of radio-collared lynx during 1991 follows:

> Nine lynx (five males, four females) with radio collars were available for monitoring as of January 1991. During 1991, one male was illegally shot or trapped and its cut-through collar found beside a road and a female starved to death. During October-November 1991, two of four remaining males were recaptured with trained dogs and fitted with new radio-collars, one male whose collar had failed in 1989 was recaptured and fitted with a radio-collar, and a new, uncollared male was captured and collared in the Skilak Loop Area. Only one of two remaining female lynx was recaptured during the fall of 1991. Another female, who's collar failed in 1991, was recaptured and collared, as were two new females in the Skilak Loop area.

A treed male lynx watches his "pursuers" below. This lynx's radio collar was replaced and later he was released. 10/91/TN

Digger barks "treed" at the lynx above. Hounds were used to capture or recapture eight lynx in 1991.
10/91/TB

Only one of three collared females monitored during the 1991 denning period successfully reared young (two) in the Mystery Creek area. No collared females or tracks of lynx kittens were observed in the Swan Lakes Canoe System area during 1991. The track of an uncollared female with one kitten was observed in the western Skilak Loop during capture operations in November 1991. Snowshoe hare numbers appeared greater in the Skilak Loop area than in the Swan Lake Canoe System area. An additional trapping grid will be established in the Skilak Loop area in 1992 to monitor the snowshoe hare population in that area.

d. Lynx Habitat Relationships

Graduate Student David Dunn from the University of Alaska, Fairbanks was accepted into the graduate program to continue work on investigating the factors influencing the Refuge lynx population. His field research will begin in January 1992 and will examine the relationship between lynx home range, habitat and hare concentration areas (i.e. hare pockets), and habitat and hare availability.

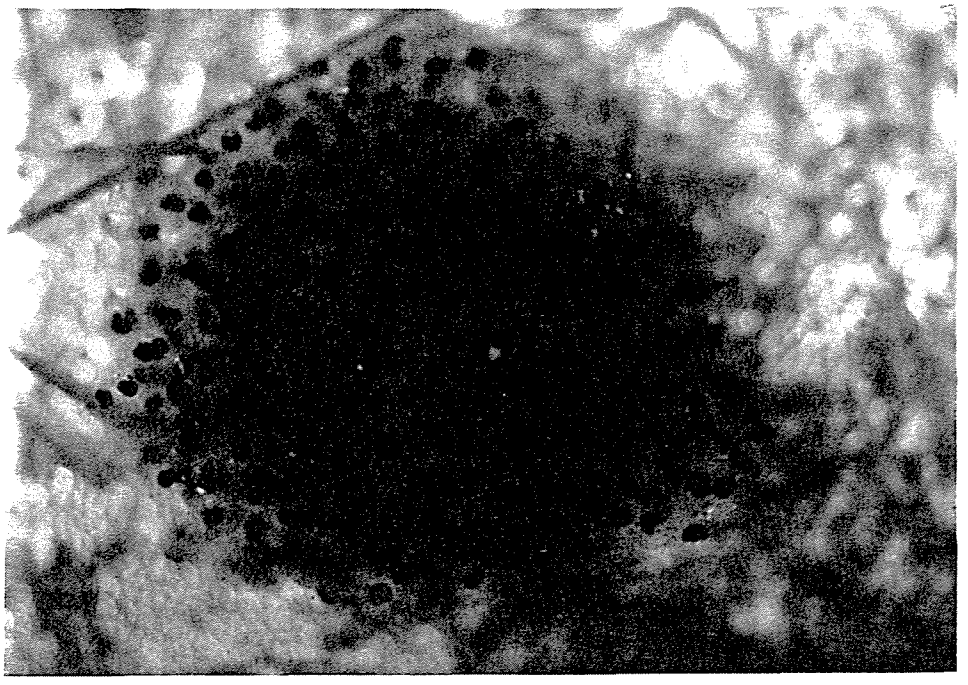
e. Breeding Wood Frog Distributions

A Challenge Grant project using Soldotna High School science student volunteers was initiated to obtain baseline data on breeding wood frogs on the Refuge as part of the general recommendations of the IVCN/SSC Declining Amphibian Populations Task Force to collect baseline information on amphibians throughout the world. The project entitled Wood Frog Distribution and Relative Abundance in Relation to Available Wetlands Breeding Sites and Selected Breeding Site Characteristic on the Kenai National Wildlife Refuge, Alaska is summarized on the next page:

Soldotna High School science students collect information on the use of breeding ponds by wood frogs on the Refuge. This was a Challenge Grant project to obtain baseline information on declining amphibian populations and to teach high school students the scientific method. 5/91/TB

Wood Frog Summary

Thirty, permanent lakes and ponds and 30 ephemeral ponds were surveyed for the presence of breeding wood frogs during May 1991. Included were 35 ponds randomly selected from 66 ponds within one-half mile of the Swanson River Road and Swan Lake Road on the Refuge; the remainder were on or near the Refuge. A higher proportion (70 percent) of ephemeral ponds than permanent ponds (43 percent) were used by breeding wood frogs. Most egg clusters (n = 641, 71 percent) were found in ephemeral ponds, but some of the ephemeral pond margins with the highest numbers of dried egg clusters completely dried up before the tadpoles were able to metamorphose. Early summer 1991 was one of the driest and hottest recorded on the Kenai Peninsula.



Wood frog egg cluster. Many amphibian populations throughout the world are declining but little baseline information is available on amphibians at high northern latitudes. 5/91/TB

f. Sockeye Salmon - Tustumena Lake

An abstract of a report summarizing the data on sockeye salmon investigations on Tustumena Lake entitled Summary of Sockeye Salmon (*Oncorhynchus nerka*) Investigations in Tustumena Lake, 1981-1991 and written by G.B. Kyle, Alaska Department of Fish and Game, appears below:

ABSTRACT

In 1981, the Alaska Department of Fish and Game and the United States Fish and Wildlife Service cooperatively initiated new and expanded fishery and limnological investigations in Tustumena Lake. These studies were designed to characterize sockeye salmon (*Oncorhynchus nerka)* production in glacially-influenced Tustumena Lake, and evaluate the stocking of hatchery-produced fingerlings relative to wild production. Sockeye salmon fingerlings were first released in Tustumena Lake from Crooked Creek Hatchery in 1976, and have been stocked almost every year since then. The initial working hypothesis of sockeye salmon production in this lake, as in the majority of other sockeye-producing lakes, followed the classical approach of the stock-recruitment theory. This approach is predicated on density-dependent fry recruitment and resultant effects on subsequent stock size under assumed conditions of a stable rearing environment. However, changing environmental conditions during lake rearing can confound stock-recruitment/density-dependent relationships. For example, the broodyear that produced the highest smolt biomass occurred during the period of high stocking (~16 million) but from a lower escapement, compared to broodyears before and after the broodyear of highest smolt biomass when stocking levels were similar. Moreover, wild smolt biomass in Tustumena Lake for broodyears 1979-1988 was not significantly ($P > 0.05$) related to the number of spawners, and similarly, hatchery smolt biomass (release years 1980-1989) was not significantly ($P < 0.05$) correlated to the number of fingerlings planted. In addition, zooplankton biomass was not significantly related to numbers of sockeye juveniles rearing in the fall. These findings are inconsistent with unconditional density-dependent sockeye production. Furthermore, a preliminary evaluation of the effects of diverse rearing environments on age-1 smolt production during six parent years (1979-1984), when numbers of spawners were relatively consistent, revealed relationships characteristic of density-independent production. That is, environmental variables (e.g., seasonal precipitation, lake temperature, onset of spring heating) accounted for most (84-94 percent) of the inter-annual variation in wild age-1 smolt production in Tustumena Lake. Thus, sockeye production in Tustumena Lake appears to be primarily influenced by environmental variables over the effects of fish density; however, there could be subsequent density-dependent effects resulting from poor environmental conditions.

g. Sockeye Salmon - Hidden Lake

An abstract of a 1991 report prepared by Cook Inlet Aquaculture Association on the sockeye salmon enhancement project at Hidden Lake on the Refuge appears below:

ABSTRACT

Hidden Lake, located on the Kenai Peninsula 69 kilometers east of Soldotna, Alaska, has been managed for sockeye salmon (*Oncorhynchus nerka*) enhancement since 1976. Initial salmon enhancement activities were conducted by the Alaska Department of Fish and Game. The Cook Inlet Aquaculture Association became involved in the Hidden Lake enhancement project in 1988 and in 1991 was responsible for all field activities.

Smolt out-migration monitoring began on 15 May 1991 and continued daily until 9 July 1991, except for a 4-day period between 25 May and 30 May 1991 when the field crew was off-site because of a threatening forest fire. Smolt out-migration at Hidden Lake is normally monitored until 15 July, but was terminated 6 days early because of bear damage to the smolt trap. Most of the sockeye smolt (more than 93 percent) migrated between 8 June and 28 June 1991. Neither the interruption from the fire nor the bear damage were believed to substantially alter the data collected.

A total of 208,524 sockeye and 43,015 coho salmon (*O. kisutch*) migrated from the lake. Sixty rainbow (*O. mykiss*) and 332 Dolly Varden (*Salvelinus malma*) were also observed. The average length and weight of the migrating sockeye smolt were 145 mm and 29.6 g, respectively. Ninety-three and one-third percent were age 1 and 6.5 percent were age 2. The average length and weight of the migrating silver salmon smolt were 133 mm and 23.1 g, respectively. Seventy-five and nine-tenths percent were age 1 and 15.7 percent were age 2. Based on an ocean survival rate of 27.68 percent the Hidden Lake sockeye smolt out-migration is projected to produce a return of 53,852 adults.

Adult escapement was monitored from 16 July to 30 August 1991. During this time period a total of 112,792 adult sockeye salmon returned to Hidden Creek. Thirty-five thousand, five hundred and seventy-six were allowed to enter the lake, 72,060 were harvested in a personal use dip-net fishery, 156 were donated to charity and 5000 were lost to the system. The ratio of adult male to female fish was 4:7. Male fish weighed an average of 1.96 kg (4.3 lbs), females 1.65 kg (3.6 lbs). Eighty-nine and one-half percent of the fish were age 1.2, seven percent were age 1.3.

Water chemistry analysis suggested that the large 1990 escapement into Hidden Lake did not alter the water quality of the lake substantially.

On 13, May 1991, 1.6 million sockeye fry were released into Hidden Lake, 1.4 million at the west end of the lake, and 200,000 at the boat ramp. Between 2 October and 11 October 1991, 2,782,500 eggs were collected and shipped to Trail Lakes Hatchery for rearing.

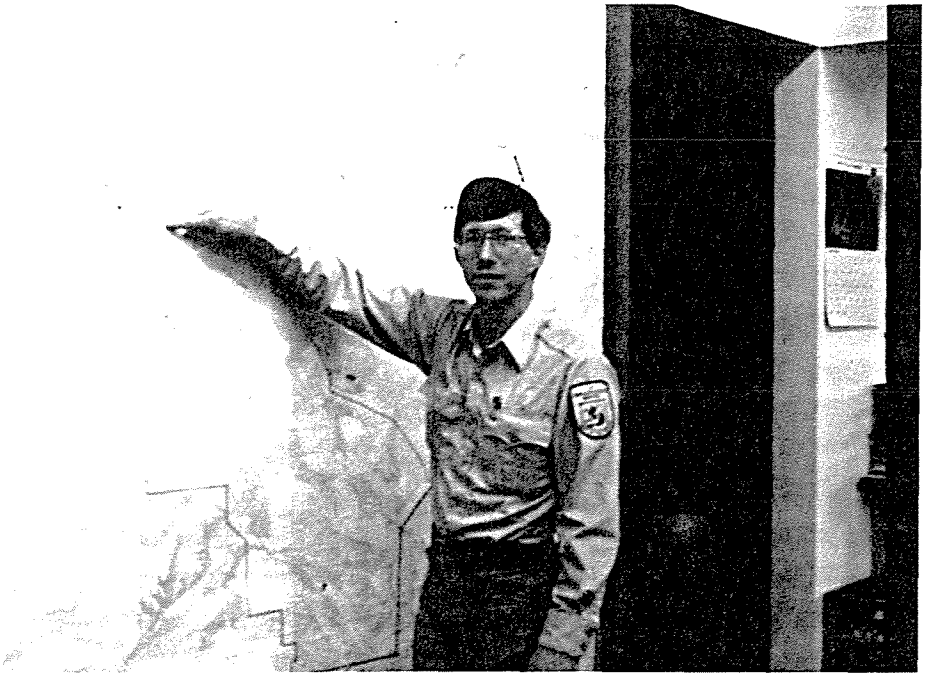
Over one thousand dead sockeye salmon in Hidden Creek. This system was overstocked with fry and too many adult returned to the system to sustain in 1991. 8/91/TB

6. Other

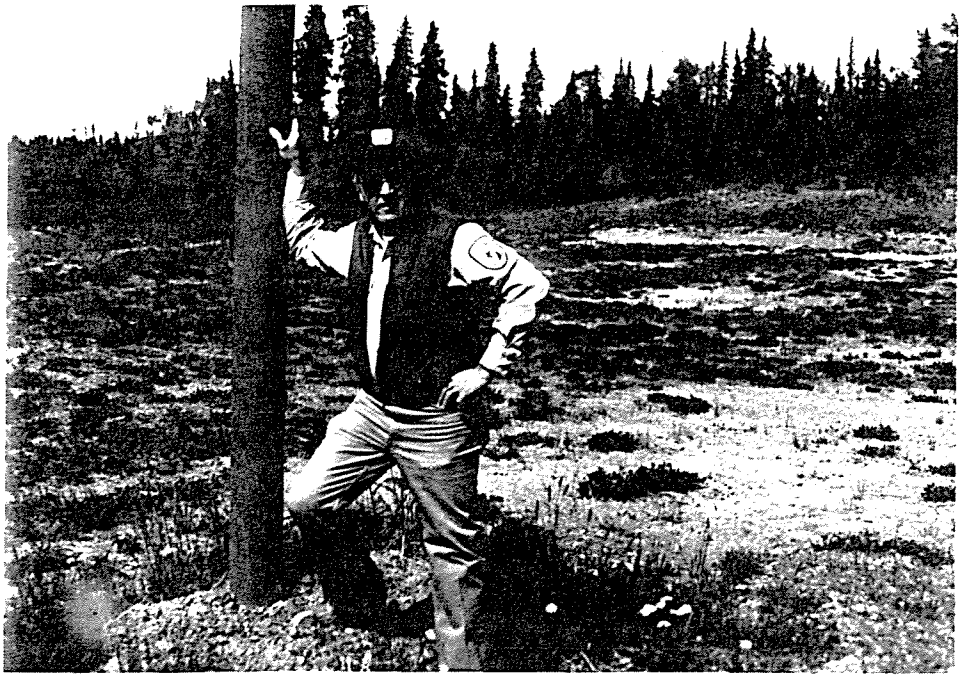
Nothing to report.

E. ADMINISTRATION

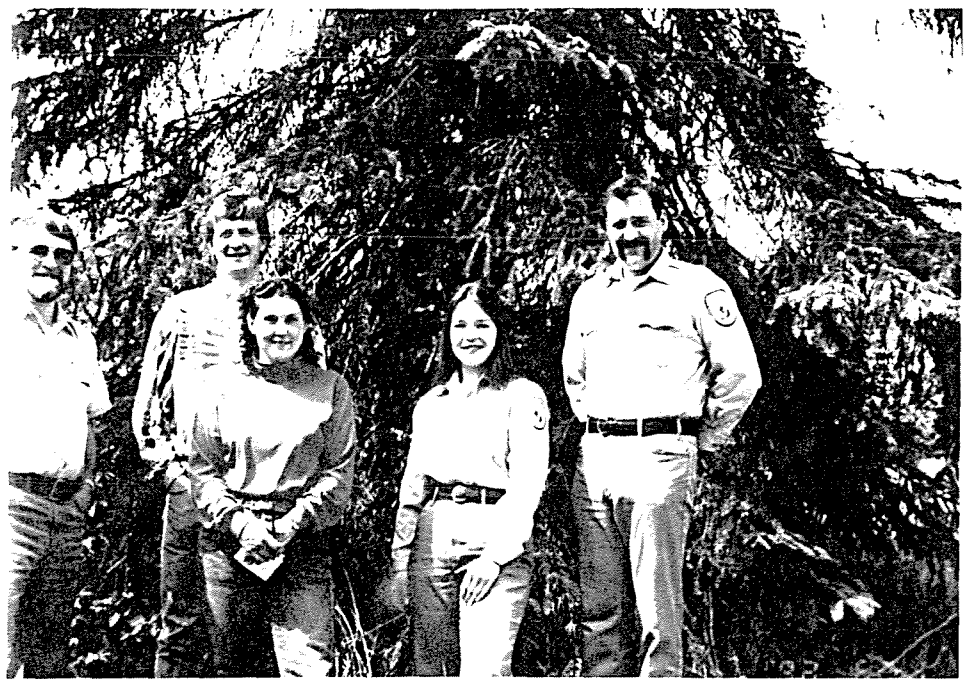
1. Personnel



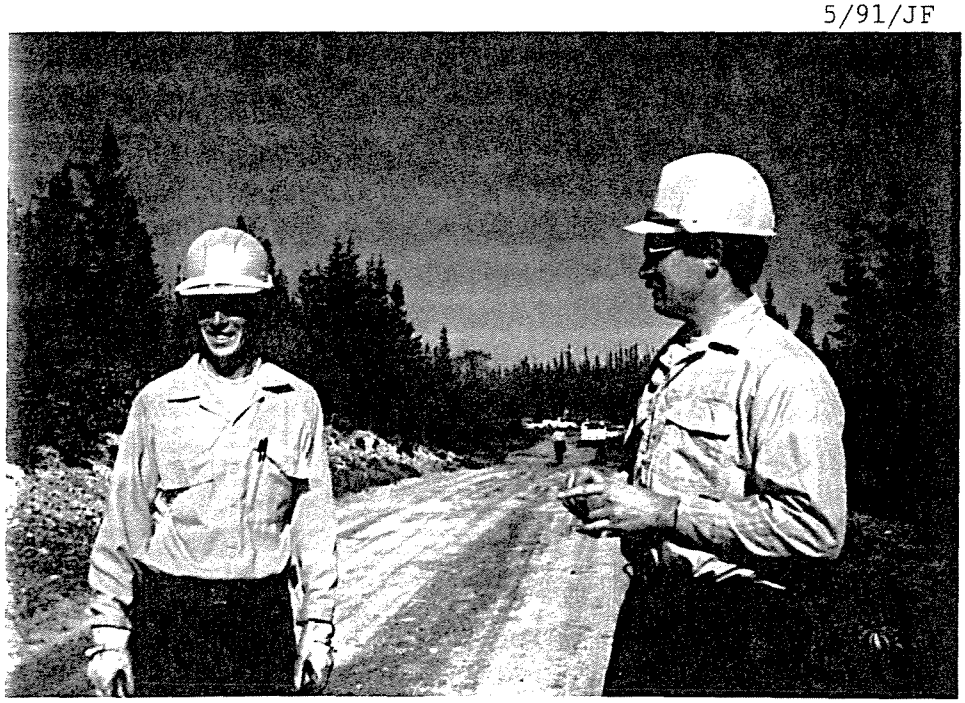
Management: Daniel Doshier (1) 5/91/JF



Management: Jim Frates (2) 5/91



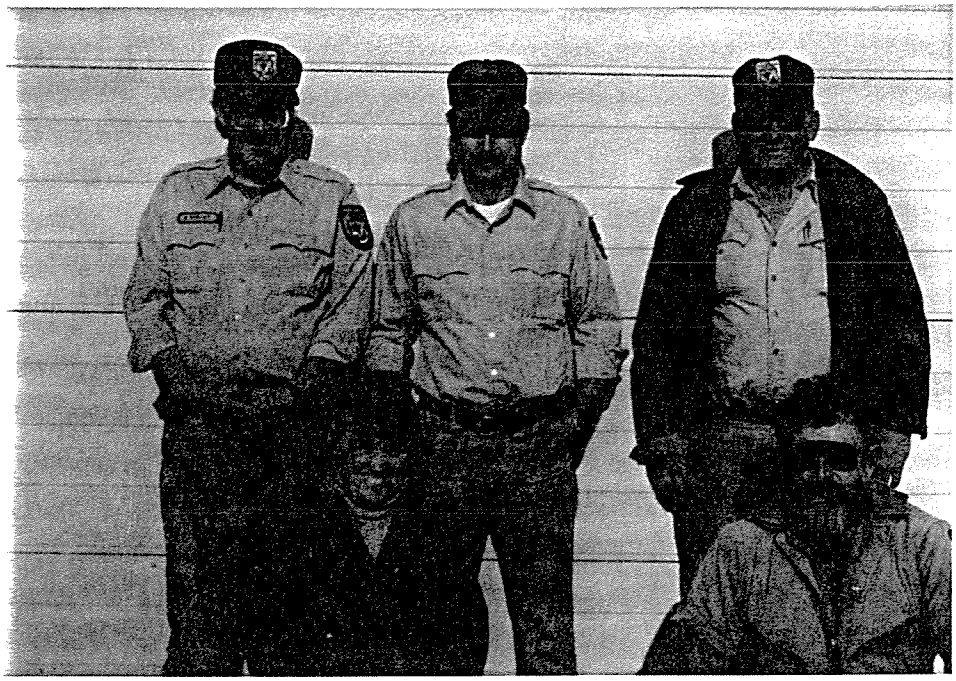
Biology: Ted Bailey (3), Burney Dunn (Volunteer), Diana Thomas (27), Elizabeth Jozwiak (9), Andy Loranger (8).
5/91/JF



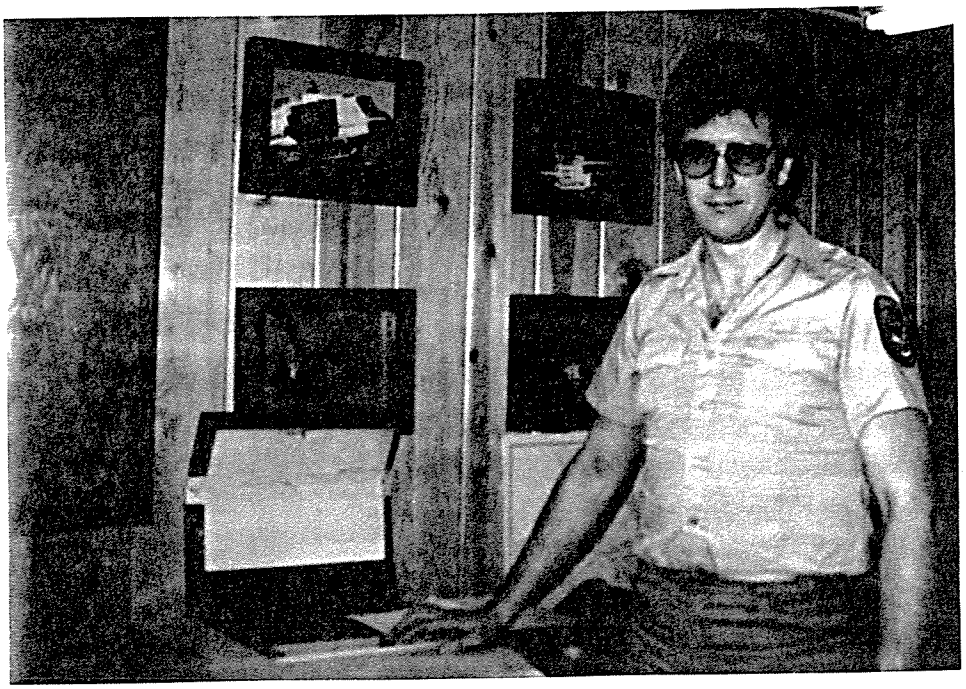
Biology: William Larned (5) and Richard McAvinchey (19)
5/91/JF

Public Use: Chris Johnson (17), Candace Ward (7), Rick Johnston (6), Emily Dekker-Fiala (EOD 1992), William Kent (4). 2/92/JF

Administration: Brenda Wise (16), Brenda Marsters (15), Deanne Nelson (14), Vivian McCain (13) 4/91/JF



Maintenance: Back Row: Brian Kemsley (30), "Al" O'Guinn (11), Dick Kivi (10), Front Row: Donna Bartman (32), Bud Marrs (31) 5/91/JF



Administration: Bob Winkelman (15) 3/91/JF

a. Permanent Personnel

Biological Technician Elizabeth Jozwiak left early in January for the University of Alaska, Fairbanks to take courses in anticipation of commencing a Masters degree program in wildlife science next fall.

Table 2. Listing of Permanent Personnel for the Kenai National Wildlife Refuge, 1991.

1.	Daniel W. Doshier	Refuge Manager	GM-14 PFT
2.	James E. Frates	Refuge Operations Specialist	GS-12 PFT
3.	Theodore N. Bailey	Fish & Wildlife Biologist	GS-12 PFT
4.	William C. Kent	Park Ranger	GS-12 PFT
5.	William W. Larned	Fire Management Officer (Pilot)	GS-12 PFT
6.	Richard K. Johnston	Park Ranger/Pilot	GS-11 PFT
7.	Candace D. Ward	Park Ranger	GS-09 PFT
8.	Andre J. Loranger	Wildlife Biologist	GS-11 PFT
9.	Elizabeth A. Jozwiak	Biological Technician	GS-07 PFT
10.	Richard D. Kivi	Equipment Operator	WG-10 PFT
11.	Elvin "Al" O'Guinn	Maintenance Mechanic	WG-10 PFT
12.	Vivian J. McCain	Budget Assistant	GS-07 PFT
15.	Robert B. Winkelman	Natural Resource Specialist	GS-09 PFT
14.	Deanne K. Nelson	Accounting Technician	GS-05 PFT
15.	Brenda E. Marsters	Refuge Clerk	GS-04 PPT
16.	Brenda B. Wise	Travel Clerk	GS-04 PFT
17.	Christopher G. Johnson	Refuge LE Officer	GS-07 PPT

On April 21, Supervisory Park Ranger Bill Kent arrived from the Klamath Basin National Wildlife Refuges to fill the position vacated when Cheryl Simpson left for Region 2, in July 1990. Bill is a welcome addition to the staff.

Bob Winkelman, staff Natural Resource Specialist since 1988, received a promotion and transfer to the Yukon Delta National Wildlife Refuge in mid-November. Bob's congeniality and "I'll do anything" attitude will certainly be missed by those of us having the privilege of working with him.

Bob and his wife, Marsha were given a rather traditional Kenai "send off" during an informal "ya'll come" noon mooseburger feed at the carpenter shop on Friday, November 15. In addition to the Refuge staff, personnel from Division of State Parks and Alaska Department of Fish and Game (ADF&G) also attended.

In a brief presentation following the meal, Bob was presented the traditional wooden carved "Moose by Marrs" (made by Carpenter Bud Marrs). The entire staff presented Bob with a hunting knife in addition to a few "spoof" gifts.

Bob began his assignment on the Kenai in 1988 as a refuge manager trainee and became involved in just about every facet of refuge operations during his three year tenure. Collectively, the Kenai staff wishes Bob and his family the very best at the Yukon Delta National Wildlife Refuge. We'll all "moose ya", Bob!

Bob Winkelman with his "Moose by Marrs". 11/91/JF

b. Temporary Personnel

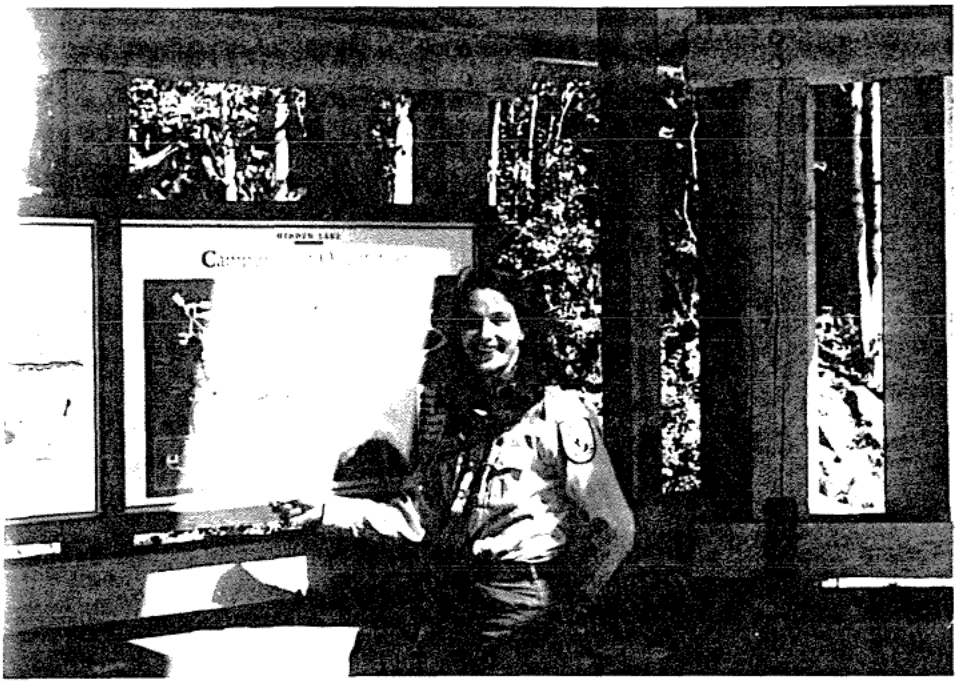
Table 3. Listing of the Temporary Personnel for the Kenai National Wildlife Refuge, 1991.

	EMPLOYEE	POSITION	GRADE
18.	Winthrop Staples III	Biol. Tech.	GS-05
19.	Richard J. McAvinchey	Biol. Tech.	GS-05
20.	Steven L. Hudson	Park Ranger	GS-05
21.	James R. Brickey	Park Ranger	GS-05
22.	Brent J. Richey	Park Ranger	GS-05
23.	Scott S. Slavik	Soc. Svcs. Ast	GS-05
24.	Jodie L. Setran	Park Ranger	GS-05
25.	John R. Gahr	Park Ranger	GS-05
26.	Terry D. Rude	Park Ranger	GS-05
27.	Diana R. Thomas	Biol. Tech	GS-05
28.	Joan M. Christian	Student Trainee	GS-04
29.	James M. Farrar	Laborer	WG-03
30.	Brian A. Kemsley	Laborer	WG-03
31.	Albert "Bud" Marrs	Carpenter	WG-09
32.	Donna M. Bartman	Laborer	WG-03

Table 4. Staff Breakdown from Fiscal Year 1985 to Fiscal Year 1991.

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
FY91	16	1	3	15	66

Full-time equivalent utilization for 1991 was 21.77



Park Ranger Jodie Setran provides information at Hidden Lake Campground, Kenai/Russian River and many high use areas during 1991. 7/91/RKJ

Table 5. Temporary Positions for 1986-1991

	1986	1987	1988	1989	1990	1991
Biological Aids & Technicians	2	3	5	7	4	3
Laborers & Carpenter	4	4	5	4	4	4
Park Rangers	5	5	7	6	4	6
YACC/YCC Staff	2	0	0	0	1	1
Clerk/Typist	0	1	1	0	0	0
Student Trainee	0	0	0	0	0	1
TOTAL	13	13	18	17	13	15

2. Youth Programs

The Youth Conservation Corps (YCC) performed excellent work for the Refuge this year under the direction of returning leader Scott Slavik. Five enrolles were on board June 17, and completed their Refuge work experience on August 9. We appreciate the work done by Bill Wolf, Les Crane, Justin

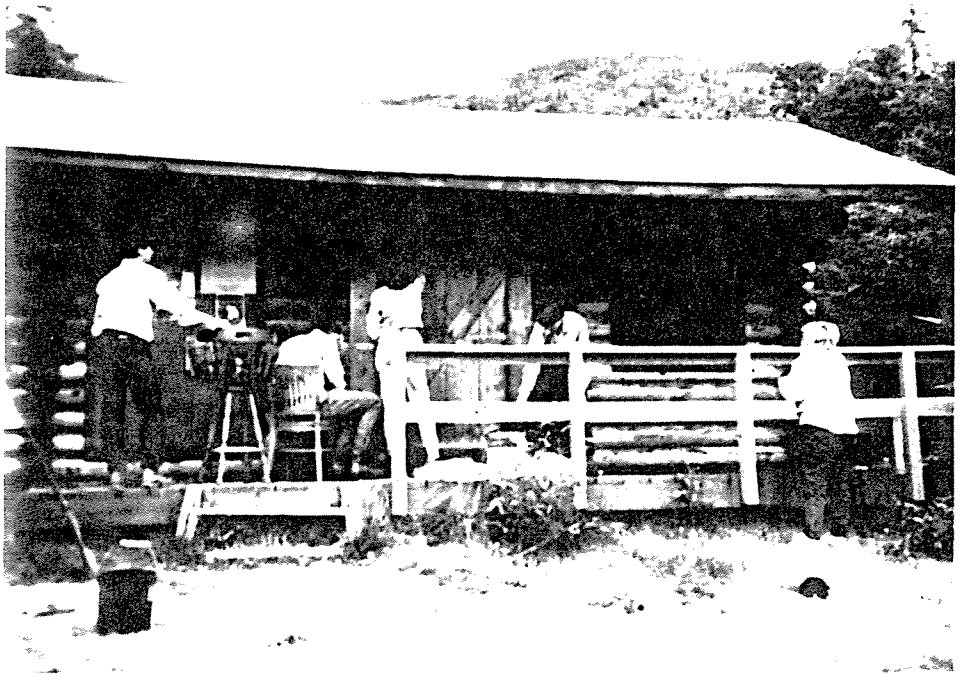
Adolf, Melissa Knight, and Laurie Adams, not to mention the smiles and fond remembrances they left with us.

Table 6 . 1991 YCC Work Projects

Project	Hours Worked	% of Total Hours
Trail Maint./Boardwalk Constr.	465	28%
Environmental Education	375	23%
Transport/Daily Preparation	175	11%
Orientation/Training/Safety	145	9%
Paint/Stain Facilities & Structures	115	7%
Biological Fieldwork	75	5%
Erosion Control/Bank Stabilization	60	4%
Litter Pickup & Removal	60	4%
Firebreak Line Construction	55	3%
Site Rehabilitation	40	3%
Landscaping/Revegetation	35	3%
TOTAL	1,600	100%

YCC Crew: Les Crane, Laurie Adams, Bill Wolf, Melissa Knight, Justin Adolf. 6/91/SS

YCC crew work on Swanson River Road. 6/91/SS



YCC crew help maintain the Visitor Contact Station.
6/91/SS

YCC crew helping at the new pull out where the Pothole Lake Fire was. 7/91/SS

Four spike camps were an exciting and "routine-breaking" respite from the normal duties of the enrolles. Each camp offered a unique wilderness experience while providing a wide variety of work projects and environmental education opportunities. The many logistical concerns of each camp also provided a chance for the enrolles to participate in the work planning, camp meals, and equipment.

Working, eating, and living together in close quarters for extended periods was challenging, to say the least. Everyone came through the experiences with new respect for each other and group responsibilities.

3. Other Manpower Programs

Nothing to report.

4. Volunteer Program

Kenai's volunteer program, which involved 66 people and thousands of volunteer hours in 1991, is comprised of six components: local volunteers, seasonal volunteers, Student Conservation Association (SCA) Resource Assistants, SCA high school programs, local service groups, and campground hosts.

Volunteers contributed 13,787 hours of service to Kenai National Wildlife Refuge in 1991, the equivalent of over six and one-half full time staff positions. Of the total, the Student Conservation Association Program accounted for well over half of the work hours with 8,600 hours of service.

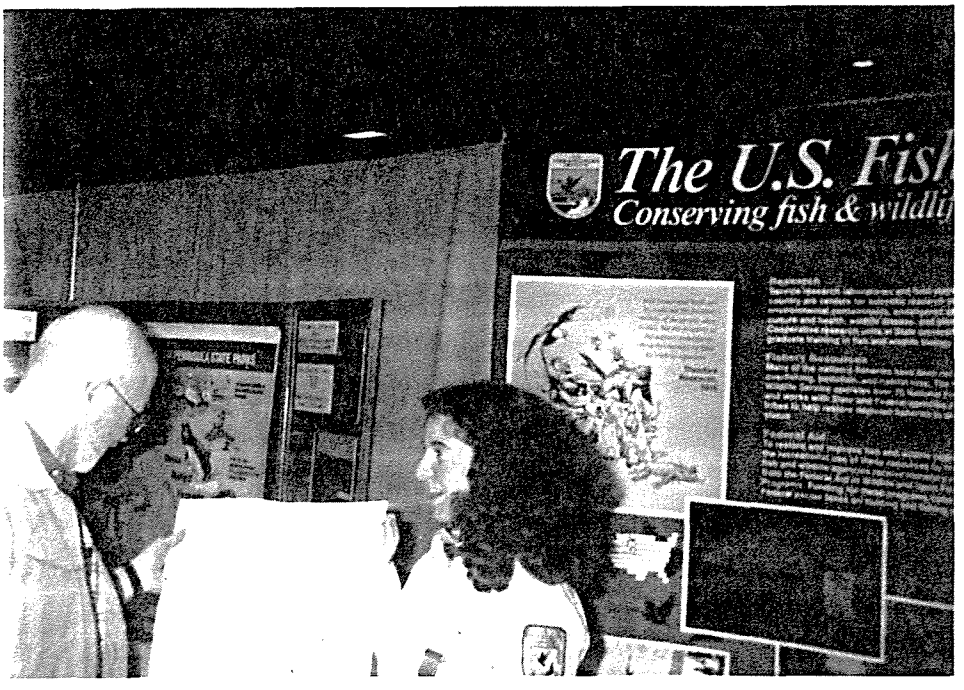
a. Local Volunteers

Local volunteers are a vital component of the Refuge program assisting in a variety of valuable projects. A core group of ten local volunteers, contributing a minimum of twelve hours of service per month, operate the Refuge Visitor Center and cooperating association sales outlet, as well as hosting our weekend wildlife media programs. These volunteers contribute significantly to a high level of public service that we could not provide without their assistance. In addition, local volunteers assist in biological survey projects and in rehabilitating injured wildlife.

In return for their efforts, local volunteers receive the following forms of recognition and appreciation:

* Free membership in the Alaska Natural History Association
* 15 percent discount on all cooperating association sales items
* Awards based on hours of volunteer service: including Refuge T-shirts, posters, wildlife books, and air flights over the Refuge
* Specialized volunteer awards and certificates
* Volunteer recognition luncheons and pizza nights

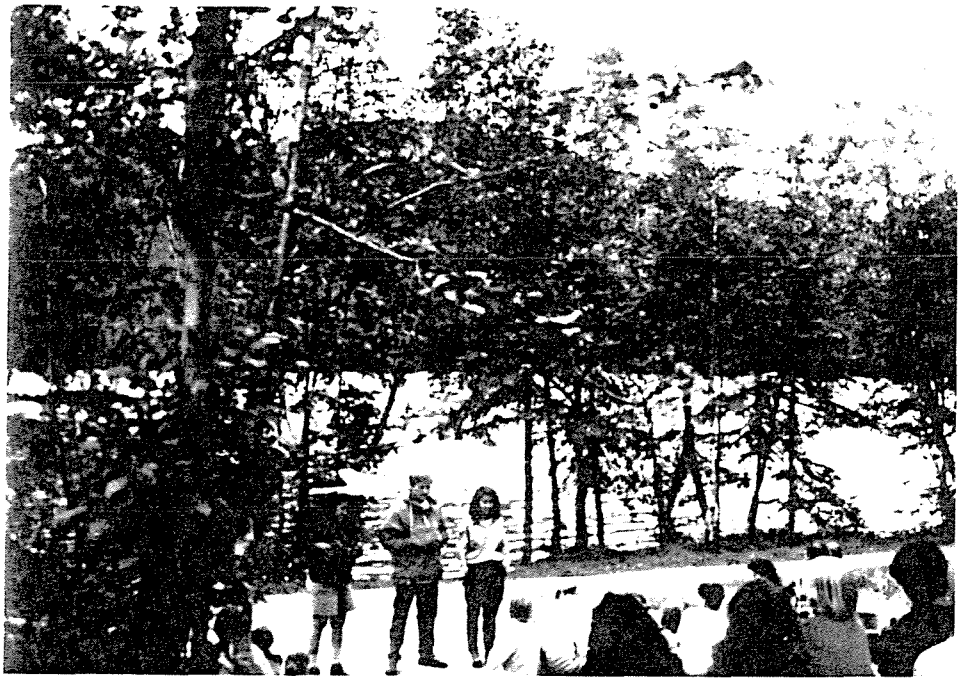
b. Seasonal Volunteers



SCA Gunter explains Refuge aircraft regulations to a local resident at the Peninsula Sportsmen Show. 4/9/CJ

SCAs Rosenblum, Barto, and Mouillesseaux operated visitor facilities and led interpretive programs.
7/9/CW

SCA Mouillesseaux leads a nature walk group in the activity "Habitat Lap Sit". 7/91/CW



SCA's Mouillesseaux, Barto, and Rosenblum lead a campfire program at Hidden Lake. 7/91/CW

Seasonal volunteers commit to at least three months of continuous 40 hour per-week service. Generally, these volunteers are recruited through the Alaska Region Volunteer Program coordinated by Bill Kirk at the Regional Office in Anchorage. Seasonal volunteers receive free housing, transportation, and a per diem subsistence allowance for food and essentials. In 1991, seasonal volunteers participated primarily in biological field work, often in conjunction with pursuing graduate degrees in wildlife biology.

c. Student Conservation Association Resource Assistant Program

The Student Conservation Association Resource Assistant Program continues to expand and remains the backbone of the Refuge's volunteer program. SCA resource assistants work with the Refuge for twelve-to-sixteen-week terms, completing a variety of operational tasks while learning about resource agency careers.

SCA resource assistants receive a small subsistence allowance and round trip transportation to the Refuge. In working with the SCA program since 1985, we have been extremely fortunate to have consistently high caliber resource assistants, who accomplish quality work.

In 1991, eleven SCA resource assistants and eight SCA high school trail crew collectively contributed over 8600 work hours. Projects included:

Visitor Center and Visitor Contact Station operation, conducting interpretive and environmental education programs, operating the Hidden Creek Personal Dipnet Fishery Program, trail brushing and rerouting, wetland rehabilitation through boardwalk construction on canoe portages, patrol of foot and canoe trials, litter pick-up and campground maintenance, moose hunter check station operation, biological data collection, and wildlife live-trapping and radio-collaring.

Through the awarding of two Challenge Grants for wetland rehabilitation and trail maintenance, the Refuge was able to fund the three SCA backcountry resource assistants and the eight SCA high school trail crew positions. In addition to these new programs, the Refuge added a fall SCA resource assistant position.

The contributions of these new positions were extremely significant. The Refuge is pursuing Challenge Grants to continue much needed future trail rehabilitation projects. Due to the success of the fall SCA position, the Refuge has adopted the position as an integral part of the basic Refuge SCA program.

d. Student Conservation Association (SCA)

The Refuge enlisted the help of the Student Conservation Association (SCA) high school program to provide the majority of the labor for a Challenge Grant project within the Swan Lake/Swanson River canoe system. The objective of the project was to construct boardwalk sections along canoe portage trails in order to protect sensitive wetlands and provide safe, environmentally-sound routes between the canoe system lakes.

SCA provided a ten-person crew which donated approximately 3500 volunteer hours in support of the project. Funding for the project came from the Wetland Initiative/Challenge Grant program in the amount of $40,000. SCA provided $9000 in matching funds for field support. Boy Scout troops were also enlisted to help, and provided an additional 400 hours of volunteer assistance with the canoe system project.

Initial planning for the project began in March when SCA was selected as the primary volunteer organization. Park Ranger/Pilot Johnston corresponded with SCA leaders to organize the cooperative project prior to their arrival in Alaska. On-site planning began on June 11 and 12 when Johnston and SCA Coordinator Jay Satz met at Refuge Headquarters and inspected planned project areas along the Swan Lake canoe route. Satz also met briefly with several SCA Resource Assistants who had recently begun their summer assignments at the Refuge.

The project began on June 14 when Refuge crews transported over 60,000 pounds of building materials from the Headquarters maintenance yard to a helicopter staging area near the Moose Research Center. On June 15, Refuge crews sorted and organized bundles of materials to be flown to 16 locations in the Swan Lake and Swanson River canoe system. A medium-sized helicopter, on standby at the State Division of Forestry, was used to sling

and transport the materials. Forestry and Refuge crews provided support at the helicopter base and at various field locations. Johnston flew crews to remote locations in order to receive the loads. Park Ranger Brent Richey calculated load sizes and was overall foreman of the operation.

The State Forestry crew and helicopter were provided cost free to the Refuge. The helicopter flew over seven hours of support, and the Refuge incurred only an aviation fuel bill of $800.

Refuge staff worked with SCA high school work group leaders to coordinate their groups's activities in the canoe system. Training and orientation included Refuge support, appropriate tools, safety, logistics, bear safety, and firearms use. Park Ranger Kent (FWS firearms instructor) provided trained and qualified SCA leaders in shotgun use.

Actual work on-site began July 14. The project involved trail preparation, minor rerouting, and removal of deteriorating corduroy sections. The majority of the work entailed cutting, fitting, leveling, and placing rustic, treated planking along wet sections of portage trails. Several small docks and landing areas were also constructed. Erosion control structures were developed along some portages.

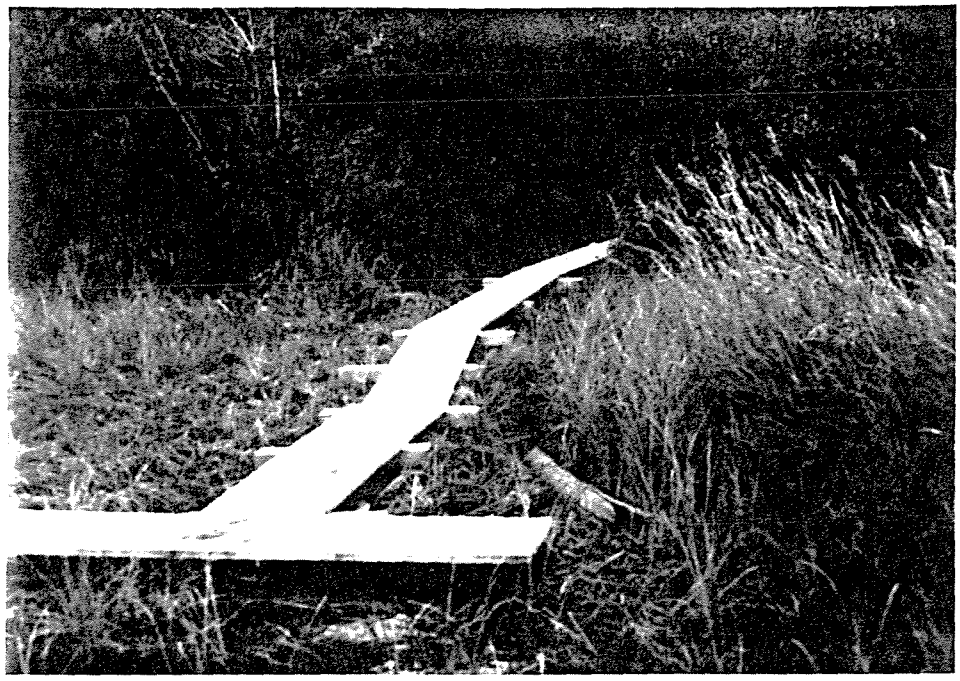
The SCA work group initially based out of the Outdoor Education Center and completed two boardwalk sections in the Canoe Lakes chain. After moving their base camp to Spruce Lake, they completed the Contact Lake-to-Martin Lake portage and the Spruce Lake portages. By the end of July, work shifted to the Cygnet Lake-to-Swan Lake portage, and the base camp was moved to Swan Lake. From there they completed the Moose River and Seven Lakes portions of the project.

By the project's end, fifteen separate portage boardwalk sections had been constructed. The SCA work group constructed approximately 5000 feet of boardwalk portage, and the Boy Scouts completed an additional 500 feet. Boy Scouts of America were also enlisted to provide additional volunteer assistance with the project. Boy Scout Troops completed 500 feet of portage work and volunteered approximately 400 volunteer hours.

Refuge staff worked with SCA high school work group leaders to coordinate their group's activities in the Canoe Trail System. Topics covered included Refuge support, appropriate tools, safety, logistics, bear safety, and firearms use. Park Ranger Kent (Fish and Wildlife firearms instructor) provided orientation and qualification to the leaders on shotguns. The project work began on July 14 and by the project's end fifteen portage projects had been completed. The group based out of the Swanson River Environmental Education Site and completed two portage boardwalk projects in the Canoe Lakes Chain. After moving their base camp to Spruce Lake, they completed the Contact Lake to Martin Lake Portage and the Spruce Lake Portages. By the end of July work shifted to Cygnet Lake to Swan Lake Portage and the base camp moved to Swan Lake. From there they completed the Moose River and Seven Lakes projects.

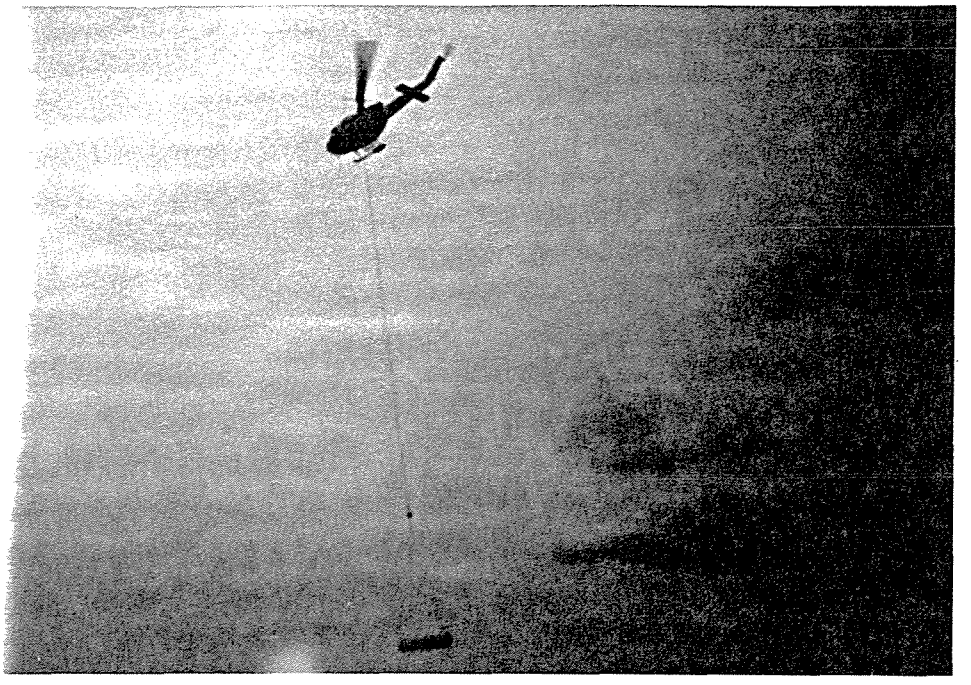
SCA high school volunteers and their leaders take a break at Swan Lake while constructing boardwalk trail. 7/91/RJ

Waterbars were constructed by SCA on the Swan Lake to Moose River portage in order to prevent erosion along a steep section of trail. 7/91/RJ



Boardwalk planking and landings were constructed along the Swan Lake Canoe Route portage in order to protect sensitive wet areas. 7/91/RJ

Johnston briefs support crew prior to air lifting bundles of building materials to remote sites. 7/91/RJ



Division of Forestry standby helicopter airlifted 60,000 pounds of building materials to Swan Lake Canoe Route sites. 5/91/RJ

The project required trail preparation, minor re-routing and removal of deteriorating corduroy sections. The primary aspect of the project required cutting, fitting, leveling, and placing rustic treated planking along wet sections of portages. Several small docks and landing areas were also constructed. Erosion control structures were developed on these portages.

e. Local Service Groups

During spring and summer 1991, several youth service organizations - such as Scouts, 4-H, Campfire, and church youth volunteered for work projects associated with litter pick-up, campground maintenance, and canoe trail portage construction and rehabilitation. Often groups visited the Refuge Visitor Center for training in minimum impact camping and bear safety prior to beginning their service projects.

A boy scout troop prepares to construct boardwalk along Konchanee to Cygnet Lake Trail. 6/91/RJ

f. Campground Hosts

The campground host program slightly expanded in 1991 with the addition of a new host couple at Lower Skilak Campground for a portion of the summer. As campgrounds are gradually rehabilitated, host positions become increasingly important in providing visitor information, collecting fees, and acting as the "eyes and ears" of the campground in alerting rangers to safety and law enforcement problems.

5. Funding

Five YCC youth and one leader were hired for $10,000 to perform campground and trail maintenance. Contaminant funds of $1,000 were used to take samples for the Pentachlorophenol Operations (7103) Project at the Moose Research Center and $33,000 was used for soil clean-up at the Kenai Airport where an underground fuel tank had been removed. "America The Beautiful" funds in the amount of $45,000 were used to rehabilitate Swanson River canoe system portages and $3,000 for the Wood Frog Distribution Survey. The Hidden Lake dipnet fishery was funded for $46,000. Maintenance Management System projects were funded as follows: $41,000 to replace obsolete computers, $39,000 for replacement of three vehicles and $43,000 for replacing Visitor Center displays and lighting. The $1,000,000 for the Skilak Wildlife Recreation Area will be used to accomplish the upgrading and expansion of Upper Skilak Campground.

Table 7. Kenai National Wildlife Refuge Funds, Fiscal Year 1987 through 1991.

	Fiscal Year				
Operating and Maintenance Funds (Thousands of Dollars):	1987	1988	1989	1990	1991
Wildlife Funds	1,087	1,324	1,181	1,093.3	1,417
Expense for Sales	82	82	82	81	90
Small ARMM*	130	0	0	0	
Fire Presuppression and Preparedness	0	0	0	233	139
Wildlife Enforcement	0	0	0	_	36
Subtotal	1,299	1,406	1,263	1,407.3	1,648
Specific Project Funds (Thousands of Dollars):					
YCC Funds	0	0	0	10	10
Large ARMM*	0	71	0	0	0
Refuge Resource Problem Contaminants	75	50	40	30	34
Refuge Resource Problem ATB	0	42	168	0	48
Refuge Resource Problem H.L.	0	0	0	0	46
Maint. Management System	0	0	0	80.5	116
Skilak Wildlife Recreation Area	**1,500	**697	**0	**0	**1,000
Subtotal	1,575	860	208	120.5	1,254
TOTAL	2,874	2,266	1,471	1527.8	2,902

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

6. Safety

This past year, 1991, was one of the "safest" years on record - not only for Refuge employees but the general public as well. We would like to attribute this past year's success to our constant effort to raise the safety consciousness of all employees, but at the same time recognize that fate, circumstance and lady luck played an equally important role. With nearly 40,000 staff hours of effort expended in 1991, our casualty count included one thumb caught in a vehicle door, lower back strain, and a case of "hives" caused by an insect bite. Although painful, none of the "incidents" resulted in lost work time. Collectively, Refuge employees

drove a total of 209,000 miles in 1991 without a single vehicle accident - a record of which we are justifiably proud!

On August 13, a 60-year-old Anchorage resident [redacted] suffered a heart attack shortly after having participated in the Hidden Creek Dipnet Fishery. Despite a valiant on-site CPR effort, the victim died prior to the paramedics' arrival.

In late October, a Cessna 152 [redacted] of Anchorage, made an emergency landing on the north gas line air strip. While no injuries occurred, the plane received considerable damage and was later air lifted by helicopter to Anchorage.

On the evening of December 13, a twin engine Piper commuter plane operated by SouthCentral Air disappeared on a flight from Kodiak to Kenai with only the pilot aboard. An intensive air and ground search was conducted over the next two-week period centering in the Caribou Hills and the area southwest of Tustumena Lake in the southern part of the Refuge. Rangers Rick Johnston and Chris Johnson participated in the ground search on February 15 and 16. Heavy snow in the search area immediately following the plane's disappearance hampered efforts to locate the aircraft, and to date the plane and pilot remain on the "missing" list. Moderate to severe turbulence and icing conditions were reported in the area at the time of the plane's disappearance.

7. Technical Assistance

Fire Management Officer/Pilot Larned spent three days in mid-January working in Anchorage with Innoko National Wildlife Refuge Biologist Bob Skinner and Information Resource Management Computer Analyst Jerry Minnick, using Landsat Imagery and GIS computer technology to customize an Innoko Refuge habitat map to use in surveying moose and other wildlife. This provided an excellent opportunity for Bill to become familiar with GIS capabilities and procedures for future habitat mapping on the Kenai.

8. Other Items

It is probably a rather uncommon occurrence in which a decision results in immediate and positive behavioral changes to an entire refuge office staff. But the decision to replace the old cantankerous, frequently unpredictable and always unreliable "Copier from Hell" was, perhaps, one of the more significant staff morale boosters in recent years. Actually, the decision to replace the thing far exceeded the availability of funds - by several years! The new high tech, computerized, whiz-bang Ricoh FT 5540 desktop finally arrived in October and immediately became the office's centerpiece of affection.

Peace and tranquility soon replaced the once frequent exhibition of human emotions which only a jammed or otherwise uncooperative copier incites. Gone are the hostile gatherings encircling the old copier and the muted (and sometimes not so muted) "expletives deleted" and professions of

profanity uttered by normally mild-mannered, sane and rational adults. In retrospect, the old copier undoubtedly served some therapeutic value by providing a target for emotional release. But then, what are refuge managers and assistants for ?

F. HABITAT MANAGEMENT

1. General

Nothing to report.

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 preclude the use of fire, or as a pre-burn treatment to help accomplish burning objectives.

In 1989, a small timber harvest was initiated as 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, the operator could not complete the sale due to heavy snow and volcanic ash, so the permit was extended until April 1991. Equipment breakdowns precluded him from making any progress during fall and winter of 1990, but he hoped to complete the sale in early 1991. When the contract period ended, about 10 acres had been harvested and rehabilitation efforts were judged as satisfactory. There will likely be no further timber harvest in the area before it is burned.

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 wood 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 in late September after Equipment Operator Dick Kivi bladed a new access trail, which made additional birch and spruce firewood available. Forty-four permits were issued in calendar year 1991, compared with 50 in 1990 and 66 in 1989.

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 not favorable for accessing the trees this year due to heavy snow accumulation, and no commercial permits were issued or requested.

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 hunting. Four permittees harvested an unreported number of poles this year, compared to five pole harvesters in 1989.

In July and August, 50 vegetation sampling plots were conducted at each of ten permanent plot markers within the 1984 Skilak Loop I prescribed burn. Results of this effort indicate that aspen root suckers predominate in the shrub layer, with an estimated density of 8696 stems per hectare. The regrowth and browse utilization table below indicates that moose are avoiding aspen and birch in favor of the much less abundant willows for winter forage. So far the willow plants seem to be able to maintain their vigor in spite of this relentless browsing pressure.

Table 8. Vegetative regrowth and utilization of major woody browse species, Skilak Loop I (1984) Prescribed Burn, 1991.

Browse species	Density stems/ha.	Average ht. (cm.)	Percent browsed	Percent with >75% of twigs browsed
Aspen	8696	87	75	19
Paper birch	1784	70	79	3
Willows	944	86	98	68

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 1991 fire season got off to a deceptively modest start when, on May 19, a small fire was spotted burning in a limited suppression area in a remote portion of the Refuge classified as wilderness. Apparently started accidently by backcountry Refuge visitors, the fire was monitored for two days and appeared to be confined by natural fuelbreaks. Surveillance on the second day showed only smoldering with no additional spread. On the third day, however, a surveillance flight by Fire Management Officer/Pilot Larned revealed that a strong wind had caused numerous spotfires, resulting in a narrow linear spread of about one mile.

Larned then called State Forestry from the Office of Aircraft Services (OAS) in Anchorage and recommended that at least indirect action be taken to prevent the spread of the fire into the Russian River drainage. Suppression action was initiated that evening as a type III incident. Incident Commander Dean Noble flew the fire to size up the situation and formulate an action plan. During this flight it was observed that a strong southwesterly wind was causing spread through some heavy live and dead spruce fuels around Pothole Lake. A second fire front approached within 1/2 mile of the Russian River.

Over the next few days the "Pothole Lake Fire" was upgraded to a class II and finally a class I incident as it grew larger and the political and operational complexity increased. Continuing very dry and windy conditions resulted in creeping and spotting spread plus another major run to the northwest, which ultimately crossed the Kenai River and Skilak Loop Road where it hit the 1947 Burn and laid down. This run, which occurred on

Memorial Day Weekend, caused Refuge and fire personnel to evacuate the Skilak Loop Recreation Area, which was nearly packed with hikers, boaters and campers. Another highlight of the fire was when, on May 24, an indirect action was attempted in the Russian River Canyon about two miles from the fire's edge. A fire line was constructed using hand tools and fireline explosives, and a burnout was attempted toward the main fire. Just when all seemed to be going well, a strong wind shift caused spotting behind the line in a large spruce stand, and a blowup with a tremendous firewhorl quickly developed. The resulting smoke column was very visible from the Sterling Highway and caused great concern among Cooper Landing residents, to put it mildly.

The next day heavy duty direct action by hand crews along with favorable weather contained this escape, with no further excitement in that portion of the fire.

By month's end, the Pothole Lake Fire was down to a messy mopup show, at a final size of 7900 acres. High fire danger persisted into June with a general ban in effect for open burning on the Kenai Peninsula. The fire was patrolled and monitored until mid-July and was officially declared out on October 31, 1991, at 1600 hours.

Memorial Day weekend traffic on the Sterling Highway held up due to the Pothole Lake Fire. 5/91/ EJ

Successful burnout on north side of Russian River.
5/91/WL

Evacuation of fire crews after flare-up jumped the line.
5/91/WL

The Skilak run eventually crosses the Kenai River and up into the Skilak Loop Road. 5/91/WL

Aftermath of Pothole Lake Fire. 6/91/EJ

Interpretive signs will help to explain the natural role of fire in the forest. 7/91/WL

10. Pest Control

Since 1970, a spreading infestation of spruce bark beetles has killed trees on an estimated 700,000 acres (about 35 percent) of forested lands on the Kenai Peninsula. About 150,000 acres have been affected in the past five years. Unusually warm spring and early summer weather conditions for three consecutive years have helped to increase bark beetle populations by decreasing spruce beetle development times from two to one year. Warm, dry spring and summer weather conditions may have increased spruce susceptibility to spruce beetle attack by decreasing host defense mechanisms, mainly resin exudation.

On the Refuge, the area of largest increase was from Point Possession south to Skilak Lake (approximate total = 75,000 acres). Further south a 35,000 acre outbreak detected in 1990 between Tustumena Lake and Clam Gulch increased to 55,346 acres in 1991. Light scattered spruce beetle activity was again apparent along the Fox River (approximately 2,000 acres).

The majority of spruce mortality on the Refuge occurs in designated wilderness and in research natural areas. Since the outbreak appears to be a natural one caused primarily by global weather patterns, local climate and age of spruce forests, little aside from removing dangerous trees

alongside the highways, trailheads, and in campgrounds can be done to address the issue.

11. Water Rights

Nothing to report.

12. Wilderness and Special Areas

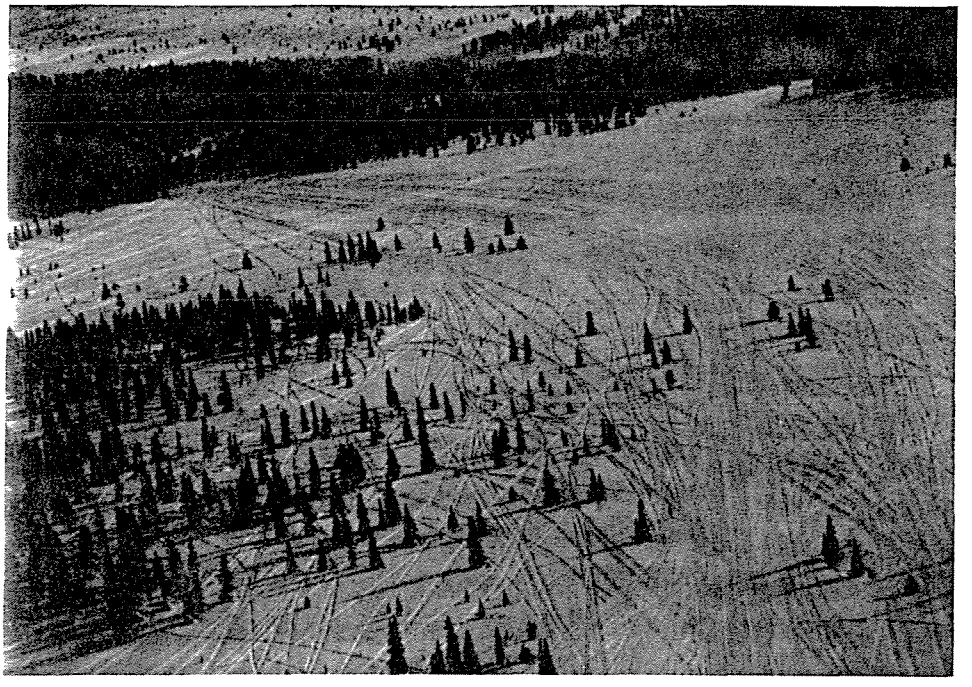
Annual work on several trails within Kenai Wilderness occurred during 1991, including maintenance conducted on Fuller Lakes, Skyline, Surprise Creek, Emma Lake trails, Swan Lake, and Swanson River canoe trails, and Funny River horse trail. Portages in the Swan Lake and Swanson River Canoe Trails received major boardwalk work. Approximately 10,000 linear feet of plank was placed in several wet and damaged areas. Within a few years the planking should be covered with local vegetation and appear relatively natural; damaged areas should revegetate within two years. In all twenty-nine portages and canoe landing lake shores were protected as a result of the project.

Several mineral assessment permits were issued within Kenai Wilderness during 1991 that involved helicopter landings. Conditions were included to minimize negative affects of the activities allowed in ANILCA Section 1010.

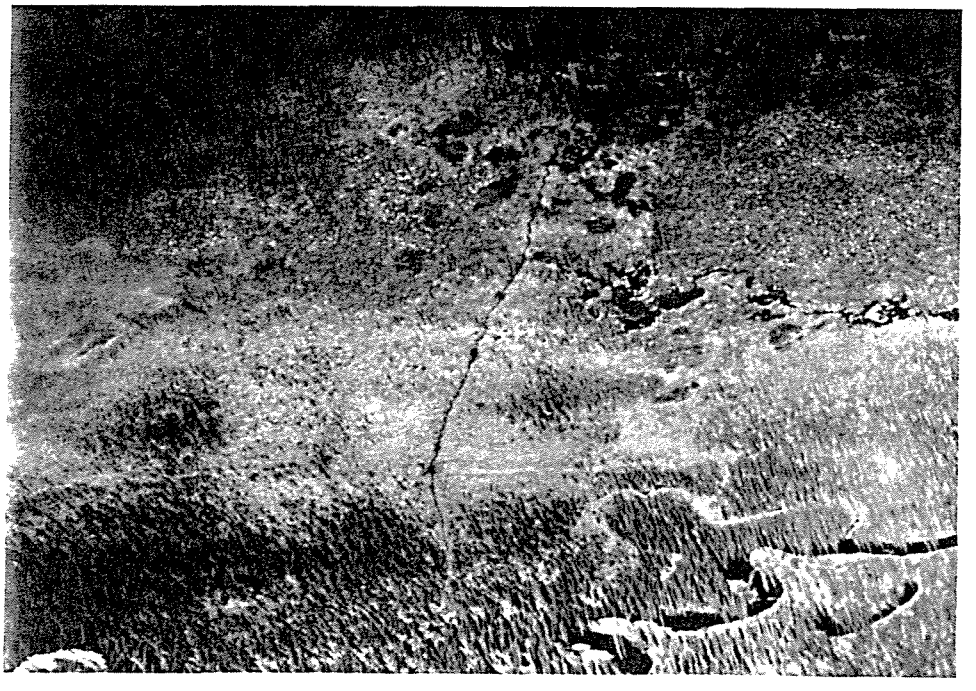
A permit for three major egg takes, salmon escapement, enumeration, fry release and various monitoring activities was authorized for salmon investigation on Tustumena Lake within Kenai Wilderness. Stipulations were included to minimize any impacts on the wilderness resource. These included guidelines for field camps, egg take, location diversity, and restricting overall stocking numbers.

A permit was reissued to the F.R.E.D Division of Alaska Department of Fish and Game to conduct sockeye salmon egg take for Goat Creek-bound sockeye salmon at Upper Russian Lake. The eggs were to provide hatchery stock for an early run of salmon at Bear Creek near Seward. Salmon eggs taken during the previous year experienced an extremely poor hatchery survival rate. The egg take targets salmon from the early run Russian River sockeye salmon. The area is located within a Refuge research natural area (RNA) in addition to wilderness lands. Sockeye salmon were specifically discussed in the RNA proclamation. Although the project appears to be taking a harvestable surplus of salmon, it has raised significant concerns with the Refuge regarding its consistency with the area's wilderness and RNA status. Stipulations designed to prevent conflict with brown bear and other values were again included.

Mechanized access (snowmobile, motorboats, airplanes) allowed in Kenai Wilderness and salmon enhancement continue to be the most significant issues related to wilderness management that the Refuge regularly deals with.



The compatibility of snowmobile use within Kenai Wilderness came into question during 1991 as recreational snowmobiling increased. 5/91/RJ



An explosive fireline was put in within Kenai Wilderness and the Russian River during suppression activities at the Pothole Lake Fire. 5/91/RJ

Air quality over Refuge and wilderness lands is also a growing concern. Although Refuge air is not Class I, as are several refuge wilderness areas designated prior to ANILCA (e.g. Tuxedni National Wildlife Refuge), it is Class II with a non-degradation standard, which for all practical purposes makes it nearly the same standard as Class I. During clear cold weather, a brown haze is regularly visible over Cook Inlet and the northern lowlands of the Refuge. Such a visible haze seen increasingly in recent years may be cause for future monitoring and evaluation of ongoing activities.

The amount and character of recreational snowmobiling continues to be of concern to the Refuge within the Caribou Hills. Alaska Department of Natural Resources (DNR) meetings provided the Refuge the opportunity to explain that any snowmobile use within the Refuges and Kenai Wilderness boundary must be for traditional purposes. Thousands of snowmobile use days appear to be occurring in the Caribou Hills alpine area, primarily for nontraditional purposes.

The Pothole Lake Fire, which was believed to be caused by a careless hunter, burned approximately 8400 acres. Nearly 7900 are within Kenai Wilderness. Fireline activities were monitored and crews were briefed so that suppression activities would have a minimal effect on the wilderness resource. Approximately twenty miles of handline was put in the Kenai Wilderness. All steep line areas were waterbarred and rehabilitated to some extent prior to demobilization.

Fireline explosives were used to create a fireline within a wetland area in Sections 20 and 27 in the Russian River Valley within Kenai Wilderness in order to prevent a backfire from traveling down valley. The line left a two-to three-feet wide straight trench across the valley floor. Crews attempted to rehabilitate the line before demobilizing, but it remained visible due to the nature of the explosive charge. The line's natural rehabilitation will be monitored for necessary additional rehabilitation work.

13. WPA Easement Monitoring

Nothing to report.

G. WILDLIFE

1. Wildlife Diversity

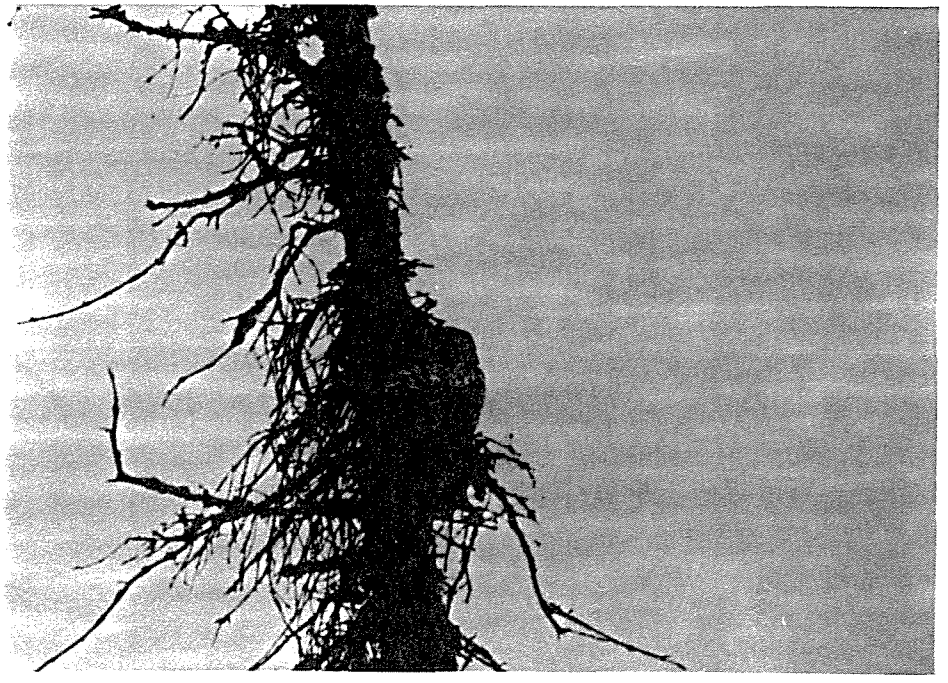
One of the most significant impacts on forest communities and wildlife on the Refuge in recent years has been the mortality of mature spruce by the spruce bark beetle (Dendroctonus rufipennis). These small insects have affected an estimated 700,000 acres or 35 percent of the forested land on the Kenai Peninsula. The changes in wildlife communities from spruce mortality, opening of the forest canopy, exposure of the forest floor to sunlight and increased temperatures, and the increased amount of deadfalls and snags are unknown.

2. Endangered and/or Threatened Species

No known endangered or threatened species were observed on the Refuge during 1991.

3. Waterfowl

Systematic surveys of waterfowl on the Refuge in 1991 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.



This adult hawk owl was observed regularly along the Marathon Road near the Beaver Creek Gas Field in June.
6/91/AJL

Refuge staff coordinated with the Division of Migratory Bird Management (MBM) and participated in the Alaska Statewide Waterfowl Production Survey. Twenty-four 1 mi^2 survey plots in Kenai-Susitna Production Area were randomly selected and surveyed by helicopter for the first time in 1991. Results were submitted to MBM, Juneau for inclusion in the calculation of the statewide waterfowl production estimate.

Fire Management Officer/Pilot Larned participated for the sixth and final year in a study being conducted by MBM, aimed at deriving visibility correction factors for 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.

Wildlife Biologist Loranger assisted MBM personnel during duck banding activities in upper Cook Inlet in August. He also attended shotgunning/ballistics expert Tom Roster's Introductory Steel Shot Seminar at Winchester/Olin's Nilo Farms in East Alton, Illinois. Region 7, in cooperation with the Alaska Department of Fish and Game, sponsored educational seminars on the use of steel shot throughout the State in 1991, the first year of mandatory steel shot regulations for waterfowl hunting in Alaska. Loranger presented clinics in Nome, Barrow, and Fairbanks.

a. Trumpeter Swans

Table 9. Summary of nesting and early and late productivity swan surveys on and adjacent to the Kenai National Wildlife Refuge, 1991.

	Survey		
Attribute	Nesting	Early Productivity	Late Productivity
Single Swans	2	0	4
Pairs	18	7	19
Flocked Swans	9	0	10
Single + Nest	2	-	-
Pair + Nest	30	-	-
Tot. Nesting Territories	37	27	27[1]
Single + Brood	1	2	3
Pair + Brood	4	25	24
Total Broods	5	27	27
Total Adults	118	68	103
Total Cygnets	26	94	86
Avg. Brood Size	5.2	3.5	3.2
Total Swans	144	162	189

[1] Includes three nesting territories with pair + brood not observed during earlier surveys.

Table 10. Trumpeter swan nesting locations and productivity on and adjacent to the Kenai National Wildlife Refuge, 1991.

Location	Wilderness	1991 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	3	2	3
	"	Camp Island	2	4	2	4
	"	Grebe Lake	2	2	2	0
	"	Greycliff Lake	2	2	1	1
	"	Moose R beaver ponds	2	0	0	0
	"	Moose R (lower)	2	1	0	0
	"	Moose R (upper)	2	6	2	3
	"	Scenic Lake Creek	2	5	2	5
	"	Warbler L. (lake S.)	2	0	0	0
	"	Moosehorn Lake	2	0	1	0
	"	Chickaloon River	2	3	0	0
	"	Vogel Lake	2	3	2	3
	"	Fish Lake	2	3	0	0
	"	Swan Lake Road	0	0	2	0
	"	Meadow Lake (lake S.)	2	0	2	0
	"	Bear Lake (creek N.)	2	0	0	0
	"	Lonesome Lake	0	0	1	1
	"	Phalarope Lake	0	0	2	4
	"	Gene Lake	2	2	2	2
	"	Dipper Lake	2	1	2	1
Subtotal			34	35	25	27
North of Kenai R. (Inside Refuge)	Outside	Beaver Lake	2	4	2	4
	"	Curlew Lake (lake N)	1	4	1	3
	"	Quill Lake	2	4	2	4
	"	Scaup Lake/Bogs	2	4	2	3
	"	Swan Creek	2	4	2	4
	"	Trapper Joe Lake	2	6	2	6
	"	Two Island Lake	2	5	2	5
	"	Flat Lake	2	4	2	3
	"	Otter Creek (pond N)	2	0	2	0
	"	Bill Besser Lake (SE)	0	0	0	0
	"	Seven Egg Creek	2	2	2	2
	"	Pipeline Lake	2	0	0	0
Subtotal			21	37	19	34
North of Kenai R. (Outside Refuge)	Outside	Bishop Creek	2	4	2	4
	"	Timberlost L. (S. of)	2	4	2	4
	"	Suneva Lake Bog	2	4	2	2
Subtotal			6	12	6	10
South of Kenai R. (Inside Refuge)	Inside	Fox Lake	2	1	2	1
	"	Fox River	2	4	2	4
	"	Harvey L./Killey R.	2	5	2	3
Subtotal			6	10	6	8
South of Kenai R. (Inside Refuge)	Outside	Bay Lakes Bogs	0	0	2	2
Subtotal			0	0	2	2
TOTAL			67	94	58	81

The trumpeter swan nesting survey was conducted on June 11, 12 and 13, the early productivity survey on July 17 and 18, and the late productivity survey on August 20 and 21. A total of 144 swans, including 30 nesting pairs, two single adults with nests, five swan broods, 18 non-nesting adult pairs, two single and nine flocked adults (two flocks of four and five swans, respectively), were observed during the spring nesting survey (Table 9). The early productivity survey consisted of surveying only those active territories discovered during the nesting survey. Of these 37 territories, 27 remained active. Of the ten territories no longer active, eight contained paired swans without young and no swans were present in two. Brood size ranged from 1 to 6 cygnets and averaged 3.5 cygnets for the 27 broods.

A total of 189 swans (103 adults, 86 cygnets; 45 percent young) was observed during the late productivity survey, including 24 pairs with broods, 19 paired adults, 4 single adults and 10 flocked adults (Table 9). Three additional nesting territories were identified by the presence of broods during the late productivity survey, bringing the minimum number of active nesting territories on and adjacent to the Refuge to 40 in 1991. Nesting success (at least one cygnet hatched successfully and survived to date of early productivity survey) was 75 percent (30 of 40 nests).

Average brood size declined 8.6 percent between the early and late productivity surveys, from 3.5 to 3.2 cygnets. Reductions in the number of cygnets from early to late brood rearing occurred in seven of the 23 broods (30 percent) which were observed during both surveys. The average cygnet loss per brood in these seven broods was 1.7.

b. Wintering Waterfowl on the Kenai River

Table 11. Waterfowl observed on the upper Kenai River - Kenai Lake outlet to Jim's Landing - during bald eagle boat surveys, 1991.

	Species				
Date	Goldeneye	Merganser	Mallard	Bufflehead	Unidentified
01-29-91[1]	n.r.	n.r.	n.r.	n.r.	n.r.
02-22-91[1]	n.r.	n.r.	n.r.	n.r.	n.r.
03-15-91[1]	n.r.	n.r.	n.r.	n.r.	n.r.
11-16-91	55	39	67	0	0
12-12-91	113	3	72	0	4

[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

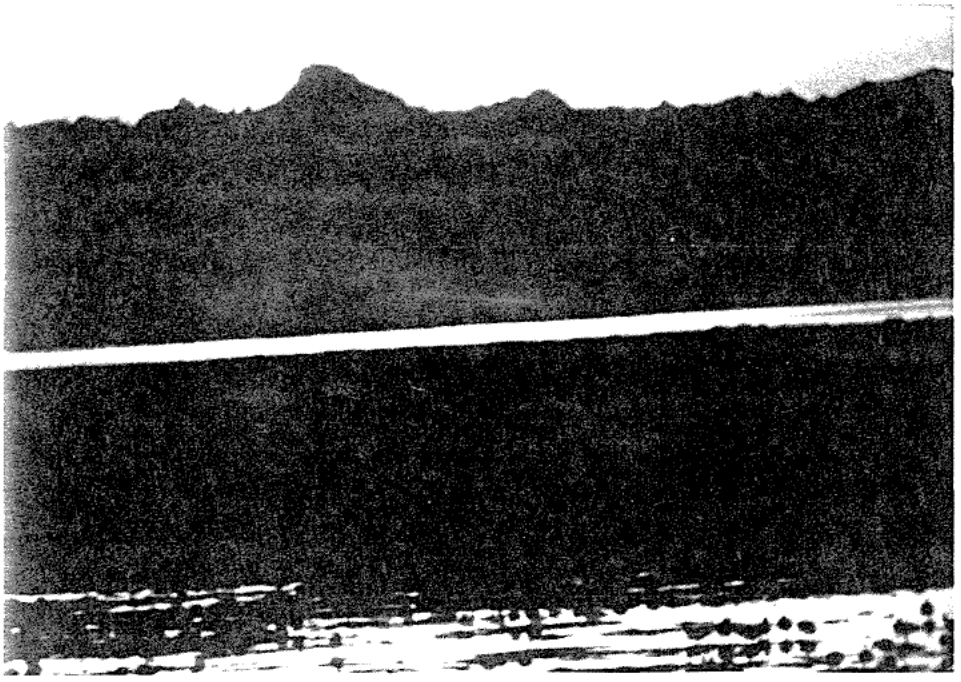
harlequins. Two trumpeter swans were observed near the outlet of Skilak Lake on March 25, 1991. Historically, several swans commonly overwintered in this area. Four adult swans and one cygnet were observed in this area during November and December 1991 surveys. Waterfowl observations during 1991 surveys are summarized in Tables 11 and 12.

Table 12. Waterfowl observed on the lower Kenai River - Skilak Lake outlet to Bing's Landing - during bald eagle surveys, 1991.

	Species				
Date	Goldeneye	Merganser	Mallard	Bufflehead	Unidentified
01-29-91[1]	n.r.	n.r.	n.r.	n.r.	n.r.
02-20-91[1]	n.r.	n.r.	n.r.	n.r	n.r
03-25-91[1]	n.r.	n.r.	n.r.	n.r.	n.r.
11-18-91	213	114	39	0	0
12-13-91	421	21	51	0	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



Snowgeese foraging at dusk on the Kenai River Flats.

Snow geese were first observed by Refuge staff on the Kenai River Flats on April 13, and reports from the public confirmed this date as the 1991 arrival date. Canada geese and mallards were present when surveys began on April 10 (Table 13). Peak use of the Kenai River Flats by snow geese occurred from April 17-24. Snow melt on the Flats was later and occurred over a longer period of time than in recent years. Snow goose use of the area continued to the end of the survey period as new habitat was continually becoming available. Maximum number of snow geese observed was 2870 on April 20. Concentrations exceeding several thousand snow geese were documented during the 1980's, and the number of geese observed in 1991 continued the downward trend of recent years. Because surveys of all staging areas in Cook Inlet were not conducted in 1991, it is unknown whether total numbers of snow geese using the Inlet have declined.

Table 13. Waterfowl observed during spring migration and staging on the Kenai River Flats, 1991.

Date	Snow Goose	Canada Goose	Northern Pintail	Mallard	American Wigeon
10 April	0	150	50	25	0
11 April	0	150	50	25	0
12 April	0	375	225	45	0
13 April	35	200	155	50	2
14 April	35	550	500	100	2
15 April	35	590	530	10	0
16 April	35	500	650	125	0
17 April	800	550	1000	125	0
18 April	1050	750	1300	150	0
19 April	965	390	1250	135	35
20 April	2870	420	1000	85	35
21 April	1185	250	1000	140	60
22 April	1000	170	500	45	55
23 April	990	175	300	70	35
24 April	1760	160	475	35	85

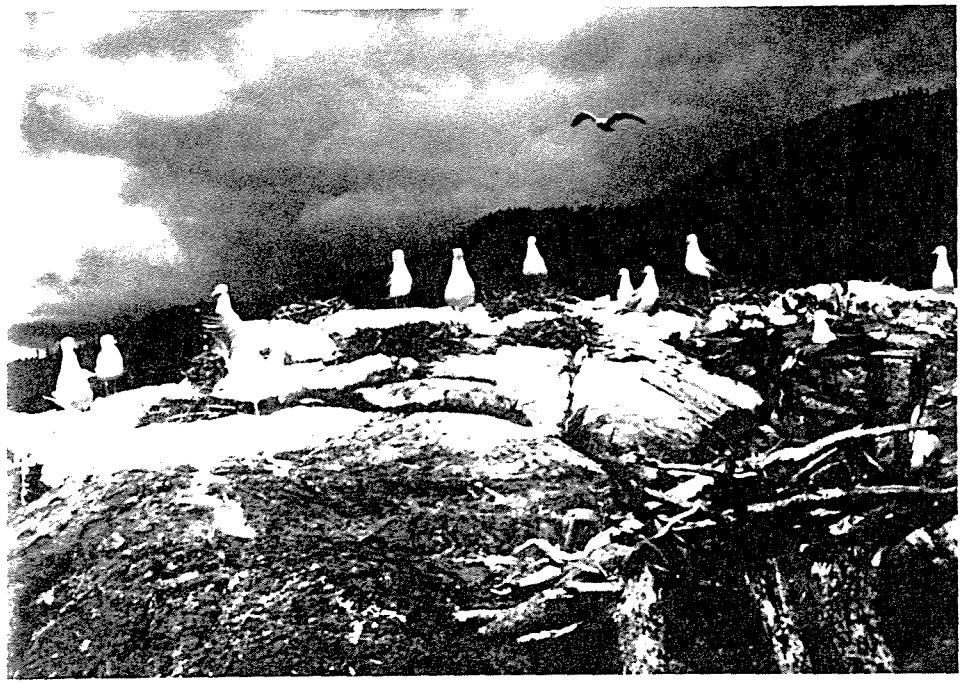
4. Marsh and Water Birds

- Nothing to report.

5. Shorebirds, Gulls, Terns, and Allied Species

The Skilak Lake marine bird survey was conducted on July 18 in the eastern end of Skilak Lake using the Refuge's Boston Whaler. The number of glaucous-winged x herring gull and cormorant colonies were counted and leg bands recorded. A total of 79 juvenile hybrid gulls were observed in the Gull Rock colony, and 317 in the Upper Skilak Rocks colony. This compares closely with 1990 results of 75 and 311 juveniles observed, respectively.

Bailey examines cormorant nests in Skilak Lake. 6/91/EJ



Few, if any, cormorants were reared on Skilak Lake in 1991, but over 300 chicks of hybrid herring x glaucous-wing gulls were observed. 6/91/TB

Of the 22 cormorant nests found on the Gull Rock colony this year, there was little evidence that these nests produced young. If there was a total

nest failure in 1991 for the cormorant colony, it follows a 65 percent increase in cormorant productivity from the previous year (43 young fledged from 22 cormorant nests in 1990). Twenty-two adult cormorants were also observed, compared to 54 adult cormorants recorded in 1990. An alternate explanation may have been that all the young cormorants fledged before the July 18 survey. Several earlier surveys will be conducted in 1992.

6. Raptors

a. Summering Bald Eagles

Adult bald eagle and young at their nest.

Five bald eagle nesting territories were discovered for the first time in 1991, bringing the total number of known nest site locations (those active in recent years) on and near the Refuge to 80 (Table 14). Nests were searched for, but not found, at five of these locations and may no longer be present. At the remaining sites, 41 nests were determined to be active (incubating adults or presence of eggs) during the aerial nesting survey conducted May 20 and 23. Twenty-five and 16 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 3 and 6. An additional active nest was located off-Refuge during this survey. Nest failure rate was high (46.5 percent) during the period between the nesting and early productivity surveys. Only 23 of the forty-two (41+1) nests active during the nesting survey remained active by early July. These nests contained a total of 38 eaglets. Eight of the nests still active contained one eaglet, and 15 nests contained two eaglets. The results of the 1991 surveys by nest site location are presented in Table 14.

Table 14. Bald eagle nesting locations and production on and near the Kenai National Wildlife Refuge, 1991.

Nesting Location	Survey: Nesting Status	Survey: Early Productivity Status	Survey: Early Productivity No. Eaglets	Survey: Late Productivity Status	Survey: Late Productivity No. Eaglets
I. Game Management Unit 15A (N. of Kenai River)					
A. On Refuge					
1. Outside Wilderness					
Torpedo Lake	A	A	1	I	-
Afonasi Lake	I	-	-	-	-
East Fork Moose R.	I	-	-	-	-
West Fork Moose R.	A	I	-	I	-
Coyote Lake	A	A	2	A	1
No Name Creek	DL	-	-	-	-
Big Indian Creek	I	-	-	-	-
Pincher Creek	A	I	-	-	-
Beaver Lake	I	-	-	-	-
North Beaver Lake	A	A	1	A	1
Mink Creek Lake	I	-	-	-	-
Campfire Lake	I	-	-	-	-
Chickadee Lake	I	-	-	-	-
Chickaloon R. Inh.	A	I	-	-	-
Akula Lake	A	A	2	A	1
Barabara Lake	A	I	-	-	-
East Elephant Lake	A	A	1	A	1
2. Inside Wilderness					
Jim's Landing	A	A	1	I	-
Camp Island Lake	I	-	-	-	-
Loon Lake	A	I	-	-	-
Clam/Moosehorn Rdg.	I	-	-	-	-
Swan Lake	A	A	1	A	1
Rock Lake	A	I	-	-	-
Spruce Lake	I	-	-	-	-
Bear Lake	I	-	-	-	-
NE. Moose Lake	A	A	2	A	2
Grouse Lake	A	A	1	A	1
Bedlam Creek Bluff	I	-	-	-	-
Gene Lake	A	I	-	-	-
Sucker Lake	I	-	-	-	-
Camper's Lake	DL	-	-	-	-
B. Off Refuge					
Kenai R./Gwin's	A	A	2	I	-
Juneau Creek	A	A	1	I	-
Moose Point Lake	A	I	-	-	-
Otter Creek Outlet	I	-	-	-	-
Bishop Creek Outlet	A	A	2	A	2
Suneva Lake	I	-	-	-	-
Daniel's Lake	I	-	-	-	-
Kenai R./Bing's	A	A	2	I	-
S. Swanson R. mouth	A	A	2	A	2
Kenai R./up. Bing's	A	I	-	-	-
Seneva Lake	A	I	-	-	-
Kenai R./E. Juneau	A	A	2	I	-
Bernice Lake	NS	NS	-	I	-
Peterson's Pond	A	A	1	I	-

Table 14. Con't

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	A	A	2	A	2
Killey R. - N.	I	-	-	-	-
Lower Killey R. - S.	I	-	-	-	-

2. Inside Wilderness

S. Shore Skilak Lake	A	I	-	-	-
Killey/Harvey Lake	I	-	-	-	-
Skilak Lake Inlet	A	I	-	-	-
Skilak Glacial Fl.	I	-	-	-	-
Russian River Burn	I	-	-	-	-
Bear Creek	DL	-	-	-	-
Killey Headwaters	A	I	-	-	-
Kenai R./downstream of Russian R. Burn	A	I	-	-	-

B. Off Refuge

Kenai R./Chicanskie	DL	-	-	-	-
Kenai R./Salamatof	I	-	-	-	-
Kenai R./Browns Lake	I	-	-	-	-
Russian River	A	I	-	-	-
Kenai R./Bluff	DL	-	-	-	
Kenai R./KPCC Isl.	I	-	-	-	-
Kenai R./Funny R. Rd.	A	A	2	A	2
Kenai R./Russian R.	A	A	2	A	2
Kasilof River/Bridge	I	-	-	-	-
Coho Road/Gas well	I	-	-	-	-
Quartz Creek	A	A	2	I	-
Echo Lake Road	A	I	-	-	-
Moose Meadows Subd.	A	A	2	A	2
Kenai R./W. Killey R. mouth	A	I	-	I	-

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	A	I	-	-	-
Lower Fox/Powerline	DL	-	-	-	-

B. Off Refuge

Sheep Crk./Fox River	I	-	-	-	-
Bradley River Outlet	I	-	-	-	-
Fox R. Flats - Rock	I	-	-	-	-

Key: New nest located in 1991 is underlined.
A = active; I = inactive; DL = searched, not located;
ANB = adult nearby; E = egg(s); NS = no search

Fifteen of the 23 nests active during the early productivity survey remained active on August 14, when the late productivity survey was flown. The fate of eaglets in the nests changing from active to inactive status between surveys is unknown, but it is believed that many or all had already fledged. Several eaglets at active nests had left the nest and were perched on limbs nearby. The survey was conducted two weeks later than normal. The number of eaglets per active nest declined from 1.7 to 1.5 between early and late productivity surveys in 1991. Reductions in the number of eaglets between the productivity surveys occurred in three nests (the eaglets remaining in these nests were not near fledgling stage and it is assumed that the missing eaglets had not fledged).

Table 15. Summary of bald eagle production by land-use classification on and near the Kenai National Wildlife Refuge, 1991.

	On Refuge			Off Refuge	
Productivity	Wilderness	Out. Wilderness	Total	Total	Total
Active Nests	14	11	25	17	42
Failed active nests	9 (64%)	4 (36%)	13 (52%)	6 (35%)	19 (45%)
Eaglets/active nest - early survey	1.4	1.6	1.5	1.8	1.7
Eaglets/active nest - late survey	1.3	1.3	1.3	2.0	1.5
Eaglets fledged/ nesting attempt[1]	0.5	1.0	0.7	1.2	0.9
Maximum number of eaglets fledged[2]	7	11	18	20	38

[1] Nesting attempts of known fate only at time of early productivity survey (n=42).
[2] Eaglets present during early productivity survey.

b. Wintering Bald Eagles

Because of extremely cold 1990-91 winter temperatures, most of the bald eagle wintering area remained frozen during January, February, and March, 1991, and eagles were surveyed from aircraft rather than by boat. Numbers of eagles observed during boat surveys in November 1991 were 41 percent lower than those observed in November 1990, but 66 percent higher in December 1991 than December 1990.

Table 16. Numbers and ages of bald eagles observed during boat surveys along the Kenai River during winter-spring and fall-winter months, 1991

	River Route					
Survey Dates	Upper River*		Lower River**		Total	
	Ad	Juv	Ad	Juv	Ad	Juv
***01/29/91	18	2	110	2	128	4
***02/20/91	40	2	108	9	148	11
***03/25/91	27	0	66	2	93	2
11/16&18/91	24	12	34	12	58	24
12/12&13/91	37	22	84	53	121	75

* Kenai Lake to Jim's Landing
** Skilak Lake outlet to Bing's Landing
*** Aerial

7. Other Migratory Birds

The Alaska Breeding Bird Survey was conducted in June 1991 along the two traditional survey routes on the Kenai National Wildlife Refuge (Tables 17 and 18). This was the ninth consecutive year Refuge staff conducted the nationwide survey along the Swanson River/Swan Lake Road and Seven Lakes/Skilak Loop Routes.

The Seven Lakes Route was surveyed on June 21. The most commonly observed birds were the Swainson's thrush (45), the slate-colored junco (27) and the white-crowned sparrow (25) (Table 17). A total of 224 identified birds of 30 species were observed along this route.

Table 17. Birds recorded on the Seven Lakes Route, Alaska Breeding bird Survey, June 1991.

Species	No.	Species	No.	Species	No.
Greater Yellowlegs	2	Sandhill Crane	2	Common Snipe	1
Red-necked grebe	1	Common Loon	15	Olv.-sided Flycat.	4
Barrows Goldeneye	2	Tree Swallow	1	Gray jay	19
Alder Flycatcher	1	Common Raven	1	Boreal Chickadee	2
Ruby-crowned Kinglet	2	Gray-chkd Thrush	5	Swainson's Thrush	45
Hermit Thrush	1	Varied Thrush	7	Myrtle Warbler	19
American Robin	14	Townsends Warbler	2	Orange-cr. Warbler	2
Blackpoll Warbler	5	Savannah Sparrow	1	Song Sparrow	1
Northern Waterthrush	4	Slate-colored Junco	27	Common Redpoll	16
White-crowned Sparrow	25	Unid Woodpecker	5	Unid Thrush	2
Black-capped Chickadee	4	Scaup Sp.	2	Gull Sp.	16
Pine Grosbeak	3				

The Swan Lake Route was completed on June 20. Commonly encountered birds included the slate-colored junco (42), myrtle warbler (36) and the Swainson's thrush (35) (Table 18). Other animals have been observed at times during the survey, as on this occasion a black wolf was seen crossing Swan Lake Road during one of the 50 early morning stops. A total of 247 identified birds of 23 species were observed along this route.

Table 18. Birds recorded on the Swan Lake Route, Alaska Breeding Bird Survey, June 1991.

Species	No.	Species	No.	Species	No.
Common Loon	5	Greater Yellowlegs	2	Ruby-crowned Kinglet	11
Olv.-sided Flycatcher	3	Alder Flycatcher	34	American Robin	7
Gray Jay	9	Boreal Chickadee	10	Myrtle Warbler	36
Swainson's Thrush	35	Varied Thrush	8	Northern Waterthrush	8
Orange-Crowned Warbler	3	Yellow Warbler	7	Song Sparrow	2
Blackpoll Warbler	3	Slate-colored junco	42	Hairy Woodpecker	1
Savannah Sparrow	2	Rusty blackbird	2	Unid Thrush	3
White Crowned Sparrow	2	Pacific Loon	2	Unid Woodpecker	10
Common Redpoll	12				

8. Game Mammals

a. Moose

The 1991 fall moose composition survey was conducted in Alaska GMS 15A from November 20 to December 1, in cooperation with the Alaska Department of Fish and Game. The Department also conducted a composition survey in GMS 15C on the southern Kenai Peninsula. No composition survey was conducted in GMS 15B. As part of the GMS 15A survey, 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.

Table 19. Results of moose composition surveys in Alaska GMU 15, 1991.

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	72	166	238	744	310	29	1083	1	369	1690
15C	93	39	68	342	151	27	520	3	208	913
GMU 15	165	258	423	1086	461	56	1603	4	577	2603

A bull moose that is now protected from hunting on the Refuge. Since antler restrictions went into effect in 1987, the bull:cow ratio has increased from 16 to 22 bulls per 100 cows in three years over the northern Refuge. 10/91/TB

Moose calf:cow ratios in the fall in the northern portion (GMS 15A) of the Refuge averaged 34:100 in 1991. 10/91/TB

Totals of 1690 and 913 moose were classified during composition surveys in GMS 15A and GMS 15C (Table 19), respectively. The bull:cow ratio in the GMS 15A was 22:100 (Table 20), and remained unchanged from 1990. We believe the relative absence of yearling animals from the 1989-cohort due to high overwinter mortality in 1989-90 resulted in halting the trend of slow increase in the bull:cow ratio 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 was 17 bulls:100 cows in 1987. 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.

Calf:cow ratios were 34:100 in GMS 15A and 40:100 in GMS 15C. Calves comprised 21.8 percent of the observed sample in GMS 15A. This percentage is slightly below the long term average of 24.4 percent calves. This may in part be the result of reduced production and/or calf survival in the 1969 burn, where forest succession is proceeding and habitat quality for moose is declining, 22 years post-fire.

Table 20. Moose population composition in Alaska GMU 15, 1991.

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	22	7	4.3	34	9	21.8	65
15C	36	18	10.2	40	15	22.8	66
GMU 15	26	10	6.3	36	11	22.2	65

b. Caribou

Only one of the three caribou herds on the Kenai Peninsula, the recently reintroduced (1985-1986) Benchland herd, was surveyed in 1991. This survey was conducted by Refuge staff in July. No fall composition surveys were conducted by the Alaska Department of Fish and Game in 1991.

A total of 175 caribou in three groups was observed in the Benchland herd, including 118 adults and 57 calves (33 percent young). The observed totals represent minimum number of caribou present. Totals of 131 and 30 caribou were observed in the main Tustumena Benchlands group (south of the Killey River to Tustumena Glacier) and the Truuli Creek Plateau group (south of Tustumena Glacier to the Fox River), respectively. Fourteen caribou were observed in the Benjamin Creek Basin group, north of the Killey River. Presence of this small group of caribou in this previously unoccupied range

was first documented in 1990. It is hoped it will exhibit a growth rate similar to that documented for the Tustumena Benchlands group since the reintroduction. Habitat north of the Killey River appears capable of supporting such an increase.

Table 21. Results of Aerial Survey of the Tustumena Benchland Caribou Herd, 1991.

Group	Adults	Calves	Percent Calves	Total
Tustumena	90	41	31.3	131
Truuli Creek	16	14	46.7	30
Benjamin Crk.	12	2	14.3	14

In April, Refuge staff cooperated with the Alaska Department of Fish and Game in capture and radio-collaring caribou from the reintroduced Benchland herd. Nine caribou from the main Tustumena Benchlands group and three from the Truuli Creek group were outfitted with transmitters. Capture operations used both a helicopter strut-mounted net gun and darting. The Department also radio-collared caribou in the other two Kenai Peninsula herds, the Lowland Herd and the Kenai Mountain Herd.

c. Dall's Sheep and Mountain Goat

Mountain goat grazing in its summer range on the Kenai National Wildlife Refuge.

The Alaska Department of Fish and Game conducted surveys of Dall's sheep in 11 count areas and mountain goat in 16 count areas on the Kenai Peninsula during the summer of 1991 (Tables 22 and 23). A total of 1217 sheep, including 995 adults and 222 lambs (18.2 percent) was observed (Table 22). Fifty-two legal rams (full curl) were observed. Total kids (317) equalled 18.5 percent of the 1711 mountain goats observed (Table 23). Kid:100 adult ratios in the 16 count areas ranged from 17-44:100.

Table 22. Dall's Sheep Surveys on the Kenai Peninsula, 1991.

Count Area	Date	Legal Rams	Sub-Legal Rams	Ewes	Lambs	Unid.	Total	M/100F	L/100F
832	06/20/91	12	74	159	46	0	291	54.1	28.9
834	07/26/91	1	0	1	3	0	4	33.3	0.0
835	07/26/91	0	0	0	0	0	0	-	-
836	07/25/91	0	1	2	1	0	4	50.0	50.0
837	07/22/91	1	6	10	4	0	21	70.0	40.0
838	06/26/91	6	33	98	36	0	173	39.8	36.7
844	08/08/91	1	3	3	1	0	8	133.3	33.3
851	06/20/91	5	23	48	23	0	99	58.3	47.9
855	08/03/91	7	22	65	15	0	109	44.6	23.1
856	08/06/91	14	100	247	77	0	438	46.1	31.2
8571	08/06/91	5	13	36	16	0	70	50.0	44.4

Note: The number of "ewes" includes young rams and yearlings of both sexes.
[1] Partial count due to turbulence.

Table 23. Mountain goat surveys on the Kenai Peninsula, 1991.

Count Area	Date	Count Time (hrs.)	Adults	Kids	Total	Kids per 100 Adults	Percent Kids
831	07/21/91	1.3	29	7	36	24	19.4
833	07/21/91	1.8	131	23	154	18	14.9
834	07/26/91	2.7	66	16	82	24	19.5
835	07/25/91 & 07/26/91	2.0	72	13	85	18	15.3
836	07/25/91	2.5	154	30	184	19	16.3
837	07/22/91	1.1	20	5	25	25	20.0
838	06/26/91	Unk.	16	7	23	44	30.4
844	08/08/91	2.3	67	17	84	25	20.2
845	08/05/91	3.0	216	49	265	23	18.5
846	07/27/91	4.0	94	26	120	28	21.7
854	07/22,23/91	2.9	78	23	101	29	22.8
855	08/02,03/91	3.0	26	6	32	23	18.8
856	08/06/91	3.1	46	19	65	41	29.2
8571	08/06/91	1.0	24	7	31	29	22.6
8631	07/18/91	2.0	235	41	276	17	14.9
865	07/29/91	1.8	120	28	148	23	18.9

[1] Partial count due to weather.

d. Wolves

Twelve wolves (ten from four packs, and two lone wolves which did not or have not associated with any known packs) were captured during 1991 in the northern Refuge (GMS 15A) and fitted with radio transmitter collars for inventory purposes (Table 24). Three wolves from the Bear Lake pack and one wolf each from the Elephant Lake and Mountain packs were collared during helicopter darting operations in February. Seven wolves were captured during summer live-trapping, conducted by Student Conservation Association Volunteer Eric Hart. The following are pack affiliations of summer-caught wolves: Elephant Lake pack - 2, Bear Lake pack - 1, Mountain pack - 1, Chickaloon River pack - 1, unknown pack affiliation - 1, lone wolf - 1.

Wolf population ecology in the northern Refuge in 1991 can best be characterized as a very dynamic situation, marked by high rates of dispersal, break-up of established packs, establishment of new packs, and shifting of traditional territories. Three new small packs, the Chickaloon River pack (6), the Swanson River II pack (3), and the Skilak Loop pack (3), were positively identified for the first time in 1991. All three of these packs contained at least one dispersed former member of other known established packs. All three contained at least one former member of the Point Possession pack, as all three radio-collared wolves (captured in 1990) from this pack dispersed. An older radio-collared male wolf from the Elephant Lake pack dispersed southward and has since joined with a radio-collared female lone wolf in the central Refuge. This male wolf had been a member of this pack since 1988 at least. Dispersal or an unknown mortality source reduced the Elephant Lake pack from 12 (the largest count in 1990 was 14, two wolves were harvested in February 1991) to 5.

Table 24. Wolves captured on the Kenai National Wildlife Refuge, 1991.

Pack	Sex	Age	Weight	Date of Capture	R/L Ear Tags
Bear Lake	M	Adult	101	02-05-91	83/82
Bear Lake	F	Pup	76	02-05-91	84/85
Bear Lake	M	Adult	110	02-06-91	93/92
Elephant Lake	M	Adult	112	02-06-91	90/91
Mountain pack	M	Adult	126	02-20-91	95/94
Elephant Lake	F	Adult	85	06-22-91	57/58
Loner	F	Subadult	62	06-26-91	62/61
Elephant Lake	M	Subadult	84	06-30-91	187/199
Unknown	F	Adult	80	07-09-91	102/101
Bear Lake	M	Adult	90	07-10-91	83/82
Chickaloon River	F	Adult	64	08-03-91	184/43
Mountain pack	F	Adult	91	08-15-91	114/113

Several wolves captured in 1991 also dispersed. A female pup from the Bear Lake pack, captured in the Moose Research Center pens in February never

rejoined her pack and dispersed off the Kenai Peninsula sometime after June 1991. She was located in Palmer, 50 miles north of Anchorage, in the company of another wolf in December. She was recaptured and fitted with a new transmitter by the Alaska Department of Fish and Game. Radio contact with the adult male wolf from the Bear Lake pack captured in July was lost during the fall; it most likely has dispersed. Radio contact was also lost with the adult male and one of the adult female wolves from the Elephant Lake pack soon after capture. Their whereabouts are presently unknown. The male wolf from the Mountain pack was recovered dead within its territory in December on Hideout Mountain in the Skilak Loop. It had been killed by other wolves. The subadult female of unknown pack affiliation was also killed by other wolves in July within the Elephant Lake pack territory.

SCA Eric Hart captured and radio-collared seven wolves during the summer of 1991. 7/91/TB

The former Skilak Lake pack, for which a lack of cohesion was documented in 1990, apparently disintegrated and/or shifted territories. Of two radio-collared members of this former pack, one joined a pack in the Kenai Mountains (Mountain pack) and then dispersed from this pack and has remained south of the Kenai River in the central Refuge, and the second is now a member of the Skilak Loop pack. The Bear Lake pack shifted territories to the south and east, filling in that area left vacant by the Skilak Lake pack. The eastern portion of the former Skilak Lake pack territory has been occupied by the Mountain pack, most of which are probably Skilak Lake wolves.

Based on visual observations and radio locations, the seven radio-collared packs on the northern Refuge (Point Possession, Elephant Lake, Bear Lake, Skilak Loop, Swanson River II, Chickaloon River, and Mountain) contained 44 wolves in late fall 1991 (Table 25). One Elephant Lake wolf was shot during the September moose season (no wolves had been harvested by trappers in the northern Refuge by year's end) and one Mountain wolf was killed by other wolves, bringing the early fall population in the northern Refuge to 46 wolves. This total does not account for single or paired wolves not associated with known packs. Louse infestation was noted in the Elephant Lake, Bear Lake and Mountain packs in 1991.

Table 25. Pack sizes of seven radio-collared wolf packs on the northern portion (north of the Kenai River) of the Kenai National Wildlife Refuge in fall 1991.

		No. Wolves	
Pack	Late Fall	Harvested	Early Fall
Elephant Lake	5	1	6
Point Possession	9	0	9
Bear Lake	12	0	12
Skilak Loop	3	0	3
Swanson River II	3	0	3
Chickaloon River	6	0	6
Mountain	6	1[a]	7
TOTAL	44	2	46

a Killed by other wolves

9. Marine Mammals

No harvest of walrus was reported to the Refuge in 1991. Refuge staff sealed 34 sea otters this year compared to 11 in 1990. Of the 34 pelts and 18 sea otter skulls, 16 were taken from Kachemak Bay near Homer, 11 from Port Chatham, 2 from Port Wells in Prince William Sound, and 1 from False Pass in the Aleutians. Four sea otters were harvested in 1990 from Green Island in Prince William Sound.

10. Other Resident Wildlife

a. Small Mammals

Small mammal population indices and trails were again sampled on the Refuge in 1991. Combined total captures of red-back voles in all snowshoe hare grids increased over 4X relative to 1990 (Table 26). Trapping success in the fall also increased over 2X in all sampled habitats (Table 27). These indices strongly suggest there was a significant increase in Refuge small mammal populations between 1990 and 1991.

Table 26. Small mammal trapping effort and success on the Kenai National Wildlife Refuge lowlands, 1991.

Area	Habitat	Dates	Nights Set	Total Trap Nights	Total Captures: Red-Back Voles	Total Captures: Masked Shrews	Trap Nights/Capture: Red-Back Other	Trap Nights/Capture: Red-Back Voles	Trap Nights/Capture: Masked Shrews
Swanson River Rd.									
Hare Grid	1947 burn	6/15-25	14	325	23	8	1	14.1	40.6
Campfire Lake									
Hare Grid	1947 burn	7/13-23	14	574	38	140	5	15.1	4.1
1969 Burn									
Hare Grid	1969 burn	7/13-23	14	542	34	117	11	15.9	4.6
Funny River Road									
Hare Grid	1947 Burn	8/7-20	14	585	132	89	4	4.4	6.6
Swan Lake Area									
	Combined1	10/4-7	4	1079	51	17	1	21.2	63.5
1991 Total	Combined	10/1-4	4	1073	117	63	4	9.2	17.0
1990 Total	---	---	48	3230	101	124	8	32.0	26.0
1989 Total	---	---	--	2428	60	61	0	40.5	39.8
1988 Lowlands	---	---	--	840	234	29	11	3.6	29.0

Table 27. Small mammal capture success in fall 1991, Swan Lake Road Region of Refuge.

Habitat	Dates	Total Trap Nights	Total Captures: R-B Voles	Total Captures: Masked Shrews	Total Captures: Tundra Voles	Trap Nights/Capture: R-B Voles	Trap Nights/Capture: Masked Shrews	Trap Nights/Capture: Tundra Voles
Mature Mixed Forest	10/1-4	360	38	24	0	9.5	15.0	0
1947 Burn Region								
North Forest	""	359	49	9	0	7.3	39.9	0
1947 Burn Tree								
Crushed Forest	""	354	30	30	4	11.8	11.8	88.5
Total	""	1073	117	63	4	9.2	17.0	268.2

b. Snowshoe Hare

The snowshoe hare population on the Kenai lowlands in the northern Refuge was monitored for the ninth consecutive year in 1991 by SCAs Melissa Leader and Colby Tinsley and Cooperative Student Joan Christian. Live-capture and pellet-count data indicated the snowshoe hare population remained at low levels north of the Kenai River (three of four grids), but there was a substantial increase in the numbers of individuals captured and total

captures on the single grid (Funny River) south of the Funny River during 1991 compared to 1990 (Table 28).

Leader (left), Tinsley (center) and Christian (right) with captured wolf. The captured wolf was a diversion...they spent the summer capturing and marking snowshoe hares.
7/91/TB

Table 28. Capture success and pellet densities in four permanent snowshoe hare study grids on the Refuge, 1983-1991.

	Swanson River Grid				Funny River Road Grid				Campfire Lake Grid				69 Burn Grid			
	Indiv		Tot.	Pellets	Indiv		Tot.	Pellets	Indiv		Tot.	Pellets	Indiv		Tot.	Pellets
Year	AD	Juv	Capt	M²	AD	Juv	Capt	M²	AD	Juv	Capt	M²	AD	Juv	Capt	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
1991	1	2	4	1.1	13	13	46	1.1	4	2	17	3.0	1	1	4	1.0

[1]Cleared for the first time, other grids previously cleared on 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-three, 21 and 27 active lodges were observed in the three survey areas, respectively (Table 29). Food caches were present at slightly over 75 percent of all active lodges observed in 1991. As documented in recent years, 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 29. Results of fall aerial beaver cache surveys on the Kenai National Wildlife Refuge, 1991.

Survey Area	Act. Lodges w/ Caches	Act. Lodges w/o Caches	Total Act. Lodges
Swan Lake C.S.	26	7	33
Finger Lake area	19	2	21
Vogel Lake area	16	11	27

d. Spruce Grouse

Table 30. Results of early morning, roadside spruce grouse surveys on the Kenai National Wildlife Refuge, 1987-1991.

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
1991	Skilak Loop	19.4	0	271	27.1	1.40
	Swanson River Rd.	15.6	10	39	3.9	0.25
	Swan Lake Rd.	12.9	10	67	6.7	0.52

Early morning roadside spruce grouse surveys conducted in 1991 indicated that the average number of grouse along the Skilak Loop Road, which is closed to the hunting of small game with firearms was over two and five-times greater, per survey mile, than the Swan Lake and Swanson River Roads, respectively, which are open to hunting (Table 30). The shooting of spruce grouse from Refuge roads, and occasionally from vehicles in violation of Refuge Regulations, continues to occur throughout the Refuge, including Skilak Loop Road.

Spruce grouse observed during early morning roadside surveys. The grouse are attracted to gravel roads to obtain "grit" for their gizzards. Most grouse hunting occurs along Refuge roads. 8/91/TB

11. Fisheries Resources

a. Hidden Lake

An abstract of the fisheries work conducted within the Hidden Lake Creek system is presented under Research and Investigation.

b. Russian River

The estimated numbers of late-run sockeye entering the Lower Kenai River in 1991 was 647,597. The early run harvest of sockeye in the Russian River was 66,235 plus 32,389 escapement to spawn (total=98,624 early-run sockeye). The total late-run for sockeye was 109,624 with 31,449 harvested by sportfishermen and 78,175 escaping to spawn. A total of 22,267 sockeye

were estimated to spawn in the Russian River below the weir at Lower Russian Lake.

c. Tustumena Lake System

An abstract of the fisheries work conducted within the Tustumena Lake system is presented under Research and Investigation.

12. Wildlife Propogation and Stocking

The taking of sockeye for eggs and release of fry into the Hidden Lake and Tustumena Lake Systems are included in abstracts under the Research and Investigation section.

13. Surplus Animal Disposal

Nothing to report

14. Scientific Collections

Nothing to report

15. Animal Control

Nothing to report.

16. Marking and Banding

All animals either eartagged, radio-collared, leg banded or incidentally captured during 1991 are presented in Table 31. The following information including number of each species, sex, age, and location of capture has been reported to the Migratory Bird Banding Laboratory, USFWS Division of Law Enforcement and the State of Alaska Department of Fish and Game as a condition of the Refuge's State (#91-58) and Federal (#692350) Collecting Permit for 1991.

Table 31. Report of Animals/Birds taken under Federal Fish and Wildlife Permit #692350 and State of Alaska Permit #91-58 in 1991.

Species	Date	Activity	Age	Sex	Weight	Status	Area
Wolf	02/05/91	Radiocollared	Pup	F	76.0 lbs	Released	Moose Pens #1
Wolf	02/05/91	"	A	M	101.0 lbs	Released	MRC Pen #1
Wolf	02/06/91	"	A	M	112.0 lbs	Released	Beaver Lake
Wolf	02/06/91	Recaptured	A	M	110.0 lbs	Released	Finger Lakes
Wolf	02/20/91	Radiocollared	A	M	126.0 lbs	Released	Doroshin Bay
Wolf	06/22/91	"	A	F	85.0 lbs	Released	Marathon Rd
Wolf	06/26/91	"	SA	F	62.0 lbs	Released	Marathon Rd
Wolf	06/30/91	"	SA	M	84.0 lbs	Released	Marathon Rd
Wolf	07/09/91	Recaptured	-	M	90.0 lbs	Released	Swanson Rvr Oilf
Wolf	07/10/91	Radiocollared	SA	F	80.0 lbs	Released	Swanson Rvr Oilf
Wolf	08/03/91	Recaptured	-	F	64.0 lbs	Released	Mystery Crk Rd
Wolf	08/15/91	Radiocollared	A	F	91.0 lbs	Released	Mystery Crk Rd
Coyote	04/26/91	Eartagged	A	M	31.0 lbs	Released	Swan Lake Rd
Coyote	04/30/91	Measured	SA	F	20.0 lbs	Released	Swan Lake Rd
Coyote	05/03/91	Recaptured	A	F	21.3 lbs	Released	Paddle Lake
Coyote	05/13/91	Recaptured	A	F	-- lbs	Released	Swan Lake Rd
Coyote	06/22/91	Eartagged	A	M	34.0 lbs	Released	Marathon Rd
Coyote	07/22/91	"	-	M	19.0 lbs	Released	Mystery Crk Rd
Coyote	07/23/91	"	-	F	24.0 lbs	Released	Mystery Crk Rd
Coyote	07/25/91	"	Pup	M	13.5 lbs	Released	Mystery Crk Rd
Coyote	07/31/91	"	-	M	24.0 lbs	Released	Mystery Crk Rd
Coyote	08/24/91	"	SA	F	21.0 lbs	Released	SW Mysy Ck Ppln
Lynx	10/29/91	Recaptured	A	M	35.0 lbs	Released	Paddle Lake
Lynx	10/29/91	Radiocollared	A	M	32.0 lbs	Released	Marsh Lake
Lynx	10/30/91	Recaptured	A	F	25.0 lbs	Released	S Pipeline Rd
Lynx	11/02/91	Radiocollared	A	F	20.5 lbs	Released	Moose Ri.
Lynx	11/03/91	Recaptured	A	F	24.0 lbs	Released	Birch Lake
Lynx	11/03/91	Radiocollared	A	F	22.4 lbs	Rehab/Rel	Hidden Lake
Lynx	11/04/91	Recaptured	A	M	28.0 lbs	Released	Weed Lake
Lynx	11/08/91	"	A	M	32.0 lbs	Released	Swan Lake
Black Bear	07/24/91	Eartagged	-	F	99.0 lbs	Released	Mysy Ck Pipeline
Moose	06/27/91	--	calf	-	-	Released	Swanson Rv Oilf

Species	Date	Activity	Number	Status	Area
Snowshoe Hare	7/10-23/91	Live Trapped	2	Eartagged/Released	Swanson
			0	Dead	Oilfld
Snowshoe Hare	7/10-23/91	Live Trapped	6	Eartagged/Released	Swan Lk
			1	Dead	Road
Snowshoe Hare	6/12-25/91	Live Trapped	3	Eartagged/Released	Swanson
			0	Dead	Rvr Rd
Snowshoe Hare	8/07-20/91	Live Trapped	23	Eartagged/Released	Funny
			3	Dead	River Rd
			38	Total Snowshoe Hare	
Small Mammals	10/01-04/91	Snaptrapped	117	Red-Backed Voles	Swanson
			4	Tundra Vole	River Rd/
			63	Masked Shrews	Swan Lk
Small Mammals	06/12/-08/20/91	Snaptrapped	227	Red-Backed Voles	KNWR Hare
			354	Masked Shrews	Grids
			765	Total Small Mammals	
Birds	06/12-08/20/91	Incid Caught	21	Songbirds	KNWR Hare Grids

The following species are stored in the Kenai National Wildlife Refuge freezer (found dead).

Species	Date	Activity	Age	Status	Area
Great Gray Owl	01/XX/90	Found dead	-	Dead	Moose River
Hawk Owl	10/21/91	Flew into window	AD	"	Soldotna
N Saw Whet Owl	10/21/91	"	AD	Dead	Soldotna
N Saw Whet Owl	04/15/91	Hit by car	AD	"	Seward
N Saw Whet Owl	11/XX/91	Flew into window	AD	Dead	Soldotna
N Boreal Owl	10/09/91	"	AD	"	Soldotna
Common Raven	12/09/91	Euthanized/rehab	JUV	Dead	Soldotna
Bald Eagle	11/27/91	COD Unknown	AD	"	Salmon Crk
Sea Otter	10/24/91	"	-	Dead	Seward

17. Disease Prevention

An abstract for a paper submitted to be presented at the Second North American Symposium on Wolves in 1992 summarizes the incidence of exposure of wolves to canine parvovirus and distemper on the Refuge. EXPOSURE OF WOLVES AND COYOTES TO CANINE PARVOVIRUS AND DISTEMPER ON THE KENAI NATIONAL WILDLIFE Refuge, KENAI PENINSULA, ALASKA, 1976-1988 by Theodore N. Bailey, Kenai National Wildlife Refuge , P.O. Box 2139, Soldotna, Alaska 99669, Edward E. Bangs, Kenai National Wildlife Refuge, P.O. Box 2139, Soldotna, Alaska, 99669 and Rolf O. Peterson, Michigan Technological University, 1400 Townsend Drive, Houghton, Michigan, 49931.

Abstract: We tested 55 serum samples from 50 wolves (*Canis lupus*) and 4 from coyotes (*C. latrans*) live-captured on the Kenai National Wildlife Refuge , Kenai Peninsula, Alaska between 1976 and 1988 for exposure to canine parvovirus (CPV) and canine distemper virus (CDV). Prevalence of CPV exposure among wolves increased from 10% between 1976-80 to 67% between 1981-88. Prevalence of CDV exposure among wolves varied from 26-32% for the same period. Twelve percent of the sampled wolves had been exposed to both viruses. Exposure to canine parvovirus was first detected in a wolf captured on the Refuge on 11 December 1979. By 1988, exposure to CPV was documented among wolves in 6 of 9 packs. Generally, once exposure to CPV was detected in a wolf pack, subsequent sampling from the pack indicated continued exposure to CPV., Exposure to canine distemper was first documented in a wolf captured on the Refuge on 6 June 1979. We documented exposure of wolves to CDV in 7 of 9 wolf packs. Exposure of wolves to CPV was significantly ($P < 0.050$) related to sex with more males than females testing positive. Exposure of wolves to CDV was significantly ($P < 0.050$) related to age with more adults and yearlings than pups testing positive. We did not detect any

significant differences in 3 body or blood condition parameters among wolves that were unexposed versus those that had been exposed to CPV only. Wolves that had been exposed to both CPV and CDV had significantly ($P < 0.50$) lower hemoglobin levels than unexposed wolves. Only 1 of 4 coyotes had been exposed to CPV and none had been exposed to CDV. Management implications are discussed especially in regards to the surrounding domestic dog (*C. familiaris)* population.

18. Injured Wildlife

The Refuge is unique among Alaska's field stations in that it has an ongoing rehabilitation program within the community in cooperation with a local veterinarian. In 1991, Refuge staff responded to 42 cases of injured or orphaned wildlife which consisted of 17 bird species and 1 mammal species. This was a slight increase from last year's total of 34 injured animals involving 16 species.

Biological Technician Liz Jozwiak exercising a young great horned owl in rehabilitation. 9/91/JF

Spring and summer brought to a select few of the Refuge biology staff many sleepless nights caring for numerous baby songbirds that were brought to the Refuge. Some of the juvenile birds were found by good-intentioned local residents who thought the young were abandoned. The busiest rehabilitation season began on May 19 when a juvenile white-winged crossbill, the first of this years' birds, was brought to the Refuge. From then through the end of August, the Refuge received and cared for four

juncos, three alder flycatchers, four robins, eleven swallows, one mallard, one belted kingfisher, a spruce grouse, two juvenile great-horned owls, and a juvenile Northern Saw-whet owl which was successfully raised, hacked and released.

Four injured bald eagles were brought to the Refuge during 1991. One juvenile eagle was found south of Soldotna with no serious injuries, and was released one week later. An adult bald eagle was found by state park rangers near Seward along a trail hanging upside down from a tree with one toe in a trap. The eagle recovered quickly, was banded and released. An eaglet was recovered from a nest that blew down in North Kenai killing its sibling. The eaglet had multiple injuries and could not be saved. A juvenile eagle is currently in rehabilitation recovering from a cracked upper beak received from impact with a moving vehicle.

Two juvenile marbled murrelets were brought to the Refuge in August. One murrelet was successfully rehabilitated and released in Homer. One adult great horned owl was shot in the leg and could not be saved. One lynx was successfully rehabilitated and released on the Refuge. It was injured during a live-capture operation using hounds for the Refuge's ongoing lynx project.

H. PUBLIC USE

1. General

This year will be remembered as "The Year of Hidden Creek"; due to the "enthusiasm" of some State fisheries personnel in a sockeye salmon enhancement project a few years back. The creek was expected to see a return of some 70,000+ fish in 1991. Hidden Lake, the source of the creek, can safely accommodate approximately 30,000 sockeyes each year; needless to say, there is a significant difference in those two numbers. When it was determined that these 120,000 fish were actually going to return, we went into "scramble mode" and made plans to entertain a personal use dipnet fishery. More on the actual event is covered in section H9.

Other public activities on the Refuge in 1991 included visitation to the Visitor Center and the Visitor Contact Station, hiking trails, horse trails, cross-country ski trails, canoe trails, camping (campgrounds and backcountry), snowmobiling, fishing, hunting, fly-in trips to the backcountry, environmental education, wildlife observation, photography, and probably some more we do not know about. Kenai Refuge is unique in Alaska in that we are only three hours by car from a major population center (Anchorage); consequently the Refuge has become that city's "playground" and favorite fishing locale.

An early winter snowstorm settles over Upper Skilak Lake glacier flats. 9/91/RKJ

Sportfishing is the primary purpose for most Refuge visitors, with camping associated. Most of our public use "challenges", including over-crowding, regulation violations, facility deterioration, and sanitation problems are the result of fishing-related visits. Periodic, sometimes unannounced, closures of some fishing seasons provides ample evidence of those relationships, as the majority of the problems magically disappear.

Overall visitation for 1991 was an estimated 510,000 visits. This is a slight decrease from 1990 and mirrors the peninsula-wide decrease in tourism for the year. Decreases were noted in counts for the Visitor Center and sportfishing due to emergency closures of some seasons. (The Hidden Creek dipnet fishery could *probably* be considered sportfishing; but we cannot bring ourselves to that.)

2. Outdoor Classrooms - Students

a. Visitor Center Program

Two-thousand-seven-hundred students participated in the Refuge's Environmental Education (EE) program in 1991. While fall use increased over 1990, April and May continued as the busiest months. All available spaces for May field trips were booked by the third week of April.

A typical field trip to the Visitor Center runs "half day". Students begin with an introductory wildlife film or videotape selected from the Refuge's extensive media library. After the media program, students explore the exhibit area with questionnaires associated with various exhibits. Questionnaires focus on concepts such as animal/plant adaptations, interdependence, natural communities, and succession. There are four levels of questionnaires including grades kindergarten through first, second through third, fourth through sixth, and seventh through twelfth.

Visitor Center activities are followed by lunch at nearby Headquarters Lake. Students then hike the three quarter mile "Keen-Eye" Trail with activity guides. Led by their teacher, they investigate spruce forest, wetland, and freshwater lake communities through an integrated series of "hands-on" activities. There are three levels of trail activity guides for grades kindergarten through first, second through third, and fourth through sixth.

b. Outdoor Education Center

In 1991, the Refuge's Outdoor Education Center (OEC), located off Swan Lake Road adjacent to the Swanson River and Swan Lake Canoe Systems, was utilized by 585 youth for a total of 1,762 user days. The OEC provides an attractive outdoor site for overnight field trips and youth group retreats. Teachers and youth leaders use the facility free-of-charge to conduct environmental education, nature appreciation, and outdoor skills activities. Rustic accommodations provide the basics including six sleeping cabins, a "commons" lodge (called the "Bear Den"), a fire ring, outdoor benches and picnic tables, an outhouse, and a water pump.

Refuge staff completed a self guided nature trail brochure and outdoor box holders. A collection box at the end of the trail promotes recycling of brochures.
7/91/CDW

Students do outdoor nature activities on the "Keen-Eye" Trail as a portion of an autumn field trip. 9/91/JB

In September 1991, the OEC was vandalized. Windows, doors, and signs were damaged by repeated volleys of bird shot. This is the second year in a row that vandals have damaged the OEC with firearms. This vandalism combined with long term "wear and tear" is taking its toll on the center. New construction and repairs are fast becoming a necessity. The Refuge is exploring assistance through Challenge Grants and other sources to correct these problems.

In 1991, thirty-nine educators were introduced to the Refuge's EE program through teacher orientation sessions and EE credit courses taught by Refuge staff. Orientation sessions are scheduled in fall and spring, when teachers show the greatest interest and need in bringing classes for field trips to the Refuge. During an one and one-half hour orientation, teachers experience an abbreviated version of a sample class field trip.

3. Outdoor Classrooms - Teachers

Environmental Education credit courses, focusing on Project WILD environmental education curricula were presented by Ranger Ward and SCA Resource Assistants Peggy Gunter and Jeff Bernet in February, March, and November 1991, with 43 educators attending.

In February, Ward presented a program on Refuge wildlife for the Magadan/ Soldotna Youth Summit for 60 Soviet students and teachers. Ward presented students with Refuge wildlife postcards, which were a big hit with Magadan youth. The students showered Refuge staff with Soviet flag lapel pins, now probably collector's items.

In March, Gunter and Ward distributed National Wildlife Week packets and Alaska Wildlife Week materials to all Kenai Peninsula Borough elementary teachers. Alaska Department of Fish and Game (ADF&F) and the U.S. Fish and Wildlife Service (USFWS) collaborated to produce outstanding Wildlife Week materials on Alaska's wetlands. Teacher response to these materials was overwhelmingly enthusiastic.

In April, Gunter, Community Volunteer Connie Ferguson, and Ward developed an Educator's Guide to Kenai National Wildlife Refuge, a 135 page resource guide for teachers to use in preparing their classes for field trips and to assist them during the field trip. Included in the guide are follow-up activities designed to bring closure to the field trip experience and to help students dig deeper into subject areas they learned about during their visit. Gunter and Ward assisted several local schools as science fair judges during April and May.

On April 27, Ward was asked to participate in a session with Alaska Maritime National Wildlife Refuge staff and with Anchorage, Homer, and Peninsula teachers to plan environmental education facilities for the new Maritime Visitor Center in Homer.

Ward completed an environmental education planning document in July outlining the next five year's needs and planning direction for the Refuge

EE program. Plans were analyzed in a region wide planning meeting in Anchorage during December to design a uniform plan format. This is the first time Refuge environmental education plans have been solicited in Alaska. The long term results of this planning effort are tremendously important for the future of the Refuge EE program.

Ward attended and gave presentations at the Region-wide environmental education meeting in September. This training was a "first" for the Alaska Region environmental education field staff. Not only were training sessions extremely helpful, but networking with other Refuge staff and Alaskan educators was invaluable.

4. Interpretive Foot Trails

Ward and Idaho artist, Angie Okamoto-Ong, completed a nature trail guide for the Visitor Center's Keen-Eye trail. Okamoto-Ong received an honorarium from the Alaska Natural History Association for her beautiful artwork. The guide provides interpretive information on wildlife signs and habits, helping the public to learn when wildlife is most likely to be viewed and to recognize evidence of their passing when they are nearby and hidden from view.

5. Interpretive Tour Trails

Nothing to report.

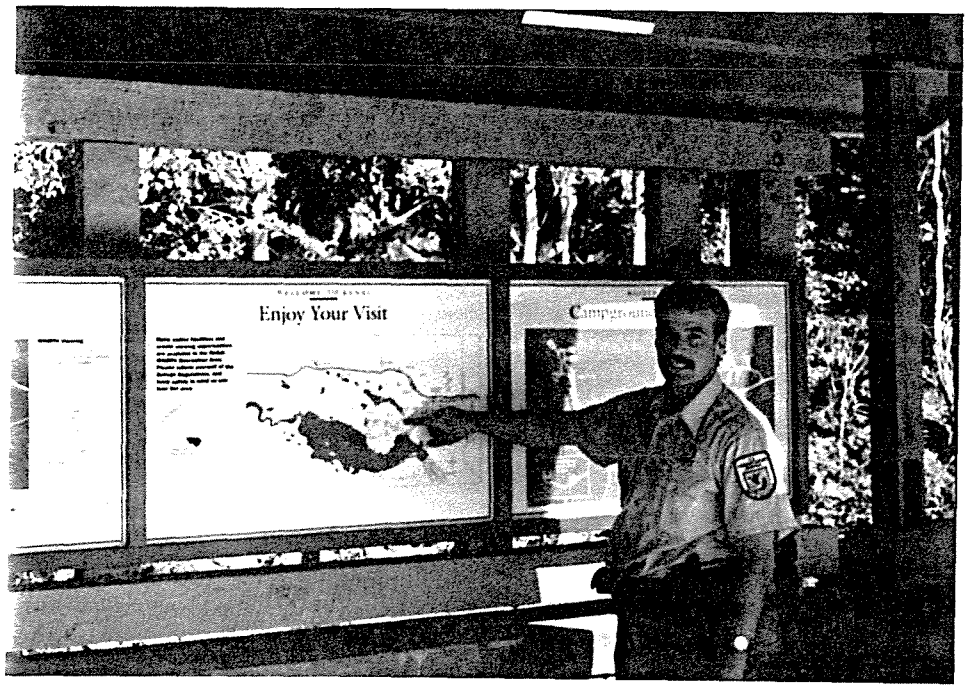
6. Interpretive Exhibits/Demonstrations

Regional Office Outdoor Recreation Planner Dave Patterson and Ward wrote an exhibit rehabilitation needs assessment for the Refuge Visitor Center in April. Supervisory Park Ranger Kent, Patterson, and Ward did final edits for submission of the rehabilitation project to Regional Office contracting in June.

After advertising the contract to prospective interpretive firms, it was awarded to Good Displays of Toledo, Ohio. In September, Ward and Kent worked with Good Displays representative Mike Fruland, during an "on-site" visit in October they finalized exhibit measurements and rehabilitation design. Kent and Ward selected and submitted photos to Good Displays in December. Ward wrote, edited, and submitted exhibit text for the project by year's end. Final exhibit installation will begin on February 24, 1992. This is the first "rehab" work on the Visitor's Center since its construction in 1982. The rehabilitation project will correct the accumulated "wear and tear" problems and add two dramatically revised exhibits on Alaska's refuges and on freshwater salmon stream ecology.

In April, for the fourth consecutive year, the Refuge public use staff participated in the Kenai Peninsula Sportsmen's Show. Ward, Law Enforcement Officer Johnson, and Student Conservation Association (SCA) Resource Assistant Gunter set up and staffed the three day show. Regional Office Resource Information Specialist Connie Wassink lent a eye-catching,

professional traveling exhibit to the Refuge for this show. Our booth made contacts with over 1500 of the 2600 visitors who visited the show. Alaska Maritime Outdoor Recreation Planner Sue Matthews participated in the show on Sunday afternoon sharing information about seabirds, marine mammals, and the Maritime Refuge at our booth.



Chris Johnson points out a good wildlife observation location at the Hidden Lake Campground orientation kiosk. 5/91/RJ

In May, Refuge Volunteer Mike Sibley created a partition system for storage of interpretive and informational materials at the Visitor Center front desk. This addition has been of tremendous value to the entire staff in finding information for the public.

In preparation for the September moose hunting season, Carpenter Marrs and Ward worked to refurbish an elaborate mobile display depicting legal and illegal moose antler configurations. The exhibit, built in 1989, has become so popular that both the Peninsula and Kenai Malls compete for it each summer and fall. The public is fascinated by the display and enjoy quizzing one another on "which racks are legal".

7. Other Interpretive Programs

The year-round weekend wildlife media series continued to be one of our most popular programs, attracting 3825 of the Visitor Center's 26,000 visitors in 1991. Local newspaper and radio stations have provided excellent, free advertising for the series.

During the summer, 1300 people watched the Refuge video, "Wild Refuge: Fortune and Future of the Kenai". This video is instrumental in introducing the public to the Refuge's wildlife viewing and recreational opportunities.

Nearly 1100 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 Kids, 4-H clubs, summer youth camps, church youth organizations, seniors' groups, mental health services, tour groups, and day care programs.

Over 6300 visitors signed the Visitor Center guest log. States with the greatest visitation included California, Texas, Washington, Minnesota, Michigan, and Oregon (in order of greatest visitation). Foreign visitation was greatest from Canada, the Soviet Far East, Germany, the Netherlands, and Italy. Surprisingly, of the 3200 visitors using the Visitor Contact Station, over half signed the guest log. At this location, states with the greatest visitation were Washington, California, Oregon, and Florida. Foreign visitation was greatest from Canada, Germany, and Japan.

Administrative and public use staff responded to 560 public information inquiries sending out Refuge brochures and orientation materials.

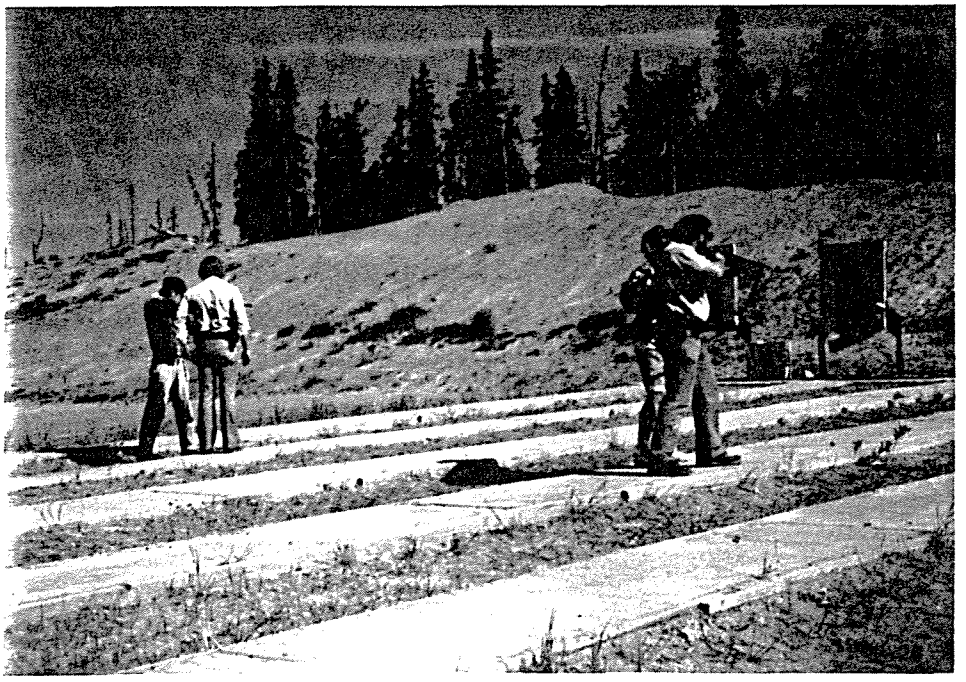
From May through June, Refuge staff and volunteers assist in orientation and training of summer seasonal staff. The Refuge gave Refuge orientation programs for the Soldotna Visitor Information Center, Elder Hostel, Chugach National Forest, Kenai Fjords National Park, Alaska Maritime National Wildlife Refuge, and Alaska State Parks as components of their seasonal staff training. We conducted a two-week training session for our own seasonal staff and summer volunteers, as well as a one-week training session for Youth Conservation Corps.

SCA Resource Assistants, Rob Barto, Heidi Mouillesseaux and Rachel Rosenblum led the Refuge's summer interpretation program. They conducted nature walks, kids' programs, and campfire programs. Four-hundred-and-ten visitors attended their entertaining and informative programs.

Their activities came to an abrupt halt with the Hidden Creek personal use dipnet fishery program. Rachel returned to school at the beginning of August, and Heidi and Rob shifted their interpretive and communication skills to handling large groups of people for 12-to-16 hour shifts, seven days a week during the Hidden Creek dipnet fishery.

Ward attended the National Association for Interpretation's (NAI) National Workshop in October in Vail, Colorado. The conference once again exceeded all expectations giving outstanding seminars on interpretive planning and exhibit design and fabrication. The NAI National Workshop is by far one of the most rewarding training programs of its kind in the country. For Refuge staff working in interpretation and visitor service, it provides an incredibly valuable training experience.

Orientation float trip with Jim Farrar, Diana Thomas, John Gahr, Josh Visitation, Connie Ferguson, Rob Barto, Heidi Mouillesseaux, Rachel Rosenblum, and Richard Press. 6/91/RJ



Refuge Officers Hudson and Johnson instruct SCAs in the use of shotguns during bear safety training. 5/91/RJK

8. Hunting

Small and big game hunting seasons attracted hunters at numerous Refuge locations in 1991. Moose hunting activity in Game Management Subunit (GMS) 15A in the northern Refuge returned to levels of recent years after falling off sharply in 1990. Overall moose hunter numbers in GMS 15C increased over 1989 and 1990 levels, and the southern Refuge portion of this management unit may have experienced increased levels of use.

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 1991. These regulations were first implemented in 1987.

A moose hunter check station was opened along the Swanson River Road and at Captain Cook State Recreation Area in the Lower Swanson River during the general (September 1-20) moose hunting season. Seasonal employees and volunteers staffed the roadside station for ten days and the river landing station for three days. A total of 396 vehicles were checked at the Swanson River Road Station during the general hunting season. Twenty-two hunting parties were checked at the Lower Swanson River Landing. Twenty legal and four illegal bull moose were checked at the two check stations.

The lower Swanson River continues to be a popular and high quality hunt for GMS 15A moose hunters. Refuge Officer Johnson contacted 29 hunters during a two-day river float on opening weekend. An aerial survey of the upper Swanson River above the Swanson River Road Landing documented decreased effort, probably due to low water conditions.

Total harvest of bulls in 1991 increased significantly over 1990 levels throughout GMU 15 (Table 32). Much of the increases in harvest were attributable to the lack of spike-fork yearling bulls in moose populations in 1990, many of which perished as calves during the previous winter. Winter conditions in 1990-91 were about average. In GMS 15C, where larger bulls generally comprise approximately 50 percent of the harvest, the highest recorded harvest since 1970 (two hundred and ninety) occurred due to high annual recruitment in the 1990 cohort. Spike-fork yearling bulls from this cohort comprised over sixty percent (178/290) of the harvest, the highest percentage since selective harvest regulations were implemented.

The limited-entry (drawing permit) cow moose hunt in the Skilak Lake Wildlife Recreation Area in GMS 15A was held for the third year from September 21-30. The 20 permittees reported harvesting 11 cow moose. A Refuge permit is also required for this hunt.

A total of 34 bulls were taken in the GMS 15B East 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 mail-out of general Refuge and safety information was sent to those drawn for this trophy hunt.

A young hunter shows off a trophy moose "rack" he took near Crane Lake. Antler restrictions within GMU 15 have increased the number of large antlered bulls harvested by hunters. 5/91/RJ

Table 32. Big game harvest on the Kenai Peninsula, 1991.

Species	Game Management Unit					Total Harvest
	15A	15B	15C	Total 15	7	
Brown bear	-	-	-	12	1	13
Black bear	-	-	-	-	-	-
Caribou						
Mountain Herd	0	0	0	0	23	23
Lowland Herd	2	-	-	2	0	2
Dall's sheep	-	-	-	-	-	40
Mountain goat	-	-	-	-	-	134
Moose*	192	73	290	555	64	619

*Preliminary data - harvest report returns not complete
Source: Alaska Department of Fish and Game

Hunting effort in the Tustumena Lake Area appeared to be above average with 47 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.

Mistakes by hunters in estimating antler width, number of brow tines or number of points of cervicorn antlers continue to decline 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 regulation.

Completion of a bowhunter proficiency course was required by state regulations for hunters participating in archery-only moose hunts for the first time during 1990. Participation in the early season bowhunt for moose in GMS 15A was contingent upon completing the course. Several sessions of this course, conducted by the Alaska Bowhunters Association, were held at the Refuge Headquarters. Topics included basic wildlife management principles, 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 1991. A total of 100 (either sex) permits were issued for the Kenai Mountain Herd. Twenty-three caribou were taken (Table 32) for an overall hunter success rate of 23 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 third year for sheep within GMUs 7 and 15. A total of 40 full-curl rams were taken on the Kenai Peninsula in 1991, up from eight harvested in 1989 and 33 in 1990. A total of 208 hunters participated, and overall success rate was 19 percent. Mean horn length of harvested sheep averaged 35.0", and horn lengths ranged from 30.0-38.5". Mean age of harvested sheep was 7.6 years, and ages ranged from 6-10 years.

Student Conservation Association Resource Assistants and Ranger Brent Richey participated in sheep hunter check camps on Round Mountain and in the Tustumena Lake area. Three sheep were checked on opening weekend. Park Ranger Johnston and Refuge Officer Johnson inspected several fly-in hunting lakes in GMS 15C; hunting activity was light. A Green Lake camp was not utilized in 1991.

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

Goat hunters harvested 134 mountain goats on the Kenai Peninsula in 1991 (Table 32). This total included 99 males, 34 females, and one of unknown sex. The open registration mountain goat hunt in selected areas opened on October 15.

No information on black bear harvest during 1991 in GMU 7 and 15 was available at the time of this writing. Several groups of black bear hunters were contacted at Upper Skilak Campground, but no bears were reported taken during the October contacts.

The Refuge issued 74 Special Use Permits for the spring black bear baiting season in 1991. Sixty-eight permittees reported hunting activities (92 percent), as stipulated in the permit. Thirty-three of the reporting permittees actually hunted (49 percent), and eight successful hunters harvested 12 bears (Table 33). This total included five sows and seven boars. Five bears were taken by bow, four by rifle, and method of take was not reported for three bears. The temporal distribution of the harvest was concentrated in the latter part of the season, with most harvest (10 of 12) occurring from 30 May to 13 June.

Table 33. Black bear baiting hunt statistics by methods of harvest, Kenai National Wildlife Refuge, 1991.

Method	Total Hunters	No. Successful	Total Harvest	Avg. Days per Hunter	Avg. Hours per Hunter	Avg. Hours per Bear
Bow	14	4 (29%)	5	8.6	38.3	107.2
Gun	13	3 (50%)	4	9.6	26.6	79.8
Unknown	6	1 (17%)	3	14.2	36.8	73.7
TOTAL	33	8 (24%)	12	9.6	33.6	89.7

Brown bear harvest in GMU 15 included three sows and two boars during the spring season (May 10-25) and three sows and four boars during the fall season (September 16-31). One sow grizzly was taken during the fall season in GMU 7.

Grouse hunters reported excellent numbers of spruce grouse at several Refuge locations. Refuge officers once again received numerous complaints of grouse hunters 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. State Officer Titus made several grouse road hunting cases during the fall.

Former Refuge Manager Will Troyer reported that ptarmigan populations were as high as he had ever observed in several alpine areas in GMS's 7 and 15

on and adjacent to the Refuge. Hunting effort is very low for ptarmigan on the Refuge, but is reportedly excellent with unlimited opportunities for those willing to hike into alpine areas.

Steel shot restrictions for waterfowl hunting were in effect for the first time in Alaska in 1991. Refuge officers checked many hunters at various Refuge locations and on the Kenai River Flats near Kenai. Hunter compliance with the new regulation was good.

A grouse hunter pursues a flock of spruce grouse that fled into the woods along Swanson River Road. Hunters must be off the roadway to legally shoot. 5/91/RJ

Waterfowl harvest success on the Chickaloon Flats was reported to be average to good. Weather conditions in October did not favor a lengthy stopover on the Flats by migrating Canada geese. The few hunters present during this five-day period the first week of October reported excellent goose hunting.

9. Fishing

Sportfishing is one of the most popular activities 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 1991, the most challenging management situations - congestion, facilities maintenance, and law enforcement situations - occurred during peak summer weekends.

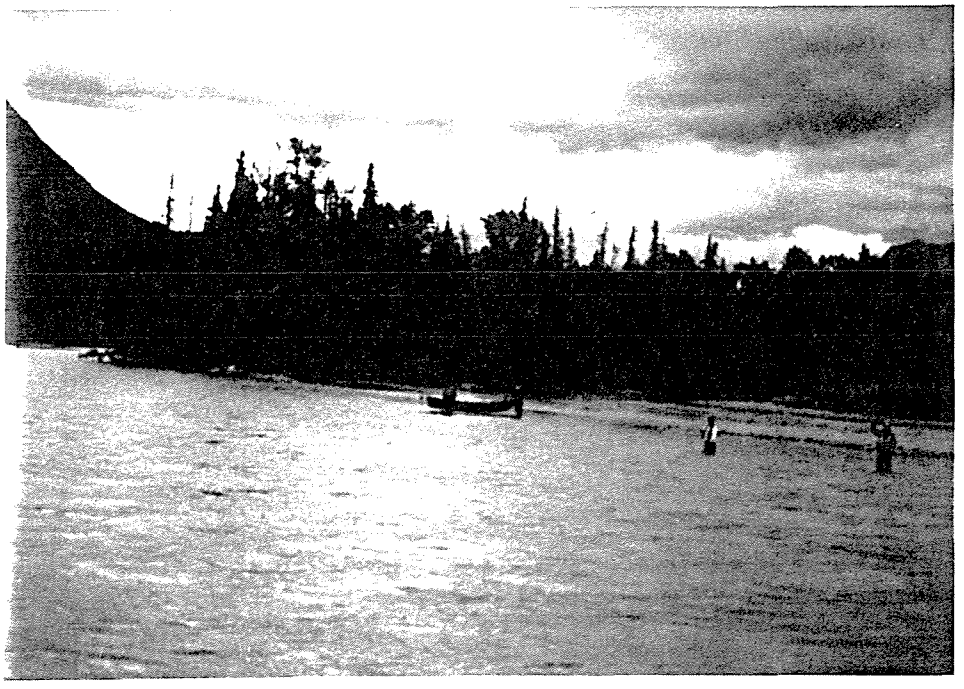
A second year of weak runs of early run Kenai River king salmon had the effect of decrease in angler use on sections of the river open to king fishing. Fishing in the Kenai River was restricted to "catch and release only" for king salmon until it was opened to a limited fishery from Soldotna downstream. Displaced angler effort also affected other rivers and other species within the Kenai River. Increased effort on the Kasilof River targeting king salmon and the Upper Kenai River targeting rainbow trout occurred in 1991. Guided fishing at these locations paralleled the increase in 1990 when the Lower Kenai River was restricted.

The Kenai River experienced a strong sockeye salmon run, which was less than the very large runs of recent years but well above the recent historical average.

Fishing effort and associated camping activities remained high on the Kenai River below Skilak Lake. The large schools of sockeye salmon concentrated in the lower lake and the Kenai River in 1988 and 1989 were significantly smaller and less concentrated during 1991, but angler effort was still high.

The Russian River early run escapement was 32,389. The early Russian River sport sockeye harvest was 65,340 with approximately 64,651 man-days of effort. As a result of a relatively strong run, the confluence sanctuary area was opened on June 26. The catch-per-hour ratio during 1991 was 0.256 (Table 34). Seven-hundred-twenty-and-nine salmon were used for brood stocking in Resurrection Bay and were included in the above figures.

A drift fisherman loads his boat at Jim's Landing. Floating use of the Upper Kenai River has increased annually for several years. 6/91/RKJ



Several anglers accompanied by a fishing guide try for Rainbow trout at the last "hot spot" above Jim's Landing on the Upper Kenai River. 7//91/RKJ

Angler use on Refuge lands was typically high during July with the Upper Kenai River, Skilak Lake, and Russian River receiving very high use. 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.

The late run sockeye salmon escapement was 100,450. The late run sockeye harvest was 31,450 with a recorded .391 man days of effort. (Table 34). The Russian River State Sportfish Division management weir was operated through September.

Three significant sportfishery regulations went into effect 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 effect for a one-half mile area where the Kenai River flows into Skilak Lake.

Despite increased and more efficient guided and non-guided fishing effort on the Upper Kenai River, the rainbow trout population and average catch size appears to be increasing as a result of various management regulations.

Ice fishing was quite popular during 1991. 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.

Perhaps the most unique, management intensive and bizarre fishery that has ever occurred anywhere in the Refuge system occurred at Hidden Creek during 1991. The fishery developed as a result of an overstocking of fry during 1988. Based on the 1989 smolt out data and the 1990 return, the 1991 adult return was projected to be between 70,000 and 120,000 fish. Special measures were determined to be necessary to deal with the return in order to preserve lake water quality.

An Environmental Assessment was prepared and alternative plans were considered by the ADF&G and the staff of the Refuge. The options included doing nothing, blocking the stream after escapement goals had been met and allowing bears to feed on trapped fish, conducting a special dipnet fishery, allowing Cook Inlet Aquaculture Association to conduct a cost recovery harvest, donating the fish to a nonprofit group, or combining two or more of these options. The alternative selected was to conduct a personal use dipnet fishery in Hidden Creek. Contribution of some fish to non-profit groups also occurred.

The special dipnet fishery in Hidden Creek was widely announced and was held for the first time on July 30. The rules allowed for Alaska residents to take six fish each. Under the supervision of the Refuge staff, a set number of people were allowed into the creek and additional people were admitted as earlier participants left. The participants were confined to the bed of the creek. The public response was overwhelming with many people turned away. A total of 1356 people took 8136 fish on the first day.

Despite the very large crowd the first day, the public did not lose interest. In eight subsequent openings held between August 3 and August 14 another 10,654 people participated and carried off an additional 63,924 fish. The total participation was 12,010 people, that harvested 72,060 sockeye salmon. A total of 156 fish were distributed to senior citizens groups in Kenai, Soldotna, and Eagle River.

Through August 30, the spawning escapement into Hidden Lake was 35,576. The weir arrangement in Hidden Creek allowed for enumerating over 113,000 fish in the return, but there was no count of the additional fish in this return that were harvested in the Kenai River or at the mouth of Hidden Creek (below the counting weir). The overall run into Hidden Creek was approximately 120,000 fish.

The entire interpretive and recreation staff, many biological staff, and most Refuge volunteers were on hand to coordinate the fishery and its anticipated people/traffic problems. Kenai Refuge personnel (<u>including</u> volunteers) worked 16 plus hours. Though the day was not without problems,

by and large the event was successful and a great many compliments were received on Refuge handling of the crowd and vehicles. Media attention was high, with both Anchorage newspapers and three television network affiliate stations in attendance. Footage of the day was also seen on Cable News Network (CNN).

After congestion problems encountered during the first fishery opening, a 1500 vehicle limit was imposed and check stations were established turning excess vehicles away. Several incidents of backed up vehicles blocking the Sterling Highway also occurred. Skilak Road was turned into a one way parking lot/camping area/"fish mart" with Hidden Lake Campground and Hidden Lake gravel pit providing supplemental vehicle capacity. The fishery was held on Tuesdays and Saturdays with several back to back supplemental days in order to keep up with the onslaught of sockeyes.

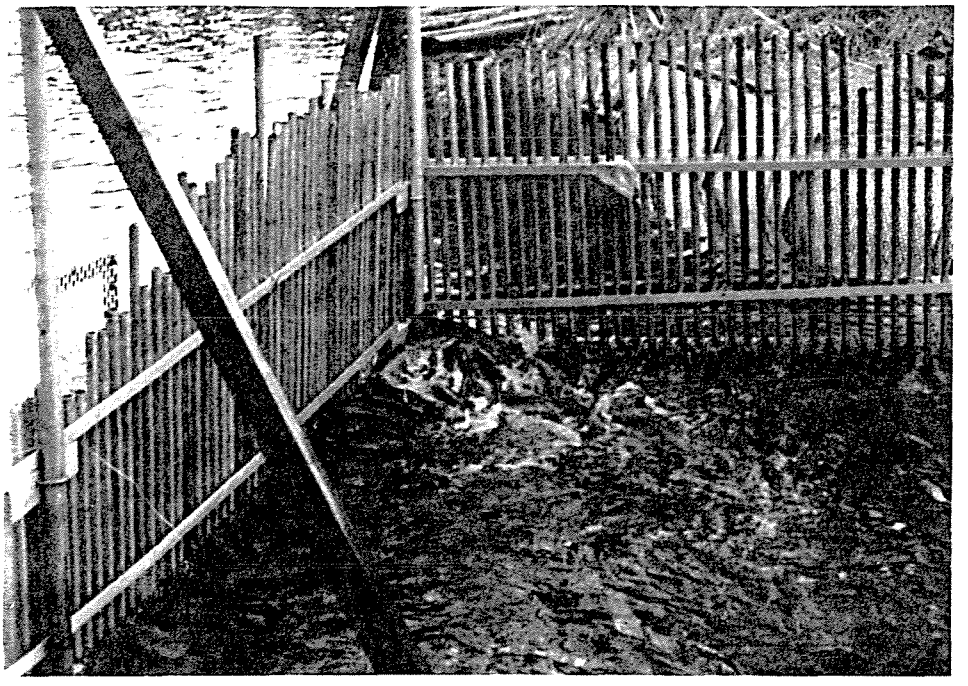
Refuge Volunteer Dick Chace contemplates the gathering horde of dipnetters lined up 10 abreast one-half mile east of Hidden Lake Road. 8/91/RJ

A scaffold reconnaissance tower was constructed with a Refuge and ADF&G biologist armed with a shotgun to keep a watchful eye on both black and brown bears that were at the area at various times during the fishery. Several individual brown and black bears, some with cubs, were observed frequenting the Hidden Creek area. Easily accessible salmon, as well as numerous fish carcasses, apparently attracted the unusually high number of bears to the area. In all, nine brown bears and five black bears were observed within the area. This was an unprecedented number of bears for this location on the Refuge.

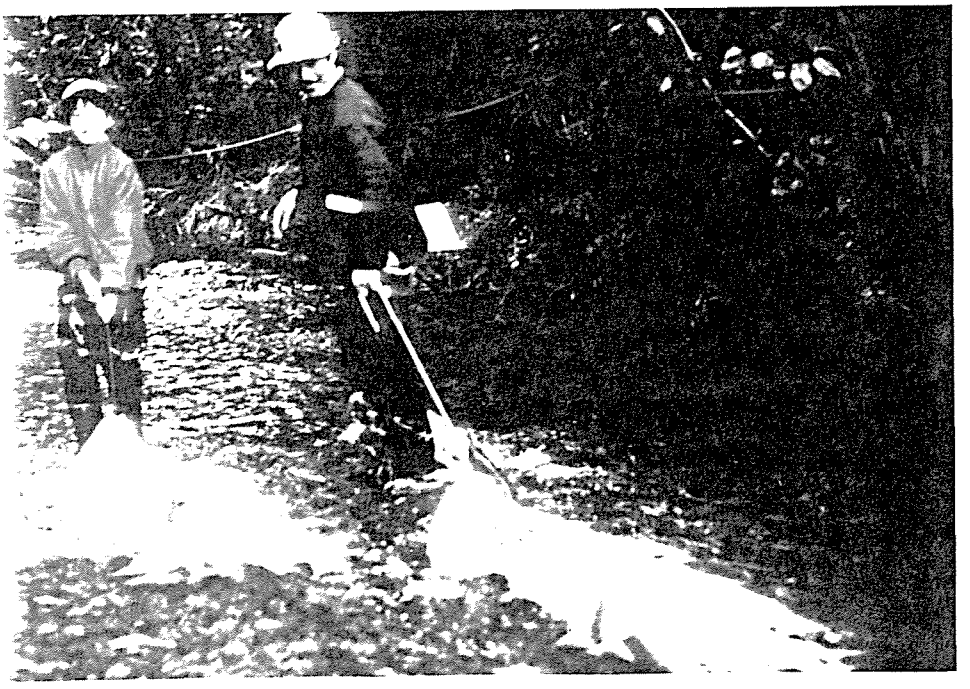
All in all, the entire project was a people, vehicle, and fishery management project of unprecedented proportions that took a considerable amount of employee and volunteer effort and Federal dollars to manage. Approximately 3700 Refuge staff hours were expended on the project, including 1700 regular hours, 1100 overtime hours, and 900 volunteer hours. An additional 300 person hours from Cook Inlet Aquaculture Association and Alaska Department of Fish and Game were expended on the project. Litter, streamside vegetation damage, and other problems associated with the fishery, though significant, were minimized by the intensive staff management effort.

In a curious twist, the Refuge staff was awarded an outstanding participation award for National Fishery Week for their combined efforts. Although many Alaskans enjoyed the intensive dipnet fishery and Refuge staff appreciated the necessity of harvesting the surplus fish, it was an event that, hopefully, will never have to be repeated on a National Wildlife Refuge.

Excess salmon crowd into Hidden Creek prior to the emergency dipnet fishery. The run exceeded 110,000 fish. 8/91/RJ



A holding weir was constructed across Hidden Creek just above Skilak Road in order to confine excess sockeye.
8/91/RJ



Fishing with poles will never be the same for these two dipnetters at Hidden Creek. 8/91/RJ

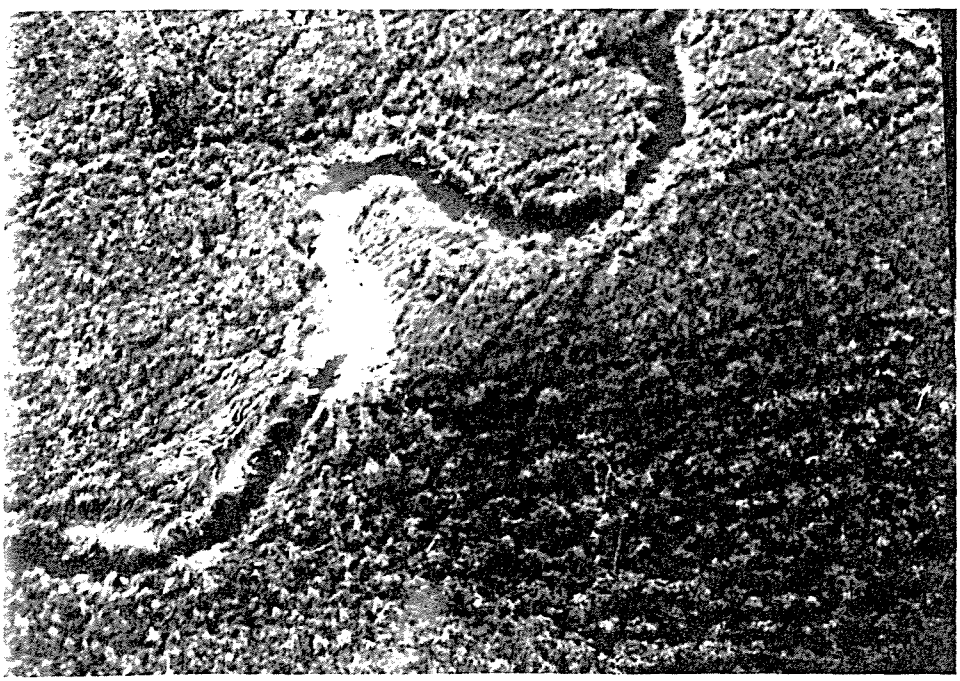
Groups of fifty anglers were allowed into Hidden Creek at one time to dipnet sockeye salmon. 8/91/RJ

Andy Loranger supervises dipnetters within Hidden Creek. Stream banks were roped off in order to minimize stream bank damage. 8/91/RJ

A young dipnetter hitches a ride while mom nets "fish in a barrel". 8/91/RJ

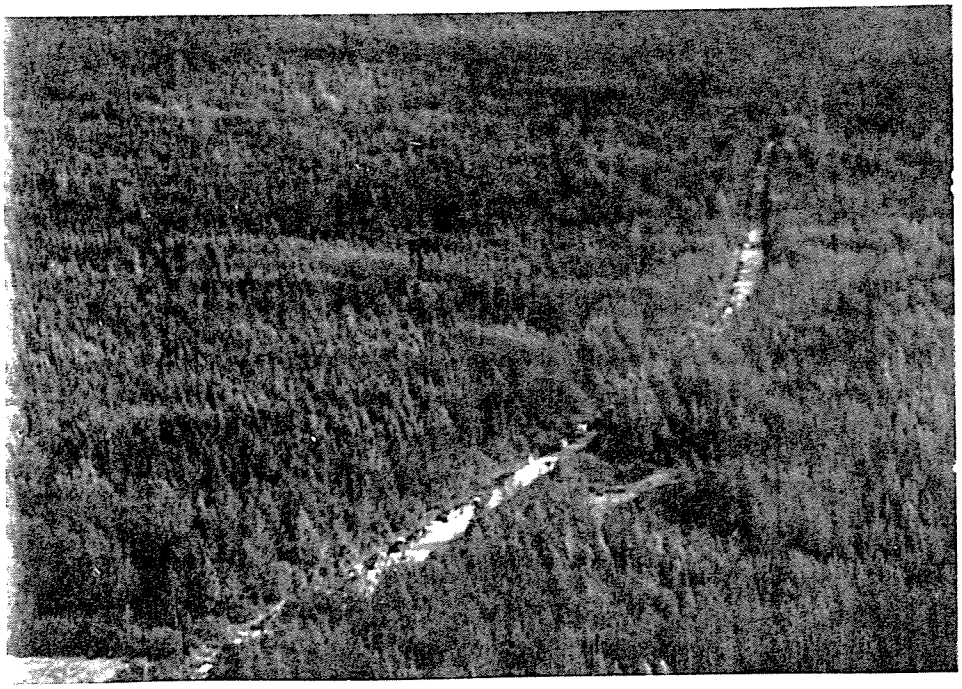
Bill Kent radios for reinforcements after being surrounded by dipnetters. 8/91/RKJ

Three successful dipnetters prepare to "take" bags of salmon back to their cars. 8/91/RKJ



Sockeye salmon at the weir that died (probably from a lack of oxygen) form a "fish jam" several hundred yards below the dipnet area on Hidden Creek. 8/91/RJ

A television crew documents the opening hours of the Hidden Creek Fishery. A bear observation tower was erected in order to watch for several brown and black bears feeding in the area. 8/91/RJ



Skilak Road became a linear parking lot with cars backed up for several miles toward the Sterling Highway. 8/91/RJ

Table 34. Estimated sockeye salmon harvest, effort and success rates on Russian River, 1963-1991.

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*
1991	65,390	31,450	97,840	96,161	0.290	06/01-08/20

*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.

Table 35. Kenai Peninsula Freshwater Sport Fisheries, 1991.

	Days fished		Est. % occur. on KNWR
	(non-guided)	(guided)	
Kenai River: (Soldotna Bridge to Moose River)	73,063	9,268	7%
Kenai River: (Moose River to Skilak Outlet)	40,438	2,963	15%
Kenai River: (Skilak Inlet to Kenai Lake)	43,012	4,300	70%
Russian River	18,861		70%
Kasilof River	40,437		5%
Swanson River	6,091		90%
Swanson River/Canoe Lake System	2,487		100%
Swan Lake/Canoe Lake System	2,402		100%
Moose River	712		90%
Other Lakes	9,375		40%
Tustumena	2,200		100%
Skilak	2,817		100%

The above statistics represent survey data for 1990 published during 1991.

10. Trapping

The overall declining trend in trapping activity on the Refuge in recent years continued during 1991. Fifty-two trapping permits were issued for the 1990-91 furbearer season on the Refuge. Fifty percent of reporting trapping permittees (24 of 48) did not trap. Probable reasons for continued low trapper numbers include: 1) decreased pelt values and demand for furs of wild furbearers across North America, 2) the past two to three trapping seasons on the Refuge have been characterized by above average snow depths or below average temperatures making trapping difficult, 3) continued closure of the lynx season throughout the Kenai Peninsula, a species whose pelt value provides significant incentive to trap; 4) additional trapping restrictions for wolverine, marten, fox and beaver; and 5) institution of a four-day trap check requirement on accessible portions of the Refuge.

Harvest of most land and aquatic furbearer species in 1991 was again well below historical levels (Tables 36 and 37). Furbearer harvest has also significantly declined across North America, including Canada, since the mid-1980's. Refuge trapping regulations, therefore, may have little to do with a general decline in trapping interest on the Refuge.

Lynx season has been closed on the Kenai Peninsula since the mid-1980's. The season will be reopened when snowshoe hare populations increase and lynx reproduction and kitten survival increases. 7/91/TB

Trapping closures near Jim's Landing have resulted in increased beaver numbers in certain locations. Jim's Landing cottonwood is fair game for a hungry beaver.
8/91/RJ

An immature bald eagle was turned into the Refuge after being caught in a trap left after the trapping season closed.
4/91/RKJ

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 1991-92 season. Fifty-two trappers attended, bringing the total number who have completed this one-time requirement since 1989 to 216.

Table 36. Total reported aquatic furbearer harvest and average per permit holder on the Kenai National Wildlife Refuge, 1960-91.

		Aquatic furbearer reported harvest							
		Beaver		Otter		Muskrat		Mink	
Season	Total permits	Tot	Mean per Permit holder	Tot	Mean per Permit holder	Tot	Mean per Permit holder	Tot	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
1990-91	52	7	0.14	4	0.08	5	0.1	16	0.32

GMS 15A has stabilized at approximately 50 wolves. As in 1989-90, no additional wolves were harvested during the season extension. Historical wolf harvest on the Kenai Peninsula is presented in Table 37.

Table 37. Historical wolf harvest/known wolf mortality on the Kenai Peninsula 1973-74 through 1990-91. (Source Alaska Department of Fish and Game).

YEAR	UNIT 7	SUBUNIT 15(A)	SUBUNIT 15(B)	SUBUNIT 15(C)	TOTAL	LAND AND SHOOT SHOOT[9]
1973-74	1	0	0	1	2[1]	
1974-75	1	0	1	4	6	
1975-76[2]	7	3	1	8	19	
1976-77[2]	3	5	2	3	13	
1977-78[2]	16	5	7	8	36	6
1978-79[2]	12	24	5	14	55	10
1979-80[2]	6	15	13	12	46	3
1980-81[2]	12	18	1	11	42	0
1981-82[2]	12	28	15	7	62	3
1982-83[2]	8	27	10	3	48	0
1983-84	10[2]	27[3,4]	5	8	50	3
1984-85	5[2]	32[3]	3	7	47	-
1985-86	13[2]	24[3,5]	15	12	64	-
1986-87	20[2]	9[3]	13	8	50[6]	-
1987-88	3[2]	8[3]	9	5	25	-
1988-89[7]	2	6	6	4	18	-
1989-90[7]	3	5[8]	10	1	19	-
1990-91	2	4	2	0	8	-

1. Two non-sport kills.
2. Trapping season November 10-March 31.
3. Trapping season November 10-March 31.
4. Western portion of 15(A) closed to trapping and hunting February 12 due to lice control efforts.
5. Trapping and hunting closed February 15, 1986 (quota set at 20).
6. One non-sport kill in Unit 7 and one non-sport kill in Subunit 15(B).
7. Trapping season November 10 - February 28.
8. Season extended 31 days, no harvest during extended season.
9. Land and shoot hunting of wolves was prohibited on the Kenai Peninsula beginning with the 1984-85 season.

In 1991, the Trapper Orientation Program included presentations by Alaska Department of Fish and Game Area Wildlife Biologists Ted Spraker or Gino DelFrate, local trapper and fur buyer Leon Metz, and Refuge Wildlife Biologist Loranger. Topics included 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.

Table 38. Total reported land furbearer harvest and average per permit holder on the Kenai National Wildlife Refuge, 1960-1991.

		Land furbearer reported harvest									
		Lynx		Coyote		Wolverine		Weasel		Wolf	
Season	Total permits	Tot	Mean per permit holder	Tot	Mean per permit holder	Tot	Mean per permit holder	Tot	Mean per permit holder	Tot	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
1990-91	523	0	0.0	22	0.44	0	0.0	6	0.12	3	0.06

[1] Includes lynx radio-collared and released for study.
[2] Includes four wolves radio-collared and released for study.
3Two permits revoked - calculations based on 50 trapping permittees.

For the second consecutive year the Alaska Department of Fish and Game extended the wolf trapping season from February 28 to March 31, 1991, in a portion of GMS 15A, by Emergency Order . This action was precipitated by a cooperative Service-ADF&G Operational Management Plan for wolves that stipulates that some management action will be taken if the post-trapping season population objective for wolves (25-35) is not met for two consecutive years. Under current low harvest rates, the wolf population in GMS 15A has remained stable at about 50 wolves for the past three years.

11. Wildlife Observation

Many Refuge visitors made inquiries regarding wildlife viewing opportunities during stops at the Visitor Contact Station and Visitor Center. They are encouraged to get an early start and to stay out late to have the best chances of seeing critters. Spruce grouse are readily seen along Refuge roads; Dall sheep and Mountain goats can be seen with the Refuge spotting scopes at the Russian River access area; moose can be encountered at any time of the year on roads and trails throughout the Refuge.

Brown and black bears, while not always visible, made their presence known during the Hidden Creek event. After the day's dipnetting was over, they came out of the brush and were heard if not always seen, crunching fish by visitors. Once or twice a bear crossed the road early in the morning only one hundred yards from the beginning of the line of anxious dipnetters.

A new overlook was constructed where the Pothole Lake fire crossed the road. Early succession stages of vegetation should attract easily observable wildlife.

8/91/RJ

Skilak Wildlife Recreation Area wildlife viewing opportunity. Two bulls clash for social dominance in the middle of Skilak Loop Road while a cow observes in the background. 10/91/TB

Beaver viewing has been significantly enhanced as a result of trapping restrictions at roadside lakes and day-use trails. A spotting scope along the Keen-Eye Trail at the Visitor Center allows visitors to view loons, gulls, and the occasional bald eagle. Eagles are also readily seen along the Upper Kenai River during the fall and winter as they feed on the last of the salmon.

The Refuge maintains a variety of roadside wildlife/wildland observation points along roadways. Swans, moose, beaver, eagles, waterfowl, passerines, and other wildlife can be seen at these locations. A new overlook/observation point was established on Skilak Loop Road at a point where the Pothole Lake fire crossed the road. We expect wildlife observation opportunities to be excellent here for the next few years as new vegetation attracts various critters closer to the road.

12. Other Wildlife-Oriented Recreation

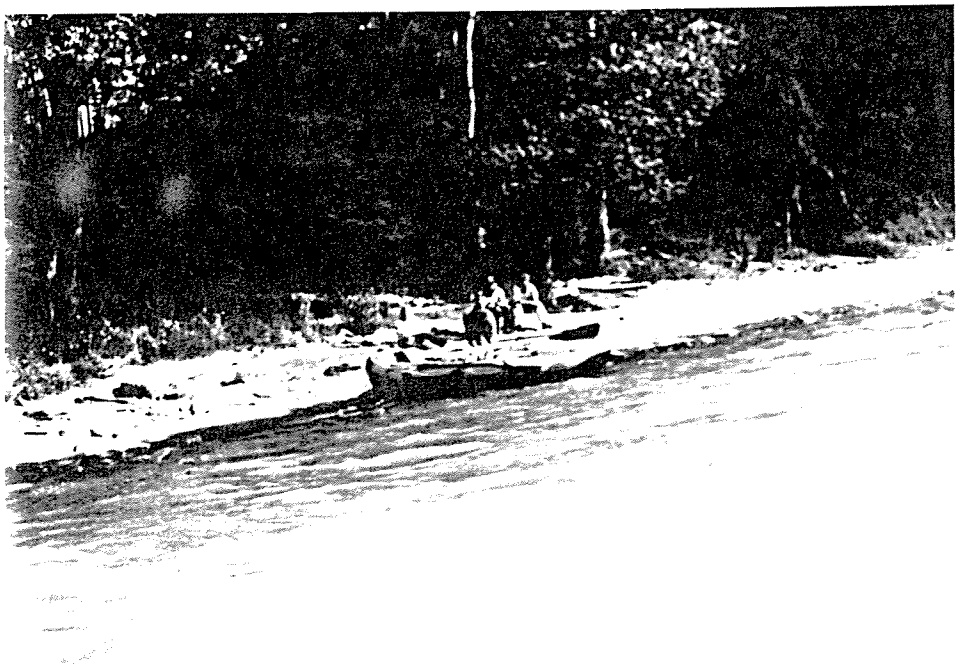
A busy canoeing/boating season began in earnest in May as visitors took to the waters in piscatorial pursuits and other recreational activities. The traditional "opener" for summer activities, Memorial Day weekend, saw all Refuge launch sites, campgrounds, and canoe trails very busy. The traditional end of the "crazy time", Labor Day, was also quite busy with similar activities.

Overall volume of boating activity appeared to be on the increase at several locations. Guided and non-guided drift boats, raft and canoes on the Upper Kenai River appear to have increased annually.

On one aerial patrol on June 12, forty rafts and fourteen drift dories were counted between Russian River and Skilak Lake. Non-consumptive, one-half day guided raft trips have also increased, particularly trips down the Kenai River Canyon.

Watercraft activity and boat launching at both Upper and Lower Skilak Lake Campgrounds also appear to be increasing annually. Observing more than one-hundred boats during a patrol of Skilak Lake and the Kenai River below Skilak Lake is not unusual. Both Upper and Lower Skilak facilities are inadequate for the amounts and character of use.

The Swan Lake and Swanson River Canoe Trails were popular during 1991 for visitors willing to carry their own canoes and paddle for excellent wildlife viewing and wilderness opportunities. An estimated 4700 visitors spent 23,500 days within the Swan Lake and Swanson River Canoe systems. Approximately 16,000 visitor days took place on the Swan Lake-Moose River Route and 7,500 on the Swanson River Route. Canoeists generally participated in multiple activities during a single trip including camping, fishing, wildlife viewing, canoeing, and hunting. Several canoeists remarked positively about the new portage work that was in various stages of completion during the 1991 field season.



A Refuge work party takes a break on the Upper Kenai River. 8/91/RJ

Park Ranger Richey and SCA interns completed trail work on the Seven Lakes Trail. Planks were installed in several muddy sections.

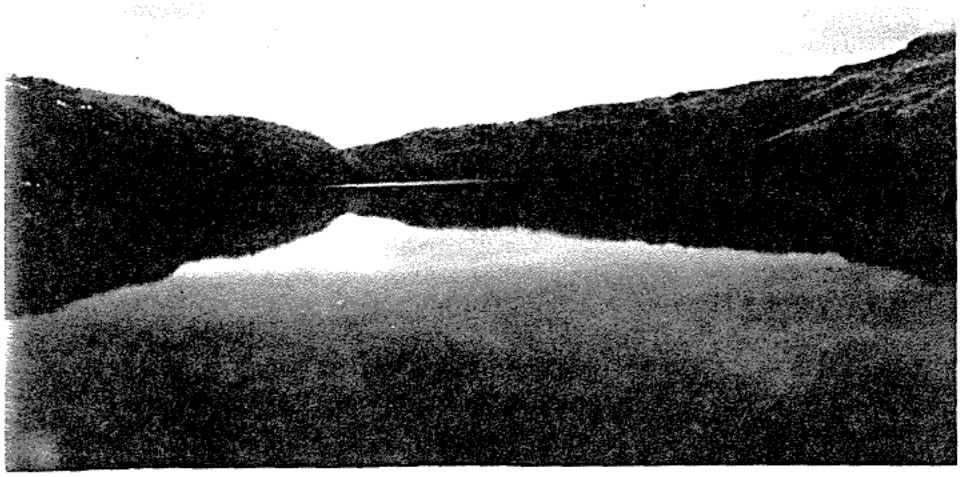
13. Camping

October and November camping at Jim's Landing provides excellent wildlife viewing opportunities for those willing to brave colder temperatures. The relative serenity of late season camping contrasts significantly with camping during July salmon runs. 10/91/RJ

This year over 75,000 visitors spent the night on the Refuge in campgrounds or backcountry areas. Although our campgrounds remain popular with the recreational vehicle/car-camping set, the backcountry trails are receiving substantial use also. Many of the more popular campsites within the canoe trail systems have been heavily impacted. Some restrictions may be necessary so heavily impacted sites can be rehabilitated.

Hidden Lake Campground continued to be a popular destination for visitors in 1991. Nearly $7000 in recreation user fees were collected this year, a decrease from 1990. This is directly attributable to the campground being evacuated over the Memorial Day weekend because of a wildfire and to the inability of the Refuge staff to effectively collect fees during the Hidden Creek dipnet fishery.

Jim's Landing Campground and boat ramp turned into a de facto fish processing area during a Hidden Creek dipnetting day. 8/91/RKJ



Hidden Lake before freeze up provides a quiet repose from the busy days of July. 7/91/RKJ

The Kenai/Russian River Access Area continued to be a popular recreation area during the year. Regional Office Engineering staff began preliminary studies on redesign of this area to better facilitate traffic flow and enhance the limited number of camping sites. These campsites could hardly be considered to meet Service standards, and certainly are not aesthetically pleasing. However, we expect some users to complain loudly if we attempt to make the area "better".

14. Picnicking

This activity occurs as an aside to other visitor activities, such as fishing, wildlife observation, and environmental education.

15. Off-Road Vehicles

The 1990-91 snowmobile season opened on December 1, 1990, and remained open until April 12, 1991, when the snow level was no longer adequate to protect underlying vegetation. The Refuge was re-opened to snowmobile use on December 1, 1991. Several November snowfalls created an adequate snowcover to protect underlying vegetation. Overall compliance with the snowmobile closures appeared good during 1990-91 and only a few warnings and 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. Though fewer than during the fall of 1990, several miles of off-road vehicles ruts were left on the tidal flats marsh during two weekends in September 1991.

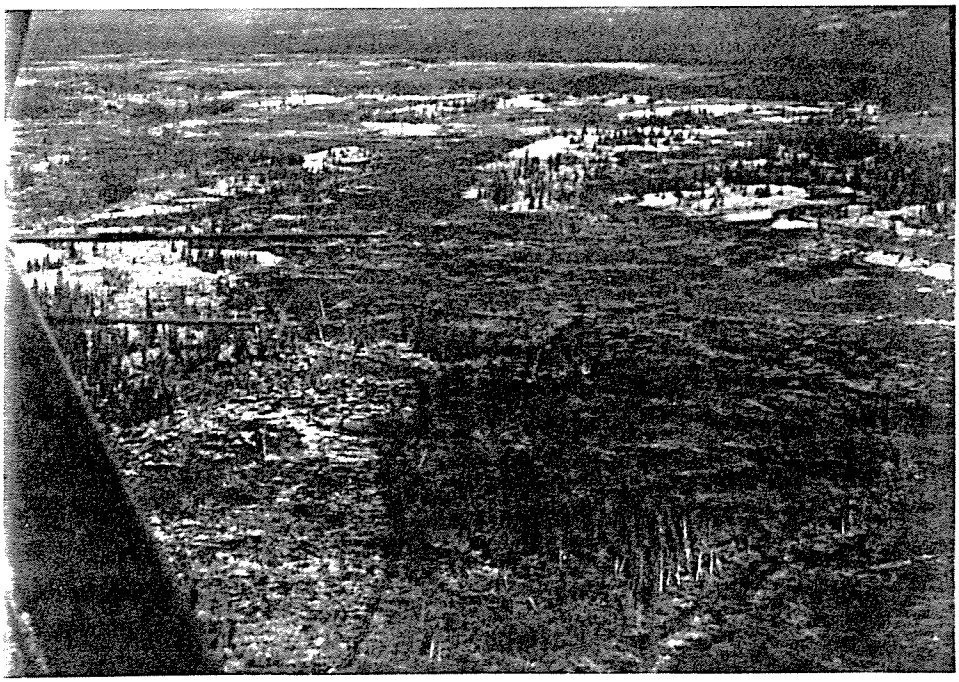
Snowmobiling in the Caribou Hills continues to be a concern. When developing the Kenai National Wildlife Refuge Comprehensive Conservation Plan in the early 1980's, Refuge staff made no attempt to close the Caribou Hills to snowmobile use. Planners were uncertain of the impact to Refuge resources and recognized public interest in the area as a winter use area. Refuge staff believed the State lands adjacent to the Refuge boundary would buffer the Refuge wilderness from impacts caused by large amounts of snowmobile use. However, winter snowmobile use has increased dramatically since 1980 within the Caribou Hills. In some areas, snow in alpine valleys is compacted from heavy snowmobile use. Areas unused by snowmobiles and all terrain vehicles are few and entire off Refuge wetlands are scarred by all terrain vehicle use. The Refuge boundary can be defined by where all terrain vehicles have stopped.

The majority of snowmobile use appears to be primarily recreational in nature and not in support of traditional activities (i.e. hunting, trapping, wildlife observation). The use appears to be originating primarily from cabins that were constructed in trespass on State lands, although day use has also increased. The proliferation of trespass structures and the subsequent increase in snowmobile use was not anticipated by the Refuge staff. The significant surface disturbance and the alarming increase in uncontrolled all terrain vehicle use on adjacent

State lands is a source of concern. Many species of wildlife have large home ranges that overlap the Refuge boundary.

In December 1985, Acting Refuge Manager Mike Hedrick enumerated the Refuge's concerns about the proliferation of trespass cabins on adjacent State lands and the increasing recreational snowmobile use associated with the cabins. Concerns about cooperative wildlife values were also documented in the 1985 correspondence and remain a significant issue. The situation in the Caribou Hills in 1985 and the decision to authorize 70 trespass structures was a source of significant concern. Even more alarming is that new trespass cabin construction has occurred since 1985. The increased snowmobile use on Refuge land and all terrain vehicle use on State lands in the summer months appears to have been dramatic and proportional to the off-Refuge trespassing. Snowmobile use for traditional purposes may have been all but replaced by recreational snowmobile use.

In 1986, the Alaska Department of Fish and Game and the Refuge reintroduced caribou into the Caribou Hills, but the caribou abandoned the area, possibly due to the disturbance from snowmobiles. The Board of Game with Refuge support significantly reduced the ptarmigan season. This action was at least partially due to concern about over-harvest by hunters with the enhanced mobility of snowmobiles.



A semi-permanent winter trail has developed as a result of inholder access west of Tustumena Lake. 5/91/RJ

Snowmobile use in the Caribou Hills remained heavy during 1991. This photo was taken within the Refuge wilderness and illustrates the extent of recreational snowmobiling occurring on Refuge lands. 1/91/RJ

The Refuge was encouraged by the enforcement actions this spring by the Department of Natural Resources against new trespass structures. However, enforcement actions were suspended until policies for State lands in the Caribou Hills are developed and adopted. We are hopeful that the State planning process for the Caribou Hills may provide an important forum to analyze and discuss the resource values and outdoor recreation vehicle problems within the Caribou Hills.

16. Other Non-Wildlife Oriented Recreation

The Headquarters cross-country ski trails were widened and cleared during December 1991 by Refuge staff. A six-foot surface was cleared and obstructions were removed. The trail work should allow ski trail use much earlier in the season and will make many areas safer.

17. LAW ENFORCEMENT

The Refuge had three collateral duty permanent Refuge Officers, one permanent full time Refuge Officer, and three seasonal commissioned officers. Supervisory Park Ranger Bill Kent arrived in the spring of the year, bringing with him his experience and strong support for the law enforcement program. We also welcomed two new seasonal officers Terry Rude and John Gahr. Refuge Officer Steve Hudson returned after spending the winter working at Umatilla National Wildlife Refuge. Officers Rick

Johnston and Chris Johnson attended the Law Enforcement Refresher Training in Marana, Arizona, in March. Officer Candace Ward completed her refresher training with the Alaska Division of State Parks Rangers.

The Kenai Peninsula receives the heaviest sport fishing pressure in a State that is crazy about fishing. As a result of this fishing pressure, the fishing is highly regulated. This makes it difficult for new officers to come in and be effective immediately. It also makes it troublesome for the resource user to know what they can and cannot do. A preventive approach to law enforcement is the use of regulatory signs. They are posted at various locations around the Refuge. News releases are sent out periodically to educate the public on the regulations. Officers spending time in the field, giving programs, and explaining the regulations. During hunting season, there are check stations and remote field camps where hunters can stop and either get information or turn in information they have come upon. Refuge officers give warnings when appropriate and also issue violation notices when necessary.

There were 225 violation notices issued in 1991. Sixty-seven percent of those were for fishing-related infractions. Seasonal Officers issued 75 violation notices. This was the first full year the Refuge has had a full-time Refuge Law Enforcement Officer, and accounts for the increase in violation notices issued. (See table for breakdown of violations issued).

Example of preventive law enforcement regulatory signs posted at entrance of Kenai River into Skilak Lake.
11/91/CJ

Significant incidents and cases during 1991 were as follows:

Johnson and State Fish and Wildlife Officer Sharp discovered a trapline along Mystery Creek Road and the pipeline right-of-way. The traps were set as flag sets, which are prohibited on the Refuge when lynx season is closed. The traps were also not marked with any identification as required in the Refuge trapping permit. The subject's identity was discovered when Johnson checked out a public use cabin in the area and found a sleeping bag with a name on it. This person was contacted and interviewed and gave a full confession.

While on routine patrol, Johnson apprehended two men trapping beaver on Waterfowl Lake and Contact Lake without a State trapping license or a Refuge trapping permit. Several snares and one adult beaver were seized.

In April, Johnson was detailed to the Yukon-Kuskokwim Delta for the enforcement of the Yukon-Kuskokwim Delta Goose Management Plan. While conducting a hunter field check with Agent Webb at Chagvan Bay, they discovered that nine hunters had taken 215 geese, one duck, and a long-tailed jaeger during the closed season. Twenty-one of those geese were also taken in violation of the Goose Management Plan.

When the Pothole Lake Fire spread across the Kenai River during Memorial Day week-end, Refuge Officer Hudson and SCA Volunteer Barto helped evacuate people from the advancing fire at the upper end of Skilak Lake. In rough water and thick smoke, they warned and evacuated several groups of people. Refuge officers also evacuated the Hidden Lake Campground and Hidden Lake as the fire and heavy smoke approached. No injuries to Refuge visitors occurred, although a boat being evacuated from Hidden Lake swamped and the persons on board were rescued by Johnson.

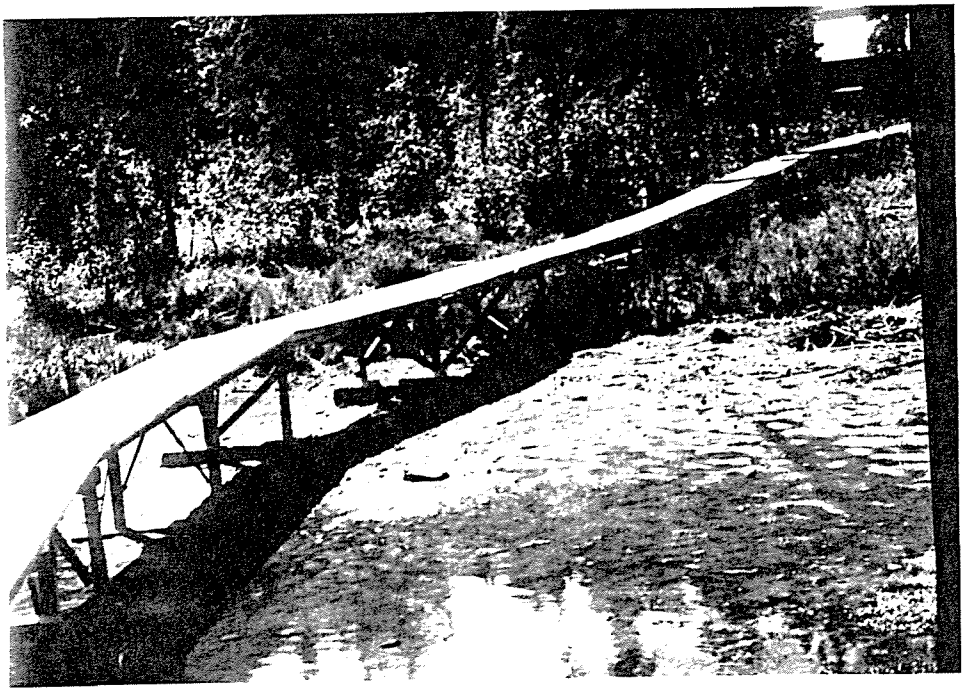
Several persons were questioned regarding the origin of the Pothole Lake Fire. At least two bear hunting groups were in the area and admitted to having fires within the general area. Neither Division of Forestry nor nor Refuge staff were able to positively identify the individual(s) who left the suspected unattended fire.

In May, Refuge personnel assisted Alaska State Troopers and Central Emergency Services (CES) personnel in one of the largest ground searches to take place on the Peninsula. On the second day of the search Johnston took over as the Incident Commander. Several teams were formed to conduct grid searches of the area looking for 71-year-old Frank Bush. Helicopters and fixed wing aircraft also searched the area west of Tustumena Lake. On the night of the third day of the search, Frank Bush walked out of the woods under his own power to his homestead. A total of nine Refuge employees and volunteers were involved in the ground and air search.
Refuge staff discovered an illegal dock structure protruding in the lake from an inholding property at Dawson Bay on Skilak Lake. The inholder, Thomas Belli, agreed to remove the structure which had been constructed

without Refuge or Corp of Engineer permits. At year's end, despite an agreement to remove it by November 15, 1991, the dock remained.

During visits to the Wade inholding, it was observed that the excavated beach in front of his inholding was not restored as ordered by the State Court in 1989. Mr. Wade had utilized a stolen backhoe to do substantial excavation of the beach. The Kenai District Attorney and Mr. Wade's parole officer were notified that the terms of his original sentence had been violated.

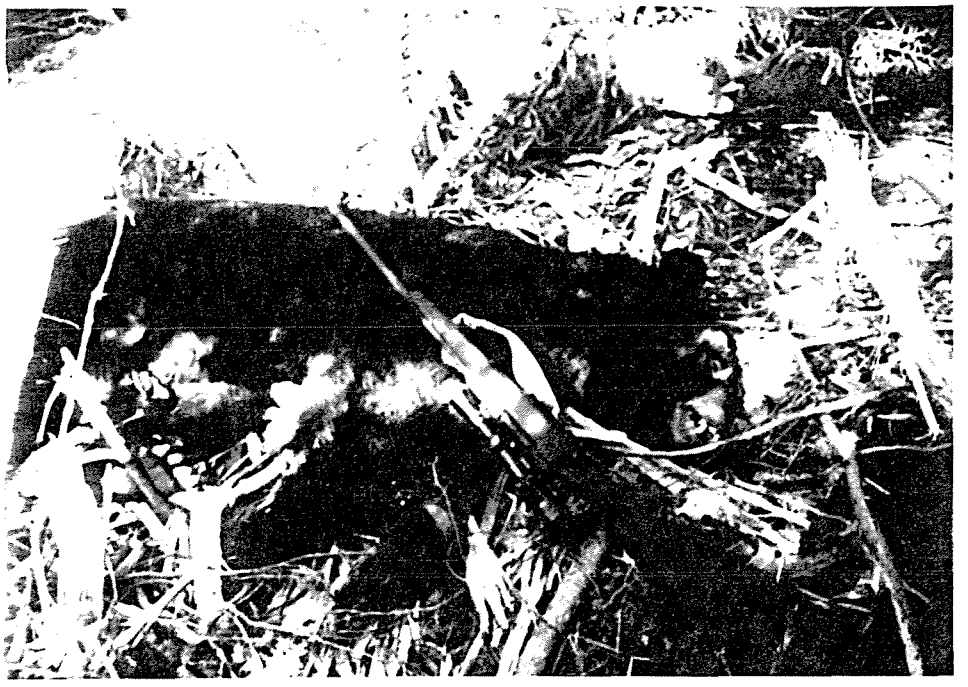
Kenai resident Steve Wiggins reported having to shoot a black bear at close range after being charged. The bear was caught in a wire snare and unable to retreat from the unwitting Wiggins. The snare was reported to have been set for bears and was 15 foot long with 5/16 gauge wire. Johnston flew to the site and found only the bear carcass. The snare was gone from the area. No suspects were identified.



A Refuge inholder constructed an unauthorized dock structure in Skilak Lake. After an investigation by Refuge officers, the inholder agreed to remove the structure. 8/91/RJ

Several campers were evacuated from Skilak and Hidden Lakes during Memorial Day weekend when the Pothole Lake Fire made a rapid run toward Skilak Lake Road. 5/91/RJ

Pothole Lake Fire three days after it started, as seen from Lower Russian Lake. 6/91/RKJ



A moose hunter had to kill this black bear in defense of his life near Shantilak Creek Tustumena Lake. The bear had been injured and caught in a trap, left after the season or in an attempt to catch bears. Note: The injured foreleg and snare. 5/91/RKJ

In July, while on patrol on Skilak Lake Road, Johnson observed a group setting up camp in an area closed to camping. He stopped and informed the group they could not camp there. While talking to them, he noticed that they were drinking Miller Genuine draft beer out of a can. He then left and stopped at a pullout down the road. Shortly, the two vehicles associated with the group went by him. As Johnson followed them down the road, he noticed an empty Miller Genuine draft beer can in the road where there had not been one 15 minutes before. Johnson later caught up to the group and asked if he could see their beer cans. He was able to match up the lot numbers on the bottoms of the cans with the one found in the road. Two of the guys were acting a little bit strange so Johnson radioed Kenai base to run their names for wants and warrants. One of the men came back with three felony warrants and a note advising that he had escaped from custody. Johnson then arrested the escapee. A subsequent inventory of the suspect's vehicle revealed a small amount of marijuana and a bag of a white powdery substance hidden under the floor mat.

While preparing for a river patrol, Officer Rude observed a raft with three people on board hit a rock and dump the people into the icy Kenai River near Schooner Bend. Rude radioed Johnson and SCA Coordinator Richey to come down with the Zodiac. A few minutes later they launched the Zodiac and were able to pick up the people. Two of the people were wearing life

jackets. The third man was very lucky to make it to a rock. Two of the people were treated for hypothermia after being rescued from the water.

In August, Johnson observed a man snag and keep a salmon. The man admitted to snagging the fish. He later contested the violation notice and requested a 12-person jury to hear the case. A two-day trial was held in Anchorage three months later. The fish had long since been donated to a charity. The defense and his lawyer tried to create a reasonable doubt in the minds of the jury on what the officer could see from his location and the amount of light present. Apparently, they did create this doubt because they found the defendant not guilty. After the trial, several members of the jury came up to Johnson and told him they thought the guy was guilty. However, there was some doubt created by the defense lawyer and they thought the defense lawyer outdid the government in this case. After this case, the Public Defenders Office said they would request a jury hearing for all the cases they represented.

Johnston investigated a case of illegal tree cutting on the Refuge. Three individuals were cited for cutting several thousand trees around their illegally built tree stands. The three were given several hundred dollar fines each and completed 40 hours of community service on the Refuge, as well as agreeing not to hunt in the area for three years.

Johnston and State Officer Titus investigated a sub-legal take and wanton waste of a moose on the Moose River. They received a tip from one of Secretary Brenda Marsters' sons that broke the case. With the tip, they were able to identify the subjects who later confessed.

Johnson investigated several cases of illegal moose being taken on the Refuge. He was able to obtain admissions on two of these cases. In each of these cases the moose meat was seized and later donated to a charity.

On Friday, December 13, 1991, at approximately 7:00 p.m., a SouthCentral airline commuter aircraft went down near the Refuge's southwestern boundary in poor weather. The plane was enroute from Homer to Kenai. The search was hampered by heavy winds and new snow. Military and Trooper aircraft were able to search during brief periods on December 14 and 15. Johnston and Johnson joined snowmobile-supported ground searchers on December 15. Ground and search aircraft were again hampered by poor weather. Some search areas were only partially covered. On December 16, the ground search was suspended due to poor weather. Aircraft met limited success covering the area on December 16 and 17, but no sign of the Piper twin engine aircraft was found. Civil Air Patrol continued the search on December 18 and 19. Only the pilot was aboard the aircraft.

In September, Two Fort Richardson hunters were cited by State Protection Officers for waste of a big game animal at Emma Lake within GMU 15 east during September. The case went to trial and convictions were obtained.

Two separate complaints were received, supported by photos from [redacted] of 60-70 mature trees having

been cut in an area south of Fox River. The trees were felled and stumps obscured by moss in order to block an historically used local trail. No suspects were identified and the trail remains blocked.

Johnston received a report from Larry Marsh, a biologist with ADF&G, regarding a sublegal ram taken at Green Lake during the early moose season. The report was also given to the primary Fish and Wildlife Protection investigator. The group involved was also involved in an illegal take during 1990.

An unauthorized sto-it structure was disassembled and transported from Chickaloon Flats on June 21, 1991. The structure had been discovered in the mid-1980's and numerous attempts to contact its owners had failed. The structure was removed with the assistance of the State Department of Natural Resources.

A total of 103 waterfowl hunters were contacted in the field. Six warnings were given for minor violations, and two hunters were cited for possession of lead shot while waterfowl hunting.

From August 1 to October 30, 1991, fifty-eight violation notices were issued by Refuge Officers on the Kenai National Wildlife Refuge. Thirty-four of them were for various fishing violations, eleven were for assorted hunting violations, four for false statements on license or no license, and five were for other violations. There are also several big game cases still under investigation.

Sub-legal moose seized by Refuge officers in the Swanson River Area. 8/19/CJ

Refuge Officer Johnson with geese seized during Yukon-Kuskokwim Delta closed season. MBTA enforcement detail. 4/91/RJ

Several cooperative patrols and investigations with the State of Alaska, Division of Fish and Wildlife Protection occurred during 1991. State Officer Gary Titus assists Johnston with a moose poaching case along the Moose River. 9/91/RJ

Table 39. Kenai National Wildlife Refuge incidents (Nov-Nov) 1986-1991.

Incident/Violation	Number of Incidents				
	1987	1988	1989	1990	1991
Low flying aircraft	10	15	8	15	8
Violation of a Refuge SUP	18	12	8	8	7
Vandalism	23	28	23	26	21
Altercation/disturbance	5	3	-	-	3
Theft	9	6	2	7	15
Drunk and disorderly	7	2	-	3	6
Unattended or abandoned property	8	10	5	4	8
Unauth. taking of wildlife/in. wildlife	27	40	33	29	31
Violation of trapping permit	9	3	4	2	5
Violation of wood cutting permit	11	5	2	-	1
Assist to public involving injury	13	10	7	8	6
Assist to public not involving injury	35	45	48	60	61
Unauthorized use of motor vehicle	18	21	17	18	15
Coast Guard violation/boating	25	60	70	75	54
Unauth. cutting green trees/timber removal	17	27	10	15	15
Unauth. fireworks	3	1	3	2	4
Unauth. park./block. Refuge road/facility	35	17	30	35	36
Target shooting/unauth. use of firearms	10	7	5	8	6
Search and rescue	15	13	8	6	9
Drowning	2	3	-	-	-
Miscellaneous fishing violations	13	33	37	39	53
Unattended fire/wildfire/unauth. fire	20	24	10	12	8
Disposal of waste/littering	25	23	25	29	22
Other Refuge regulations	20	17	15	18	41
Assist to Ak State Troopers/traffic acc.	20	23	17	19	20
Assist to Ak F. & W. Protection Officers	21	18	28	23	37
Miscellaneous traffic violations	4	8	15	15	4
Bear baiting permit violation	5	4	2	2	3
Bear encounter	4	3	3	5	7
Aircraft violation	33	43	10	8	13
Eagle Ace	-	-	-	-	4
Arrests	-	-	-	-	1
Assists to F. & W. Agents (Off Refuge)	7	30	25	27	19
TOTAL	481	562	470	578	543

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

Table 40. Kenai National Wildlife Refuge Violations cited for 1982-1991

Violation	82	83	84	85	86	87	88	89	90	91
Snagging fish	24	26	23	10	1	15	14	20	26	7
Fishing closed waters	4	13	4	3	3	3	1	8	15	36
Overlimit fishing	3	6	3	4	1	4	8	4	24	17
Fishing without a license	4	1	1	2	1	1	10	14	8	11
Other fishing violations	0	7	4	2	0	2	1	29	51	69
Snowmobile violations	4	6	2	0	0	2	1	0	0	0
Motor boat closed area	0	0	0	0	0	1	4	2	0	4
Unauth. use of motor veh.	10	9	20	28	15	13	9	2	4	7
Illegal parking	13	2	12	2	0	3	3	2	5	19
Illegal aircraft landing	4	6	0	0	0	4	2	0	1	0
Illegal fireworks	1	4	2	2	0	2	0	0	1	1
Weapons violation	0	0	0	2	6	3	1	0	0	3
Violation of hunting regs.	0	1	1	0	0	4	0	7	7	10
Migratory bird act	0	10	2	2	1	2	4	2	1	4
Littering	0	3	2	3	4	1	1	0	4	3
Unauthorized structure	1	0	0	0	2	0	2	0	0	0
Illegal woodcutting	4	5	2	9	3	4	4	0	1	4
Speeding	0	5	3	0	2	1	1	1	1	1
Unattended fire	0	0	0	0	0	0	1	1	2	3
Interference with officer	0	0	0	0	0	1	0	0	0	1
Destruction of property	1	0	0	0	0	0	1	0	2	0
Permit violations	1	2	2	2	1	3	2	1	2	1
Violation Coast Guard regs	0	5	0	0	0	0	0	14	8	8
Violation Refuge regs	0	0	0	2	1	5	0	3	5	5
Trapping violations	0	0	0	4	4	2	0	1	2	5
Violation of bear baiting	0	0	0	0	0	0	0	0	0	1
Theft	0	0	0	0	1	5	0	0	0	0
Violation of traffic code	0	0	0	0	0	0	0	0	5	5
Total	74	111	83	77	46	81	70	111	175	225

Several unauthorized clearings were constructed in the Skilak Lake area for the purpose of moose hunting. An investigation lead Refuge officers to three local hunters. 9/91/RJ

18. Cooperating Associations

Final 1991 sales for the Refuge's Alaska Natural History Association cooperating sales outlet (Kenai branch) totaled $21,570. Sales remained roughly equal to 1990, due to a second consecutive year of poor king salmon fishing creating a "slow down" in the summer tourist season.

Proceeds from cooperating association sales were used for volunteer awards and were especially instrumental in creating honorariums for outstanding volunteer contributions during the Hidden Creek dipnet fishery. Association funds were used for conducting teacher environmental education workshops and for the purchase of computer equipment, including a Radius full-page monitor and Hewlett Packard Laser Jet III printer. Through acquisition of these components we have begun to improve our ability to design quality brochures, environmental education materials, temporary exhibits, volunteer training materials, and other public outreach materials.

Ward and Kent attended the Alaska Natural History Association Annual Meeting and Workshop in December. Ward presented 1991 accomplishments to the board of directors and submitted the 1992 Kenai branch budget. She also facilitated a branch managers forum during the workshop.

19. Concessions/Commercial Operations/Special Use Permits

Most Refuge Special Use Permits for various outdoor recreation services were issued by May 1, 1991. A total of 85 individuals or business' obtained Refuge Special Use Permits for commercial services. Several new permittees were offering non-consumptive wildlife-oriented outings, while other permittees offered sport fishing services.

Permittee fees remained consistent with Region 7 policy regarding Refuge special use; however, an evaluation of the existing regional fee program was underway in 1991. While several fee collection strategies were being reviewed, the primary thrust was to increase fees based on an accurate ratio-of-use. At year's end, a visitor use formula had been selected but then put on hold pending a departmental review.

No new big game outfitter/guide permits were issued during the year in compliance with the regional policy, which 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.

Refuge staff commented on two separate outfitter/guide proposals during 1991. The first was the State proposal for establishing new outfitter/guide areas and a the second was Region 7 contingency plan in case the State system fails to be implemented. By year's end, the Region 7

plan was being developed in detail, and Regional Office staffers were pessimistic about the State's ability to finalize a plan.

The Refuge corresponded during 1991 with the Regional Office regarding existing guide areas and prospective outfitter/guide areas. No guide areas have become vacant since the interim policy was implemented. We have one outfitter who was under permit and is now permitted as an outfitter/guide.

Approximately five guides with Game Management Unit (GMU) 15 and/or GMU 7 endorsements have applied for permits, but have been denied authorization to conduct activities. Denial of opportunity is not applicable since it is estimated that either existing permittees' clients or members of the general public are harvesting all available trophy animals.

No guide areas were vacant at the time that the interim policy was started. Several of our existing guides are hunting intermittent years due to the overall low density of big game populations in various areas. Their husbandry of the available trophy animals is encouraged by the Refuge and several guides use their areas intermittently accordingly. Theoretically, others could hunt these "rest years" if permitted by the Refuge; however, animals of smaller size would be harvested. Individual husbandry of an area would, unfortunately, be discouraged if such were the case.

Approximately five guides, primarily for Dall sheep hunting, and five to seven clients will be affected by any new outfitter/guide policy. A regional task force was assembled in December to formulate criteria for selection of big game outfitter/guides.

Table 41. Guided recreational visits occurring on Kenai National Wildlife Refuge, 1991.

	Number Visitors	Total Visits
Upper Kenai River Sportfishing	1700	2650
Upper Kenai River Scenic Floats	2800	3350
Lower Kenai River Sportfishing	1700	1900
Fly-in Tent Camps	1150	2700
Outfitter/Guides/ Big Game/Transports	210	970
Other	780	1021
TOTAL	8340	12529

The Peninsula Sled Dog Racing Association conducted three scheduled weekend sled dog races on Refuge lands. All participants reported the Refuge

trails were excellent and the races appeared to be in compliance with all permit stipulations.

The Kenai/Russian River Access Area was under the third 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.

Tawah Trading Company is under contract to operate the Russian River ferry and to collect parking fees at the Kenai/Russian River Access Area. A total of 14,077 vehicles was accommodated and $54,327 in parking fees were collected. The concessionaire's ferry transported 47,453 passengers for user fees of $135,433.

There are serious shortcomings in the present contract, which unfortunately, cannot be dealt with until the contract expires. The Supervisory Park Ranger has the responsibility for all dealings with the concessioner and will institute a concession inspection schedule in FY92, as well as make regular and unscheduled visits to the area.

A letter was sent out February 6, to Upper Kenai River sportfishing guides outlining minor changes for the 1991 season. Sport fishing guides are limited to two registered boats, and all occupants of drift boats are now required to wear life jackets. Several other features of the program were also clarified including the policy on "brokering" permits.

Compliance with special use permit conditions increased significantly during 1991. Law enforcement officers inspected several guides on the Upper Kenai River both during routine patrols and in response to reports of unauthorized guiding. Several guides were either warned or issued notices of violation for various permit or regulation infractions.

The Kenai River Advisory Board and Refuge staff continued to review, consider, and offer comments on the Alaska State Parks' proposal to limit Kenai River guides. Initially, the Refuge intended to maintain its current control of Refuge portions of the Kenai River via the Refuge Special Use Permit. However, in the interest of administrative streamlining, the Refuge and Alaska State Parks proposed to consolidate the permit under the State permit system. For Kenai River activities the Refuge's current limit on the Upper Kenai River would generally be maintained by Parks.

The Refuge continued to consider consolidating the Refuge and Alaska State Parks Special Use Permits for the Upper Kenai River. Alaska State Parks issued its final decision regarding the overall limit for Kenai River guides. A non-monetary competitive bid process would authorize 125 drift guides and 125 motor boat guides starting in the 1992 season. The State decision also would authorize 40 individual guides on the Upper Kenai 36-137River.

In September 1991, Refuge Manager Doshier corresponded with Commissioner Harold Heinz regarding the Alaska State Parks proposal to limit guides and consolidate the State and Refuge permits for the Upper Kenai River.

Doshier's letter stated the cooperative permit was contingent on clear limits on sport fishing operations, Refuge participation in the sport fish guide selection process, acceptance by Parks of in-kind services, an updated memorandum of Understanding and, finally, that selection criteria be modified to give existing Refuge guides a fair chance at selection based on Upper Kenai River experience.

The entire guide limit proposal and subsequently the cooperative permit fell apart before a response was received, based on a determination by the State Attorney General's Office that Parks had no authority to limit guides.

On April 18, Doshier corresponded with Kenai River ferry concessionaire John Galazia regarding a previous request to gate off the facility due to a perceived vandalism problem. Doshier declined a complete off-season closure but confirmed the Refuge's intent to close the area between mid-November and mid-April and on an as needed basis.

I. EQUIPMENT AND FACILITIES

1. New Construction

Two new overlooks were developed along the Skilak Loop Road in the Hidden Lake vicinity during the summer. The Pothole Lake Fire Overlook was constructed, using heavy equipment assigned to suppression activities, east of Hidden Lake at a location where the fire jumped the Skilak Road. Refuge dump trucks and heavy equipment were later used to place a rock barrier along the outer perimeter of the overlook. With help from Youth Conservation Corps (YCC) enrolles, the downslope was contoured and seeded.

Mechanic Al O'Guinn fabricated a steel sign base and frame for a computer generated interpretive map showing a chronological sequence of events surrounding the Pothole Lake Fire which started from an unattended campfire over Memorial Day weekend.

A second overlook using Refuge equipment and personnel was constructed just south of the Hidden Lake entrance along the Skilak Loop Road. When completed, this site will be one of the most impressive "vistas" on the Refuge, overlooking a portion of Upper Skilak Lake, Skilak Flats, Skilak Glacier and the Kenai River.

Carpenter Bud Marrs and Seasonal Laborer Donna Bartman constructed a number of wood-routed signs, including a 5' X 6' "Visitor Information" for use at the multi-agency Coldfoot Visitor Center located along the Dalton Highway. A number of other wooden signs were repaired and returned to service. The badly shot sub-entrance sign along the southern portion of the Swanson River Road was dismantled and brought in for a "face lift". This sign will be re-installed in the spring of 1992. While there has been a noticeable decrease in the frequency of sign shooting the past few years, an increasing problem seems to be the theft of small wood routed lake and trail markers. Perhaps some of our local "sportsmen" think our signs make a more appropriate decoration for den walls than they do targets. Unfortunately, the net result is about the same!

Marrs and Bartman also constructed a wooden stairway to permit fisherman to access Hidden Creek during the now-famous dipnet fishery held this past summer. The stairs permitted access to the creek from Skilak Loop Road and prevented what would have been a serious erosion problem.

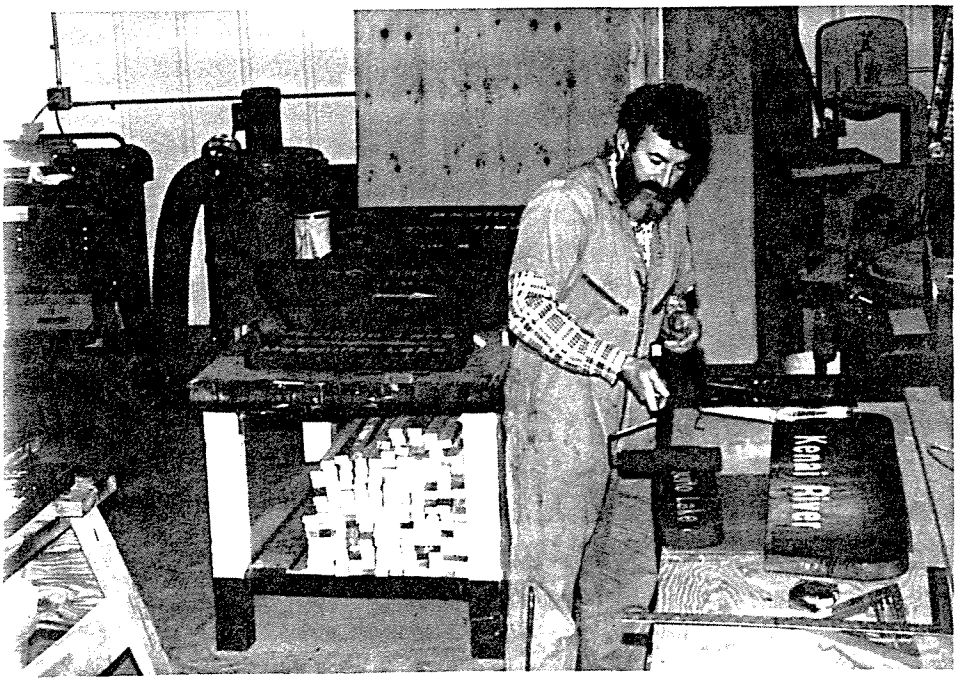
O'Guinn fabricated and installed two steel gates for improving security at entrances to the Outdoor Education Center (OEC) and Skilak Guard Station respectively.

The maintenance staff assisted with logistical support in getting supplies and materials transported to strategic locations within the Canoe System for construction of boardwalks along selected portage routes. Over 5000 lineal feet of boardwalk was eventually constructed using high school Student Conservation Association (SCA) volunteers and Boy Scouts.

Construction of turn-out where the 1991 Pothole Lake Fire jumped the Skilak Road between Hidden Lake and Sterling Highway. Most of the construction was done by fire suppression crews. 6/91/RW

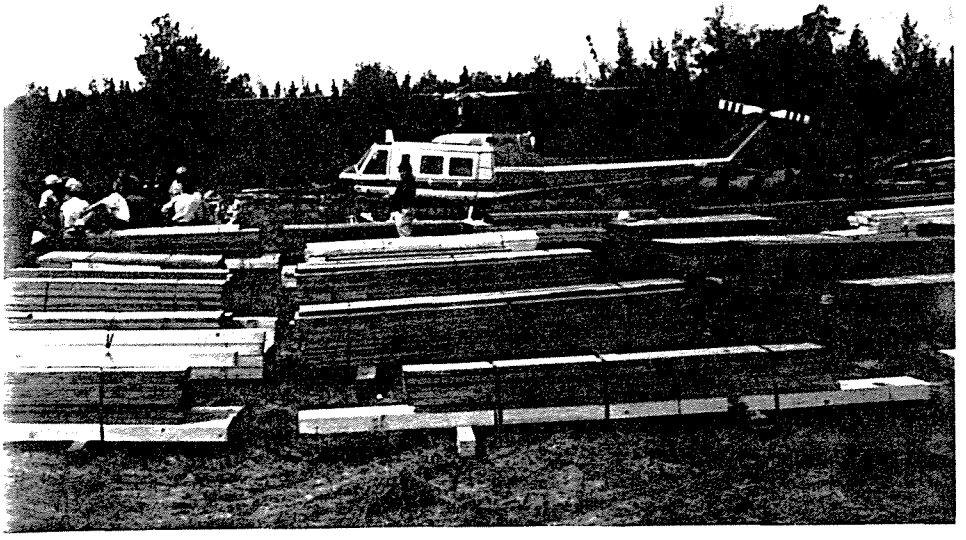
Nearly-completed turnout overlooking the path of the Pothole Lake Fire along Skilak Road. Site will be used to interpret, not only a chronology of events relating to the fire, but the role fire plays in habitat management on the Kenai. Skilak Lake in background. 6/91/RW

Initial phase to develop the Upper Skilak Lake/Kenai River overlook was started in 1991. One of the most scenic "vistas" on the Refuge, the site will eventually have a scope and interpretive facilities. 6/91/JF



Refuge Carpenter Bud Marrs doing what he does best---
7/21/JF

---and often. Sign construction and maintenance is a big part of our seasonal program. 7/91/JF



Logistical planning became a key element in transporting several thousand board feet of lumber to strategic locations within the Canoe Trail System. Placement of boardwalks between portages was done by SCA high school volunteers and Boy Scouts. 8/91/DB

Refuge maintenance staff provided support for the Canoe Trail System boardwalk portage project. 8/91/DB

2. Rehabilitation

Following spring break-up, several loads of gravel were hauled to repair wash-outs along the Swan Lake Road. One culvert at the base of Muckuluk Hill was lowered to facilitate drainage and, hopefully, correct a perennial problem at this location.

Low spring water level in Skilak Lake permitted us to finally make needed repairs to the lower landing boat ramp damaged by wind-induced ice the last two years. Ramp edges were "shored up" with several dump truck loads of gravel, and large boulders placed at selected access points to prevent vehicle access to the outlet of Skilak Lake.

3. Major Maintenance

Our aging five-and ten-yard dump trucks were completely overhauled, as it appears replacement opportunities are about as slim as lightning striking a house won in an Ed McMahon-sponsored sweepstake. Brakes were replaced as were hydraulic hoses, pumps and rams. Hopefully, we can "squeeze out" a few more dump loads before they are forced into retirement from the fleet.

O'Guinn and Operator Dick Kivi spent a good part of the winter rebuilding the transmission on the John Deer 350 backhoe. They also changed the hydraulic system in order to retrofit a hydraulically operated post pounder. The project was a cooperative venture with the Alaska Department

of Fish and Game (ADF&G). The unit will be used in an extensive fence rehabilitation project at the Moose Research Center. ADF&G purchased transmission parts and the post pounder while the Refuge provided shop space and labor.

Other maintenance projects completed during the year included: (1) the well at the OEC was pulled and a broken pump rod replaced; (2) the old security lights were replaced within the shop complex with amazing results - we can now detect the difference between night and day!; (3) new exhaust fans were installed in the bunkhouse bathrooms in order to prevent the constant generation of mildew and other strains of "bunkhouse-ish" fungi; (4) the pipes in the old Kenai Headquarters freezing resulting in considerable damage to ceiling tiles on the lower level, and requiring replacement and rerouting of some lines, installation of new zone valves and a circulation pump, and putting the furnace back in operation; and (5) a number of repairs were made to the OEC, including cabin steps, window encasement, doors and roofs.

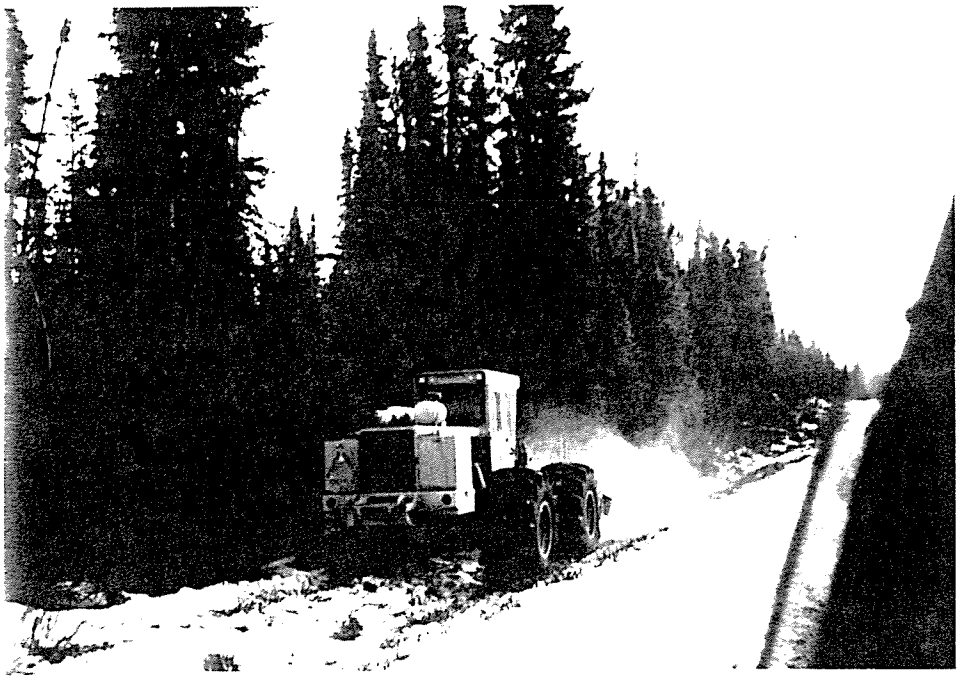
4. Equipment Utilization and Replacement

Kivi and the Refuge Hydro-ax were put on "loan" to the U.S. Forest Service (USFS) in April as part of an experimental moose habitat improvement project in the Copper River Delta near Cordova. Inclement weather delayed the project longer than we would have liked as Kivi did not return to the Refuge until May 27. Another trip had to be made to Cordova to ferry the Hydro-ax back to Whittier about mid-June. Although the USFS paid for Kivi's salary, overtime, repairs and transportation, his time away from the Refuge put a "crimp" in our already deficit-plagued maintenance program.

In October, the Refuge obtained an excess 60' X 14' house trailer made available by the Federal Power Authority at the Bradley Lake Hydro Project near Homer, Alaska. Transportation to the Schooner Bend field camp in Cooper Landing was arranged through a local construction contractor. This unit (two bedrooms) will replace the old 10' X 40' trailer that had become a maintenance liability. While we did not gain any additional bunk space, we did significantly upgrade the quality of the living quarters. The old trailer will be moved to a nearby site and used for badly-needed storage.

The Refuge Hydro-ax was moved briefly to the Skilak Loop Area during late fall to assist with brush clearing for a parking area adjacent to the Kenai River Delta overlook. It was then transported to the Swanson River area where we began clearing a heavy growth of alders within the right-of-way. A total of nearly eight miles of "roadside axing" was accomplished until a mid-November snowfall brought a halt to operations. The project is scheduled for completion in 1992.

Kivi had to "walk" the Refuge Hydro-ax several miles across Copper River Delta near Cordova to reach the project site scheduled for moose habitat improvement. Four-wheelers were used for daily transportation to and from site. Sheridan Glacier in background. 6/91/DK



Hydro-ax on Swan Lake Road. 7/91/DK

One of the small Refuge Playmor house trailers was made available to Regional Botanist Steve Talbot most of the summer in support of an aquatic vegetation study in the Swanson River area. In cooperation with ARCO Alaska, Inc., the trailer was moved to the residential area within the Swanson River oilfield where water, electricity and sewer hookups were available.

5. Communications Systems

By mid-May we were able to get to the remote repeater and do repairs to both the repeater and the duplexer. The repairs helped some of the communication problems, and we were able to make it through the summer season. Still having problems with our communications system, we decided to re-evaluate the radio system problem to determine how it could be improved. We are currently awaiting a re-evaluation.

The Federal Telephone System 2000 was installed and in operation by mid-November. It took a year from the date the request was submitted to the day of actual operation. A substantial decrease in the telephone bill should take place.

6. Computer Systems

The long awaited Novell Netware 386 Local Area Network system arrived by August 1, along with the hardware. With great expectations of the system being up and running by October 1, we unpacked boxes and those of us lucky enough to get a new computer at our desk proceeded to clear a space for it. However, our excitement was short lived as it was not long before the installer found we had a bad hard drive on the file server that was quickly repacked and sent back to the vendor for repair. It was early November before we had the server back and proceeded with installation. However, with bad T connectors and other miscellaneous problems the system was only partially operational at the end of the year. It is hoped by the end of 1992 all computers will be in place, the system fully operational, and a smile on everyone's face.

7. Energy Conservation

Energy consumption in 1991 showed an increase in all categories. The most significant increase was natural gas (nearly 30 percent) which is attributable to a recalibration of our Headquarters/Visitor Center metering system by ENSTAR. We had advised ENSTAR on a number of occasions that usage for the building was not consistent with other metered facilities within the headquarters complex. While the statement "honesty is the best policy" may be a debatable issue in this case, we are at least getting a better profile of total annual energy consumption on a per-facility basis.

Some increase in diesel fuel consumption was expected due to Hydro-ax work during late fall in the Swanson River/Swan Lake Road area.

The Refuge carpenter shop being in use for a longer period of time than experienced in 1990 was, at least in part, a contributing factor for the increase in consumption of electricity.

Table 42. Comparison of energy consumption between calendar years 1990 and 1991.

Energy-Use Comparisons

Product	Unit of Measure	1990	1991	% Change with 1990
Electricity	Kilowatt Hours	171,791	172,527	+.14
Natural Gas	100 Cubic feet	12,424	17,213	+.28
Vehicle Gas	Gallons	13,458	14,637	+.08
Aviation Gas	Gallons	4,124	4,244	+.03
Propane	Gallons	252	333	+.24
Diesel Fuel	Gallons	2,237	2,602	+.14

The reflected increase in propane usage is not so much a result of increased consumption, but timing of the rotational fill cycle.

8. Other

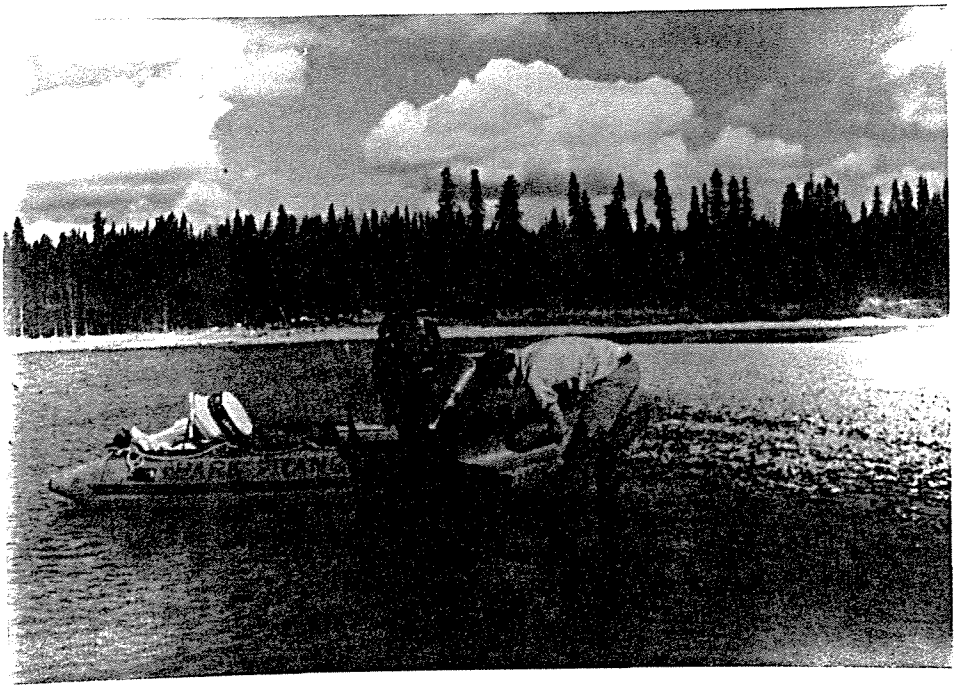
Nothing to report.

J. Other Items

1. Cooperative Programs

a. Kenai River Water Quality Study

In May Natural Resource Specialist Bob Winkelman resumed water quality work with Alaska Department of Fish and Game (ADF&G) and State Parks personnel after the river became ice-free. Water sampling was conducted through November at ten river sites ranging from the Kenai Lake bridge to the mouth of the river. Extremely low water and shelf ice in May made it difficult or impossible to launch a boat at most boat launches. As a result, many sample sites could be accessed only by drifting long stretches of river. Under normal conditions, all sites could be sampled in two days.



Refuge Natural Resource Specialist Bob Winkelman and ADF&G Biologist Ginny Litchfield collect water samples along Kenai River as part of a three year multi-agency effort to monitor and gather baseline water quality data throughout the entire river system. 6/91/RW

Benthic invertebrate sampling was conducted throughout the summer and fall on a weekly basis. University of Alaska, Anchorage Limnologist Dr. Sandy Milner provided guidance concerning sampling techniques and habitat classification. In all, 12 river sites were sampled to determine species, composition and diversity. A bottom sediment size classification was also

conducted to allow correlation of results of benthic population sampling with habitat.

To date, water sampling has revealed differences in hydrocarbon levels between the upper and lower river. Volatile Organics Analysis (VOA) has shown hydrocarbon levels to be higher in the lower river where boat traffic is usually heavier. In late summer, sampling was concentrated in the lower river and conducted during peak boat traffic periods and periods of high run off. In addition, elevated fecal coliform levels (FC) have been found at several locations. A sample taken between river miles 18-20, contained approximately 200 ppm., FC. A final report for the three-year project is expected to be available from ADF&G in 1992.

2. Other Economic Uses

a. Oil and Gas

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

Crude oil production from Alaska's oldest continuous operating oilfield averaged 5374 barrels per day in 1991 - up slightly from the 5145 barrels per day recorded in 1990. Cumulative production since the field became operational in 1957 was 215,177,218 barrels as of December 31. Maximum number of producing wells in 1991 ranged from 29 to 31.

One event worth noting in 1991 was ARCO's decision to plug and abandon the initial 1957 discovery well 34-10. The well has been "shut-in" since 1982 when it was last put into production to help commemorate the fields twenty-fifth anniversary. We are continuing our discussions with ARCO to establish an appropriate permanent marker for this historic site that eventually provided the economic catalyst for statehood in 1959.

In an effort to meet State and Federal environmental compliance regulations for hydrocarbon contaminants, ARCO aggressively explored and implemented various technologies designed to meet established clean-up criteria within the field. Remediation of groundwater contaminated by aromatic hydrocarbons (BTEX) within the Pipe and Supply (P&S) Yard began in late summer with installation of an air-stripping system. A downstream intercept trench was excavated and a pump installed to transfer all groundwater discharge back to a centralized lift station/air impregnation tower to facilitate volatilization of the lighter BTEX hydrocarbons. Early results were encouraging in reducing groundwater contamination, however, like any new system, "fine tuning" and "debugging" occupied a good share of the manufacturer's and contractor's time. By year's end, another set of problems added to the complexity equation - cold temperatures. We are still confident the system will perform to earlier expectations and that eventually off-site discharge of ground water will meet established State and Federal criteria. This is a multi-year project and will be monitored on a continuous basis.

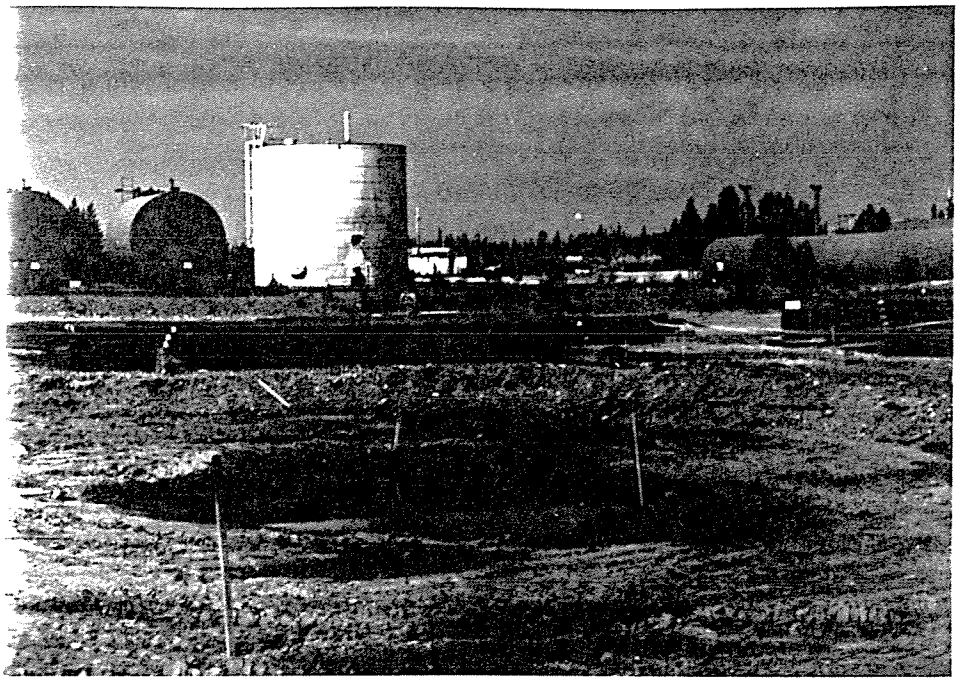
Several discussions were held with ARCO during the year concerning crude oil contamination at the seven tank settings and eight flare stack sites. Field tests have been conducted the past two years in an attempt to delineate the extent of contamination as well as contamination levels at the tank settings and flare pits. ARCO is exploring various remediation technologies, such as in-situ bioremediation and bioventing (vapor extraction), in an effort to avoid traditional "excavate and remediate" methods of clean-up. Excavation will be nearly impossible as long as the field remains operational. This would be not only highly disruptive, but dangerous, considering the inadequacy and accuracy of "as builts". We are quite confident that contamination is highly localized with minimal threat of outward migration beyond known affected areas. Evaluation of in-situ bioventing, conducted in 1991, showed enough promise that an expanded pilot project will be initiated in the summer of 1992 at the 1-9 tank setting.

We are continuing to work with ARCO, Alaska Department of Environmental Conservation (ADEC) and the Bureau of Land Management (BLM) to establish clean up level criteria.

Incineration of PCB-contaminated soils through the Circulating Bed Combustor Unit (CBC) continued throughout the year with an average daily production of slightly under 100 tons. As of December 31, a cumulative total of 93,649 tons had been processed since the project was initiated in 1989. ARCO's 1991 demobilization of the old 1-33 skim pit facility and 1-22 drain line produced additional PCB-contaminated material that further extended the CBC incineration effort. August was a milestone of sorts in that it marked excavation of the last known site of PCB contamination within the field.

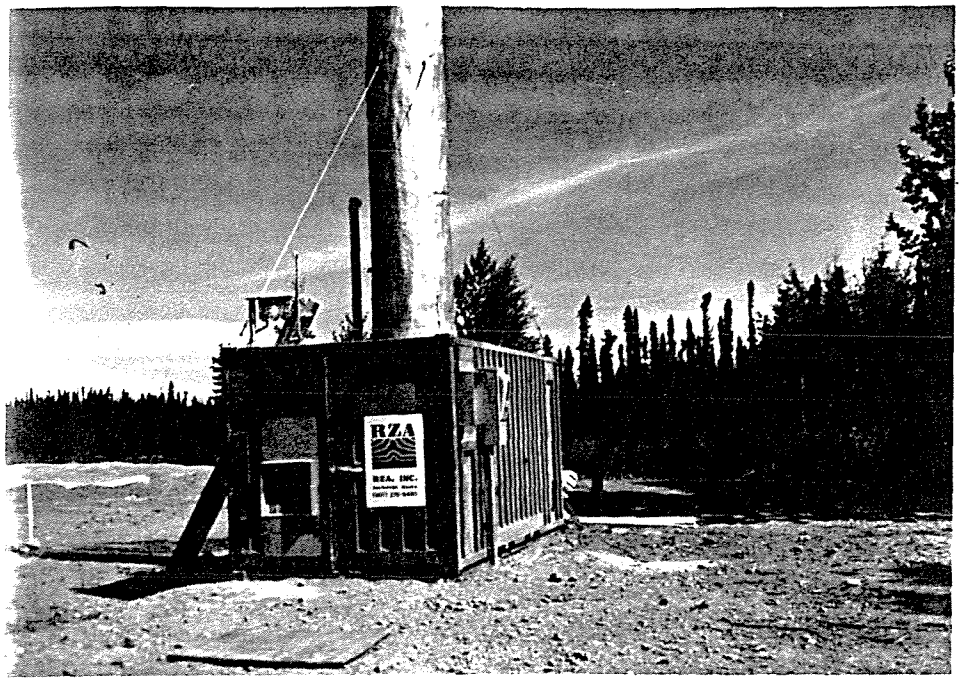
Ogden Environmental Services (OES), under contract to ARCO for the CBC operation, is now forecasting a completion date for incineration in July 1992. Demobilization is expected to take place April-July 1992, and OES plans to move off-site by late summer.

What was initially thought to be a major crude spill due to a break in an underground flow line from Well 21-22 on November 25 turned out to be primarily produced water. Later investigation revealed less than 15 barrels of crude was released within an approximate 30' X 30' area in an upland site along the powerline access right-of-way. The site was excavated and contaminated soil transported to the solid waste disposal site. The 21-22 flowline, in place for a number of years, was found to be badly deteriorated, raising the question of flowline integrity for the many miles of old underground lines throughout the field. Well 21-22 has since been shut-in. The incident prompted ARCO to initiate a more aggressive approach to study flowline integrity throughout the field.

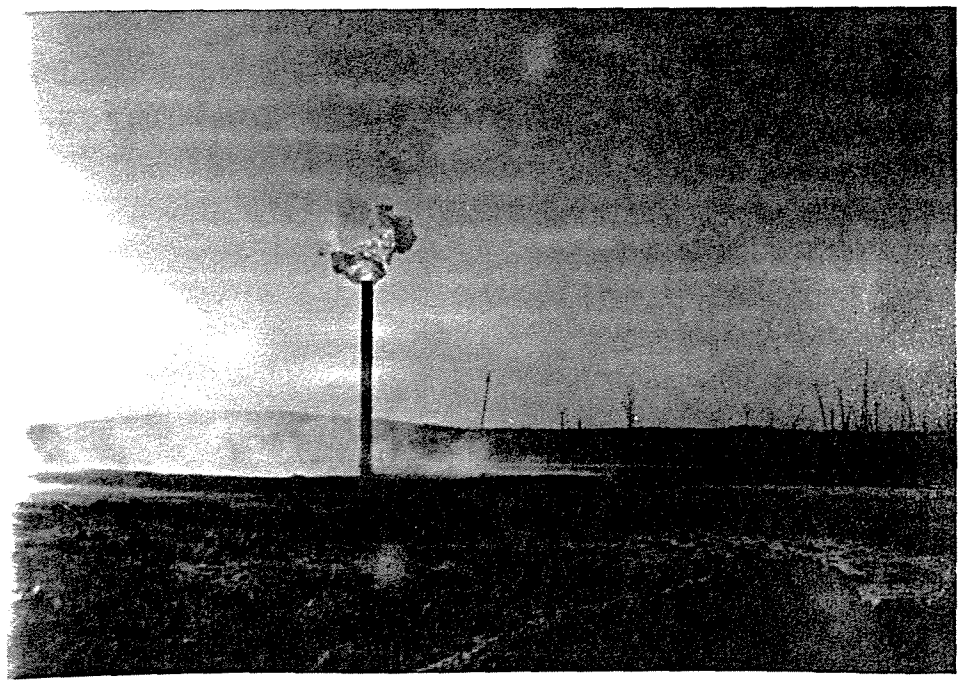


Groundwater contamination of the P&S Yard was thought to have originated from an inadvertent spill from one of the "upstream" storage areas prior to ARCO taking over as unit operator in 1986. 6/91/JF

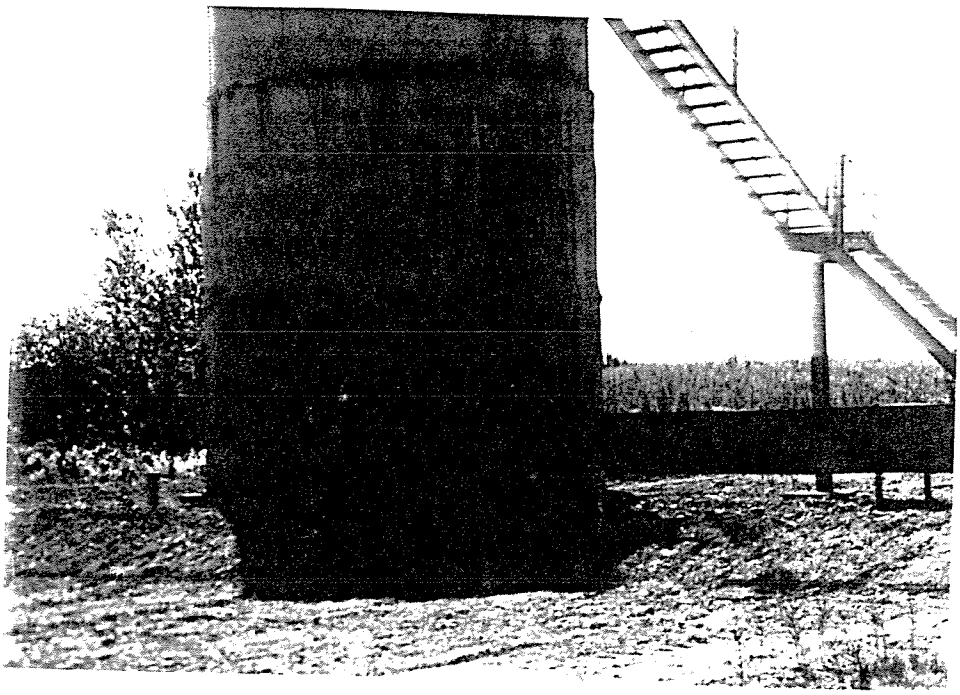
Construction of the air stripping system for removing BTEX contaminated groundwater at the P&S Yard. 6/91/JF



Groundwater from the P&S Yard is pumped from a downstream intercept site and circulated through the air stripping tower where the aromatic (BTEX) are volatilized. 7/91/JF

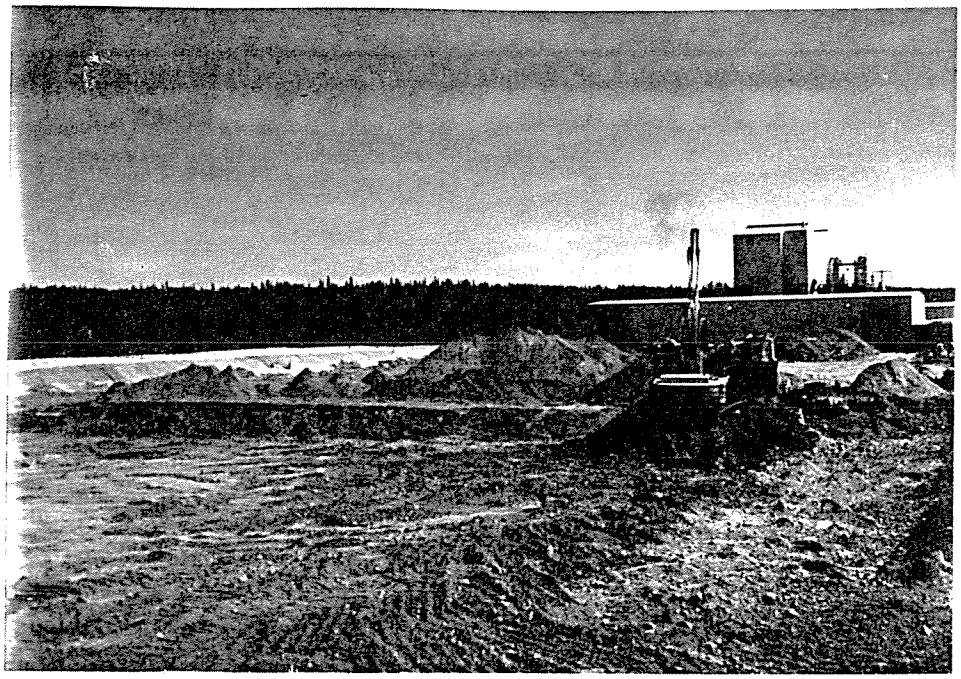


All eight flare stack sites within the SRF were found to have hydrocarbon contamination. 2/91/JF

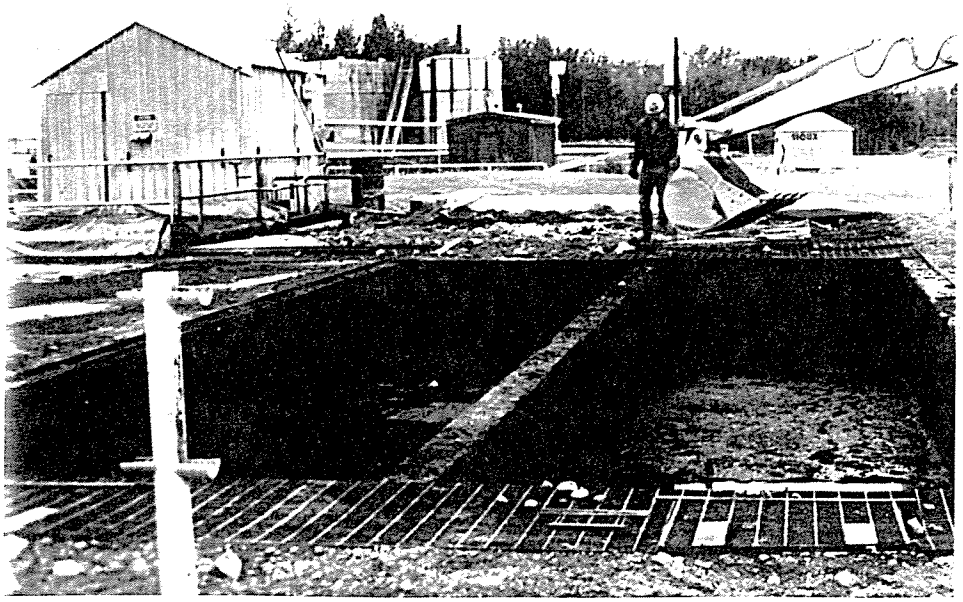


Investigations of the seven tank settings within SRF showed varying degrees of hydrocarbon contamination. A pilot project to test bioventing remediation technology is scheduled to get underway in 1992. 8/91/JF

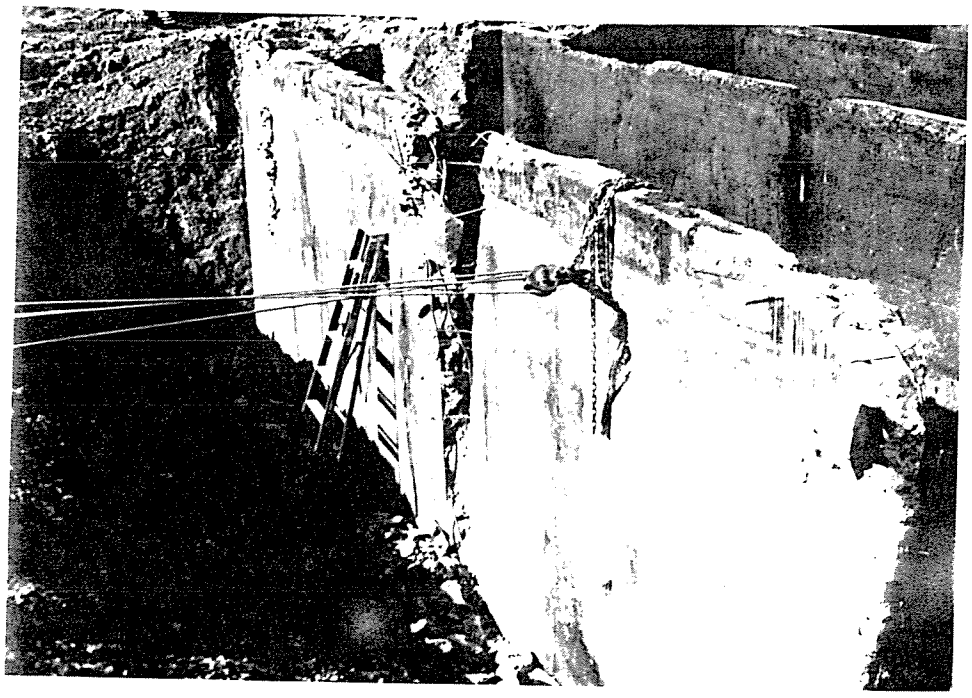
Establishing grid sampling procedure for residual PCB contaminants within the main stockpile area. 6/91/RW



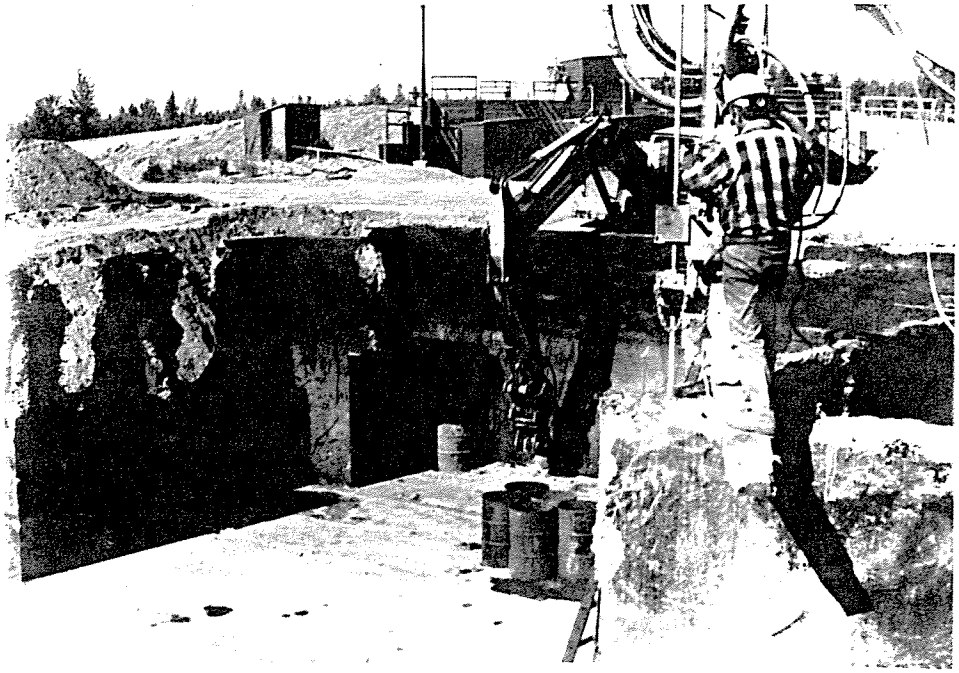
Incineration of the main stockpile of PCB-contaminated soils continued on schedule throughout 1991. Ogden Environmental Services' CBC in background. Nearly 100,000 tons of material has been processed since 1989. 6/91/JF



The old 1-33 skim pit had been used as a repository for liquid wastes generated within the field since the late 1950's. This was dismantled and replaced with a modern, high tech separation facility in late 1990. 6/91/RW



Case-hardened concrete with steel re-bar used at the 1-33 skim pit facility in the early 1960's proved challenging for the demolition crews. Some of the concrete was contaminated with PCB's. 8/91/JF



Removal of the old 1960-vintage 1-33 skim pit facility proved to be a difficult and time-consuming project. Concrete was broken into "manageable" pieces pressure washed, and transferred to local landfill. New skim pit facility in background. 8/91/JF

The 1-22 drainline was the last known area of PCB contamination within SRF. 7/91/JF

ARCO's Environmental Supervisor for Alaska Jim Ives (second from left) reviews SRF operations with Regional Contaminants Coordinator Everett Robinson-Wilson (second from right), DARD Jon Nelson (far right) and Frank Deluis (center) of the Washington D.C. contaminants office during a tour on April 17. 4/91/JF

On July 7, a meeting was held with ARCO representatives, the BLM, and Fish and Wildlife Service (FWS) to discuss ARCO's request to reconfigure perimeter diking around a number of well sites. Snow accumulation and subsequent runoff was presenting a costly and time-consuming maintenance problem since the decking was originally constructed to accommodate the perimeter of the entire drill pad. Authorization was given to decrease the size of the containment area on four selected sites for evaluation purposes.

On December 3, Assistant Refuge Manager Frates met with Scott Marson, Regional Claims Manager for CIGNA Property and Casualty Company of California, to review file material in response to a Freedom of Information Request (FOI). At least one of ARCO's insurance companies is contesting claims relating to contaminant clean-up within the field. Central to the litigation is when and how much did ARCO know about the level and extent of contamination (primarily PCB's) at the time they took over as unit operator in 1986. The FOI request generated over 2000 documents being copied. Just what the Refuge's future involvement will be in this litigation is uncertain at this time.

The Refuge participated in a number of meetings, tours and public meetings relative to the Swanson River oilfield in 1991, including a tour and briefing on April 17 for Regional Contaminants Coordinator Everett Robinson-Wilson, Deputy Assistant Regional Director Jon Nelson, and Frank DeLuise of the Washington D.C. Contaminants Office. On September 17, Frates and Refuge Manager Doshier accompanied Assistant Regional Director John Rogers and Associate Manager George Constantino on a tour and briefing of field operations and PCB remediation activities.

Following several complaints by the public (as well as Refuge employees) of excessive speed on the Swanson River Road by oilfield contractors, a meeting was held with ARCO management on September 27. As a result, ARCO issued letters to all contractors warning them of possible contract cancellations should offenders be found in violation of careless operations. This action, coupled with radar spot checks by the State Troopers, apparently got the drivers attention as compliance improved considerably thereafter.

Crude production within the field is expected to continue sometime beyond the year 2000 at which time the field will undergo conversion to a natural gas recovery operation. In the meantime, ARCO will be faced with lower revenues and rising environmental clean-up costs, primarily for actions (or inactions) that occurred prior to their taking over from Chevron USA as unit operator in 1986. ARCO is to be commended for exhibiting high professional standards in contaminant clean-up while working through a plethora of State and Federal environmental regulations, permits, and special stipulations, as well as constant public scrutiny.

(2) Beaver Creek Unit (Marathon Oil Company)

Crude production from two wells in 1991 totaled 179,040 barrels for an average daily production of slightly less than 500 barrels. Cumulative production since the initial discovery well in 1967 was 4,279,387 barrels as of December 31. Natural gas production from three wells averaged about 28,000 thousand cubic feet (MCF) per day. Crude oil is transported via tanker truck on a daily basis to a North Kenai refinery, while the gas is contracted to ENSTAR and transported via Alaska Pipeline Company for marketing in the Anchorage area. By year's end, Well No. 6 began producing a high ratio of water to gas, which may have a significant effect on overall field production at least through the first quarter of 1992 or at such time that water production can be controlled.

Declining crude production from Well No. 5 resulted in a re-drill and re-fracture job last summer within the Sterling formation level at 14,000 feet. A freeze-up of the gas lift system delayed an adequate test of the refracture job for several weeks. However, at year's end it appears that production was not stimulated as hoped, as production remained at or below the pre-fracture effort.

Declining gas pressure within the field resulted in Marathon installing an in-line gas-powered compressor unit. This met delivery requirements under their contract to ENSTAR.

Marathon again re-activated their Mobile Soil Incineration Unit to thermally treat hydrocarbon contaminated soils stockpiled from excavation of the 1988 tank setting spill. Incineration began on July 2 following stack emission testing and certification by ADEC. Outside of occasional shutdown, due to mechanical failure and/or exceeding emission standards, the operation continued on a nearly 24 hour basis through October 11. Over 10,000 tons of soil were treated in 1991, and nearly 6,000 cubic yards were back-hauled to the original spill site.

Frates participated in both pre-and-post certification and quality assurance sampling procedures conducted by JMM Engineering Company. Outside of groundwater monitoring, remediation of the 1988 crude spill is essentially complete. Marathon, and in particular Field Foremen Ray Brickey, are to be commended for a "total team approach" in committing the resources necessary to complete this project. A major change from the rather "shaky" level of operations in 1990 was contracting the incineration unit operations to a private firm - Energy Products of Idaho (EPI). This brought a high level of technical expertise to the project, an element sorely lacking in 1990.

Marathon was obviously "stung" economically by the 1988 tank farm crude spill clean-up and, understandably, less than enthusiastic to commit to another major remediation project. But history did repeat itself as we were notified in January of an "unknown quantity" diesel spill at a generator site adjacent to the 1988 crude spill location. For reasons not yet fully understood, Marathon discovered the spill the previous September

and failed to provide notification to either FWS or the BLM within the required 24-hour period.

Marathon's non-compliance with agency policies prompted a January 15 joint FWS-BLM meeting to discuss and review past actions (and inactions) relating to Marathon's clean up efforts, and overall past track record of compliance with both. The BLM's on-shore lease agreement and FWS permit stipulations. Since the BLM possessed greater leverage in the Issuance of Assessments and/or civil penalties in accordance with 43CFR 3163, it was decided that agency would submit a letter to Marathon Oil Company in an attempt to "get their attention".

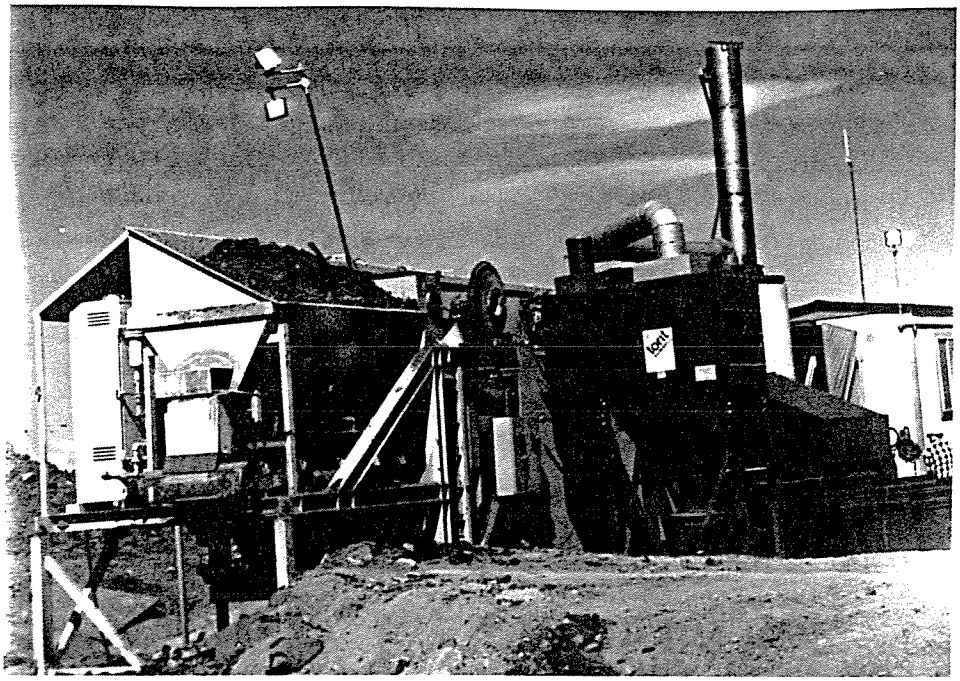
The January 18 letter had the desired effect resulting in a February meeting with Marathon's top management in Alaska, environmental personnel and the Beaver Creek field foremen. The meeting "cleared the air" on a number of issues and elicited a commitment to establish clear lines of communication among the agencies in addition to accelerating the diesel spill remediation effort.

Marathon awarded the diesel spill site Assessment Plan to the Anchorage Firm of Woodward-Clyde. A joint FWS-BLM team reviewed the working draft on June 26 at Marathon's Anchorage Office. At ADEC's request, two more additional monitoring wells were drilled within the affected area. Excavation of the site began on September 16, and continued through the end of the month when the project was shut down for the winter. The excavated soil (about 1000 tons) was thermally treated through the mobile incinerator and the site backfilled until work could begin again in the spring of 1992.

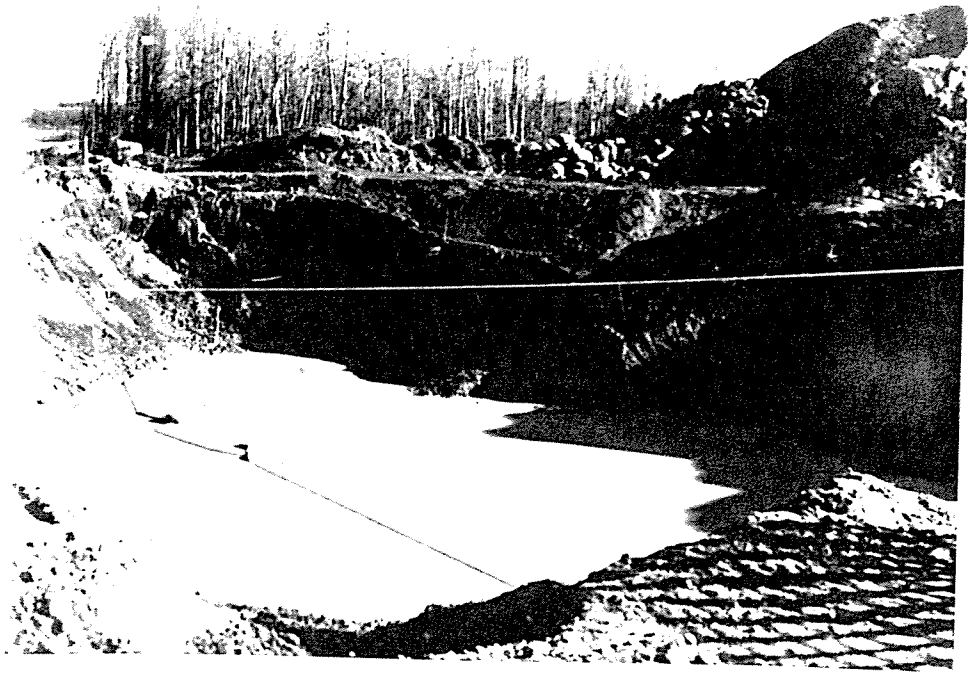
There is evidence that groundwater contamination has taken place, thus, adding to the urgency in not only further monitoring, but determining and defining the limits of the contamination zone. We are continuing to hold Marathon's "feet to the fire" on this project since the groundwater issue raises some serious concerns and potential impacts within the Beaver Creek drainage system.

What was initially thought to be a rather insignificant spill may turn out to be more extensive than the 1988 tank farm spill. Apparently a fuel line from an above ground tank sprung a leak within a buried section where it entered the generator building. We suspect the leak occurred over a several year period prior to detection.

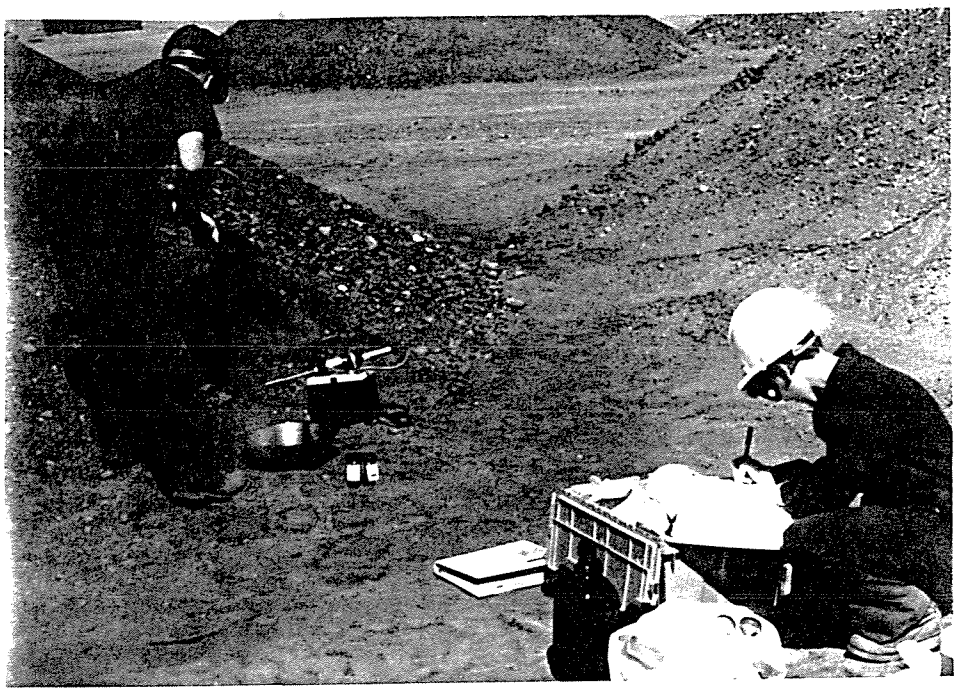
On September 13, Frates participated in a simulated "spill drill" involving a crude oil transport truck on Marathon Road. While the drill was frightening real, it did point out a number of "weak links" in the response effort - shortage of absorbent booms, personnel, and communications. The fact that the Refuge was not notified until two and one-half hours <u>after</u> the spill was not acceptable. The response networking system is being changed to correct this.



Marathon's Mobile Soil Incinerator processed over 10,000 tons of hydrocarbon-contaminated soil between June and September. 7/91/JF



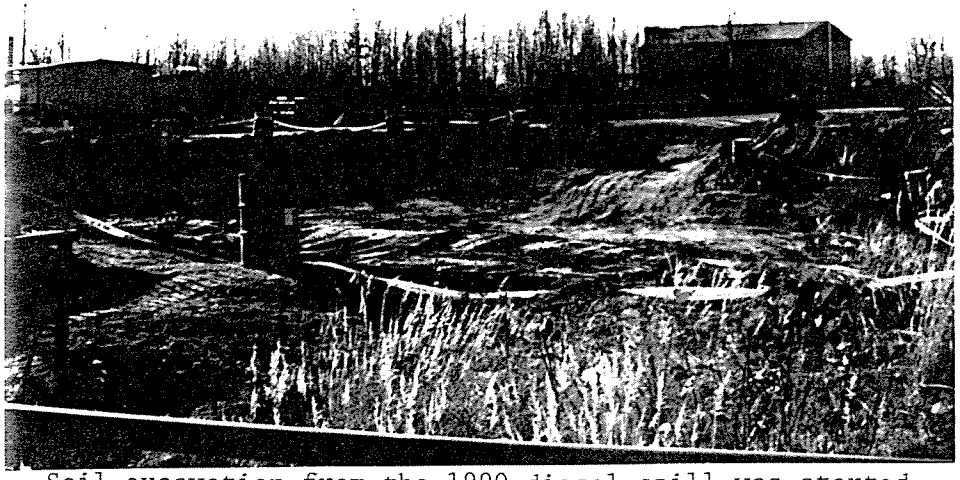
Excavation site of 1988 tank farm spill at Beaver Creek. Nearly 10,000 cubic yards of material was removed from site before being declared "hydrocarbon free" in September of 1991. 9/91/JF



Technicians from JMM Engineering taking pre-certification samples of soils processed through the mobile incinerator unit at Marathon's Beaver Creek facility. Soil from 1988 tank farm spill. 9/18/JF

The 1988 tank farm spill site following back-filled operations with "clean" soil processed through the mobile incinerator at Beaver Creek. Monitoring well standpipes visible in center of picture. 10/91/JF

Excavation of two major oilspills at Marathon's Beaver Creek Production Facility. Crude spill of 1988 on left and 1990 diesel spill on right. Large white tank for crude storage was moved to present location from across the road when spill was identified in 1988. 9/91/JF



Soil excavation from the 1990 diesel spill was started in September but was halted before freeze-up. Diesel was spilled from an above-ground fuel tank for a generator plant (left of picture) where the fuel line entered the building below the foundation Excavation will resume in 1992. 10/91/JF

Oil tank accident "spill drill" conducted on Marathon Road brought in several emergency response teams from the Kenai/Nikiski area. 9/13/JF

Placement of absorbent boom material around site of simulated tanker accident on Marathon Road during a "spill drill" exercise on. 9/91/JF

The simulated drill involved the tanker truck and a pickup resulting in injuries to the pickup driver. A helicopter with paramedics from the Nikiski Fire Service Area arrived within minutes, followed by the Kenai fire truck and ambulance. The Cook Inlet spill emergency response team also responded transporting additional absorbent boom rigging to the site. The apparent reality of the drill caught two nearby, unsuspecting moose hunters by surprise, as they ran about a quarter of a mile down Marathon Road to the site asking if they could provide assistance. Both were paramedics from the Anchorage Fire Department.

On November 13, Marathon experienced an approximate 160 gallon release of triethgleneglycol due to a malfunction in the gas dehydration system. The affected gravel area was excavated on the morning of November 14 and 15 and temporarily stored at Pad 7 until a disposal method can be identified. The recovered liquid will be disposed of as an exempt waste in the Beaver Creek injection well.

(3) Exploratory Wells (outside unitized areas)

a. Birch Hill (ARCO Alaska, Inc.)

ARCO Alaska, Inc. continued to pursue their efforts to secure authorization for an access road across Refuge lands to reach a proposed natural gas drill site in the NW¼ of Section 35, T9N, R9W. The land was previously conveyed to the Tyonek Native Corporation (TNC).

ARCO's consultant, JMM Engineering of Anchorage, completed the final Environmental Assessment on April 29, at which time it was made available for public review and comment. At the same time, ARCO made application for a right-of-way permit mandated under Title XI of the Alaska National Interest Lands Conservation Act (ANILCA). In July, a Finding of No Significant Impact was made and ARCO was given clearance to proceed with construction of the 1.2 miles of road across Refuge lands with a number of stipulations and restrictions imposed on timing, design, and environmental concerns.

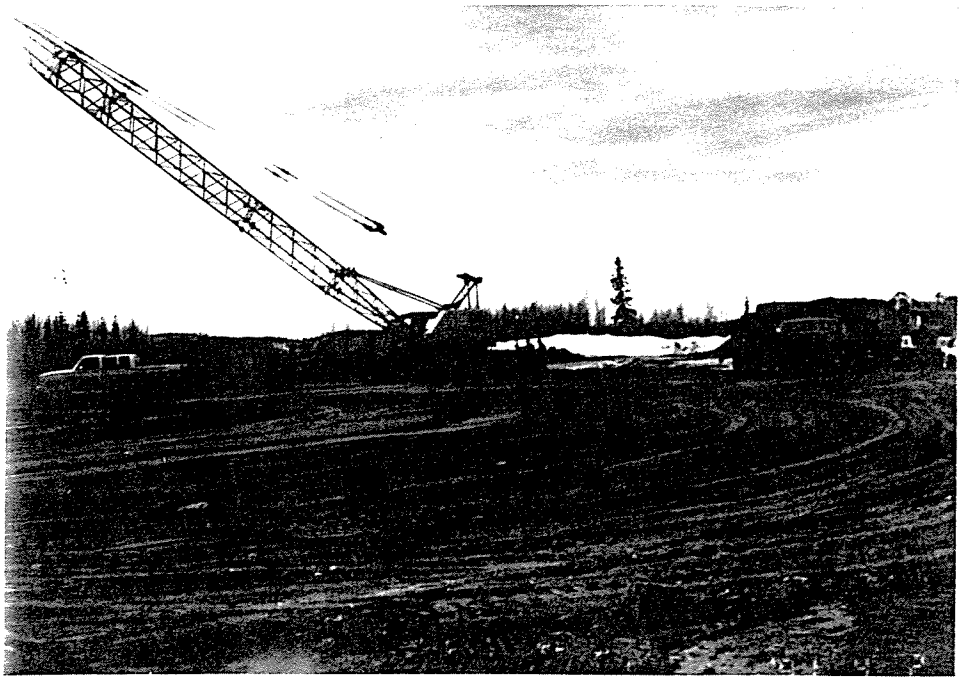
The 60-day public comment period generated only a limited response. A group of landowners in the Gray Cliff Subdivision west of the drill site wanted ARCO to access the area by constructing a road through the subdivision, connecting with the paved North Kenai Road to Captain Cook State Park. While this would have been the preferred route from a Refuge standpoint, it was not an acceptable economic alternative for product marketability and sharing of existing infrastructure facilities within Swanson River field to the south.

Construction of the road was expected to get underway in October, however, problems developed with partnership commitments and the project was put on temporary hold. We expect ARCO will continue to maintain a high interest in gas recovery from the Birch Hill site, although they remain noncommittal as to a time schedule.

b. Galena #1 (ARCO Alaska, Inc.)

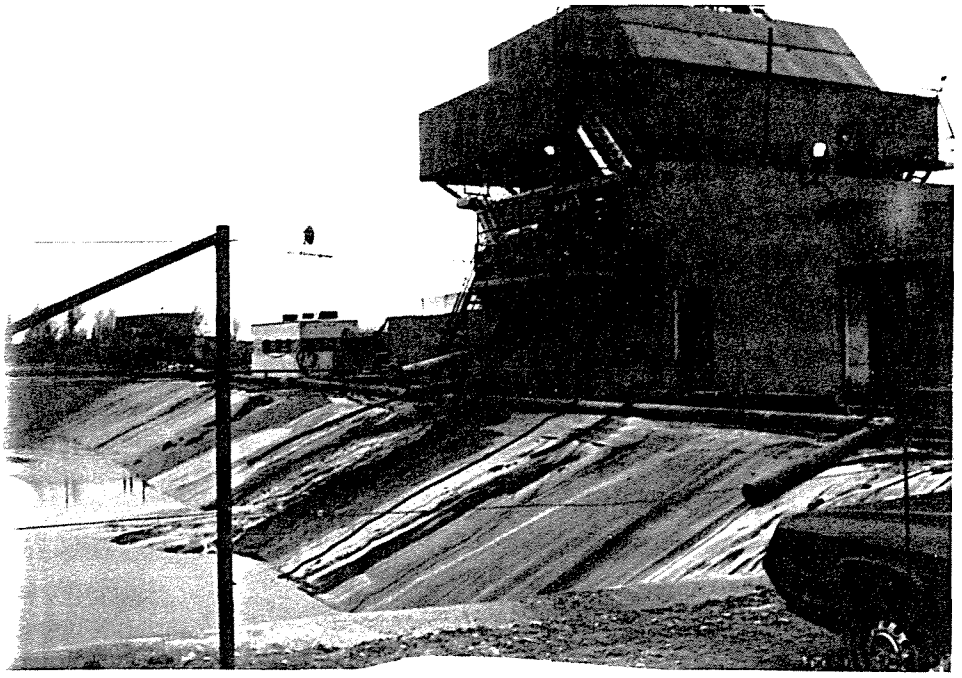
Analysis of geophysical data gathered in 1990 in the Swanson River area resulted in renewed interest in potential hydrocarbon resources south of the existing Swanson River field. In January, ARCO decided to directional drill from the old SOCAL 22A-32(1963) well site near Finger Lakes. A pre-bid meeting was conducted at the site on February 21, and authorization given to extend the pad approximately 50 feet to the north to accommodate the large Grace 154 rig. Pad enlargement and reserve pit excavation occurred in March and April and the rig moved on site April 19. Drilling commenced on April 22 with plans to reach the 14,000 foot level of the Hemlock Zone by July.

So much for plans. Drilling proceeded on schedule until about the 2,500 foot level when a coal seam resulted in a stuck bit. Operations from that point on became something of a driller's nightmare. Eventually the schedule was set back several weeks as coal seam encounters within the Hemlock Zone became increasingly troublesome. ARCO applied for, and was granted, a permit extension through November. No marketable hydrocarbon reserves were found, so the rig was dismantled and moved off site by late September.

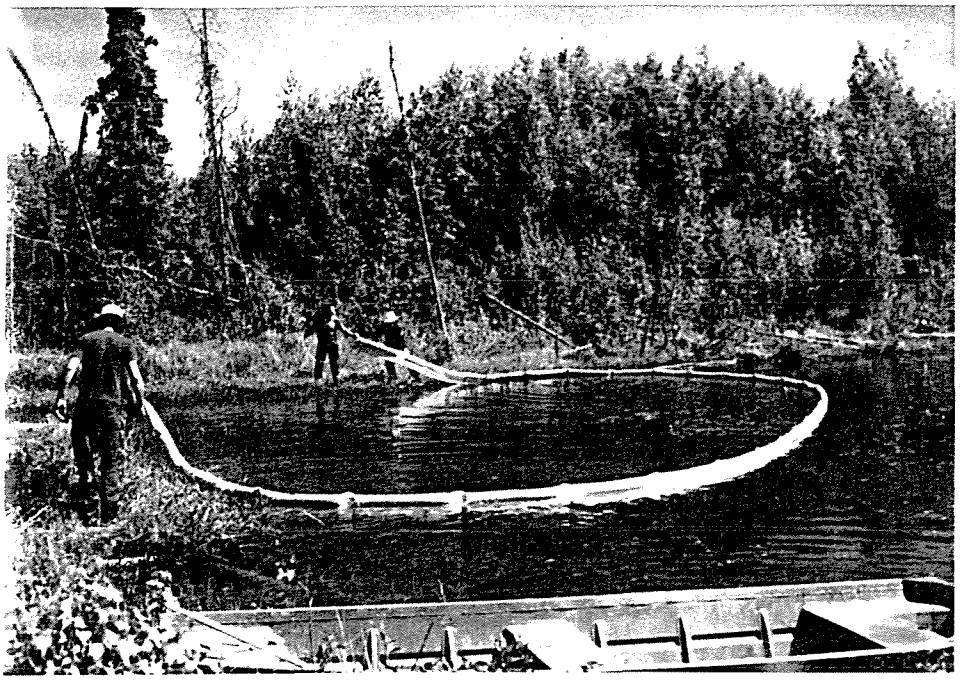


Galena # 1 pad enlargement and resurfacing project near Finger Lakes. 4/91/JF

Construction of reserve pit for Galena # 1 exploratory well conducted by ARCO Alaska, Inc. 4/91/JF



Lined reserve pit and Grace 154 rig at ARCO's Galena # 1 exploratory well. Drillers encountered numerous problems with coal seams in the Hemlock Zone and finally abandoned the site in late September. No producible hydrocarbon reserves were found. 9/91/JF



A "spill drill" simulating an overturned tanker on shore of Fingers Lake was held on 6/20. Containment booms were dispatched to site from nearby Swanson River field. Overall, response time was excellent. 6/91/JF

Because of this delay, the drilling operation coincided with the moose season in September and resulted in at least two incidents of illegal hunting activity related to the Finger Lakes Road being open. The incidents have been discussed with ARCO management. They share our extreme intolerance of any activities where on-site workers take advantage of accessibility not afforded the general public. Any further drilling operations coinciding with hunting season will be watched closely.

c. Bufflehead (ARCO Alaska, Inc.)

ARCO initiated plans to secure the necessary drilling permits for a possible directional drill off existing Pad # 212 located at the extreme northern portion of the Swanson River field in October. The plan called for a slight pad expansion. Downhole location is on Cook Inlet Region Inc. (CIRI) subsurface entitlement outside the Swanson River unit boundary. Again, partnership commitment problems delayed the project indefinitely.

d. Stormy Lake East (ARCO Alaska, Inc.)

Preliminary discussions were held with ARCO management in October and November concerning their latest proposal for onshore exploration within the Refuge. The proposed drill site is located about 1.5 miles southwest of the Galena #1 site in the SW¼ of Section 36, T7N, R9W.

Right-of-way permit application and Environmental Assessment work will begin in early 1992 with a late summer drill date anticipated. Both the Cultural Resources Assessment and Field Environmental Review were completed by ARCO's Consultant Dr. Jack Lobdell in late 1991. We are anticipating ARCO presenting a proposal for a 1.5 mile all-weather road connecting the Galena # 1 pad with the Stormy Lake East site. It is still somewhat puzzling to us that interest remains high despite four known "dry" holes drilled in this area in recent years.

e. Westfork 1-21 (Cook Inlet Production Company [CPC])

The shallow gas well, drilled by Cook Inlet Production Company (CPC) in late 1990 on native selected lands near Sunken Island Lake, was tested in early 1991 and found to produce marketable quantities of gas. During 1991 the facility underwent reconversion to permit product sales via a pre-existing 3½ inch line from the site to ENSTAR's main 20-inch Anchorage intercept line north of the Sterling School.

While the Westfork 1-21 well is on Kenai Native Association (KNA) lands with the Cook Inlet Regional Corporation Inc. (CIRI) controlling sub-surface resources, activities are technically still subject to 22g provisions of ANILCA. Just what this means is still uncertain, given the broad interpretation of what leverage the 22g provision does or does not permit concerning Refuge management on these lands. The CPC, for example, has made application to the ADEC for discharge of produced water into nearby wetlands. Unless the water meets ADEC drinking water standards, the FWS will continue to oppose this practice due to the intrinsically high levels of salts and dissolved solids. To our knowledge, produced water has never been permitted to be discharged into natural wetlands but rather reinjected to downhole formations.

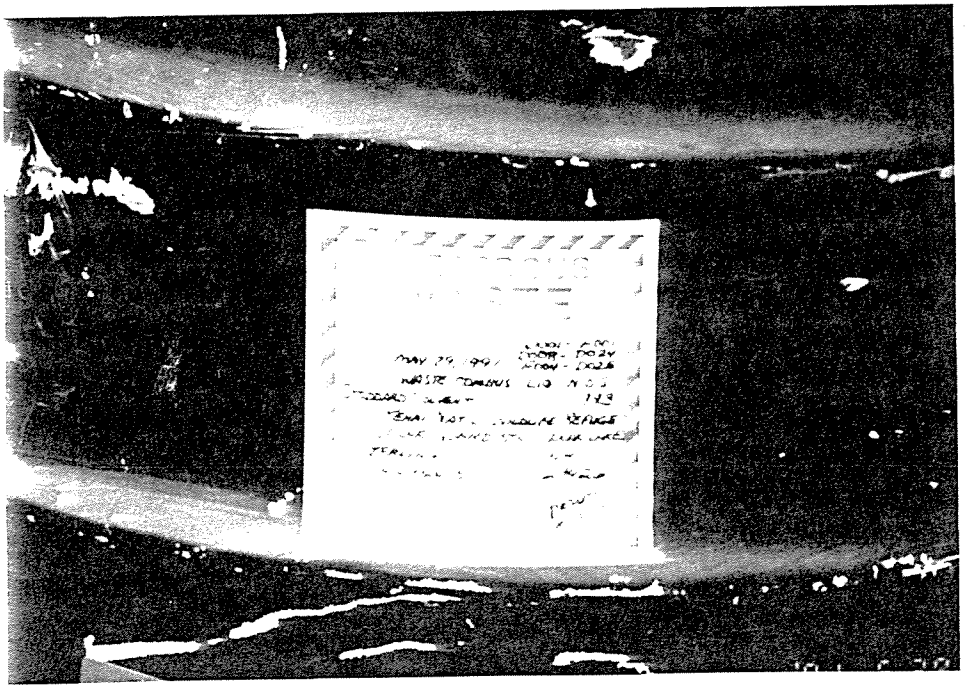
Another problem arising from the Westfork 1-21 well concerns drainage from nearby lands under Federal lease. Negotiations are currently underway with CIRI in an attempt to examine possible land trade options. Should negotiations reach an impasse, the BLM will likely impose some form of royalty compensation action on CIRI, especially in view of the fact that additional wells are planned for the Westfork unit in the near future - perhaps as early as 1992.

3. Contaminants (non oil/gas field related)

a. Skilak Guard Station (Drum Storage Facility)

Of the 45 (fifty-five gallon) drums stored at the Skilak Guard Station since the late 1950's, thirty-six were removed and contents disposed of in 1990. The remaining six drums, thought to contain hazardous material, were re-analyzed and removed from the site on April 19 by Alaska Pollution Control (APC) of Palmer, Alaska. Only two of the six were found to contain hazardous substances requiring shipment and disposal to a hazardous waste disposal facility in Oregon. The other four, containing ethylene glycol, were incinerated at APC's facility in Palmer.

Hazardous PCP waste being put in overpacks for eventual shipment to Oregon for disposal. Loading supervised by Alaska Pollution Control, Inc. 5/91/JF



Wood preservative PCP had to receive prior clearance before transportation through Canada enroute to Oregon disposal site. 5/91/JF

Skilak drum storage site showing some surface contamination scheduled for clean-up in 1992. 5/91/JF

Since some leakage had occurred over the years, a contract was awarded to a local engineering firm, Rozak Inc., to develop a Site Assessment Plan (Plan) and disposal recommendations. The Plan was received in mid-September, with a copy submitted to the ADEC for their review and comment. Contaminant funding was made available for site clean up in 1992. Based on soil samples taken and analyzed during the site assessment, it appears contamination was primarily waste oil and only surficial in nature.

b. Kenai Hangar Site (underground tank removal)

The September 1990 excavation and removal of a 2000-gallon aviation gas tank at the Kenai hangar resulted in the on-site storage of approximately 200 cubic yards of contaminated soil. Field screening, using an Organic Vapor Monitor (OVM), indicated a wide range of contamination from non-detect to 1700 PPM. Most of the high readings were highly isolated, with much of the soil showing no contamination. Laboratory analysis later indicated no samples in excess of 50 PPM, thus, by State standards, the soil was non- contaminated. Because of this extreme variability, we asked ADEC about the possibility of resampling as soon as the stockpile became frost free. It was our understanding that, if samples came back less than 50 PPM, we could then use the material to backfill the excavation site, which had been left open over the winter.

On June 10, Regional Contaminants Coordinator Everett Robinson-Wilson collected a number of samples for analysis at the Chemical and Geological Laboratory in Anchorage. Again, the results of these samples were all below the 50 PPM level.

At about this time, we were advised by ADEC that their policy had changed and that detectable levels of hydrocarbons (exceeding 50 PPM) found during the initial field screening would determine factor as to whether or not the soil was contaminated, thus requiring remediation. ADEC's inflexible position meant we now had to contract to clean up our already relatively "clean" 200 cubic yards of soil.

Because there were no facilities on the Kenai Peninsula in the soil remediation business, we considered trucking the material to Anchorage for processing through a thermal unit at an asphalt batch plant. This was not only expensive, but re-sampling would have to be done again in Anchorage (also expensive). Because no one wants clean "dirty dirt", the material would have to be trucked back to the hangar in Kenai for disposal. We were beginning to feel the same frustrations as others in the area, having contaminated soil but no economical means by which to meet established clean-up criteria.

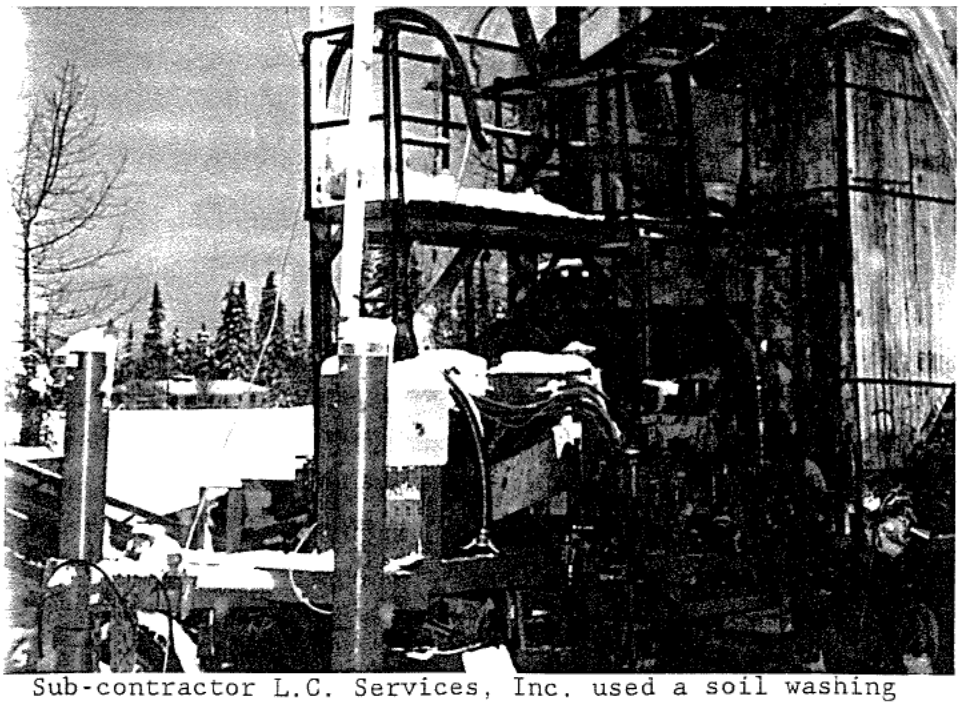
We eventually contracted with Anchorage Asbestos, Inc., which was looking for an opportunity to develop a test project in the area. The disposal plan was contracted to an Anchorage consultant, Quest Environmental, Inc. The plan was held up by ADEC for several weeks pending resolution of a number of technical questions.

The contaminated soil was finally trucked from the hangar site on November 20 and 21 to Foster Sand and Gravel at mile 18 of the Kenai Spur Road. The actual remediation was sub-contracted to L.C. Services of Anchorage. The system consisted of washing the soil through a slow-feed conveyor, using hot water with chemical additives to release hydrocarbon molecules from the colloidal soil structure. What was to be a four-day project, turned out to be nearly six weeks, as the system was plagued with numerous mechanical problems from the outset. Several violations of the ADEC-approved disposal plan resulted in a "cessation of operations" until the problems could be corrected.

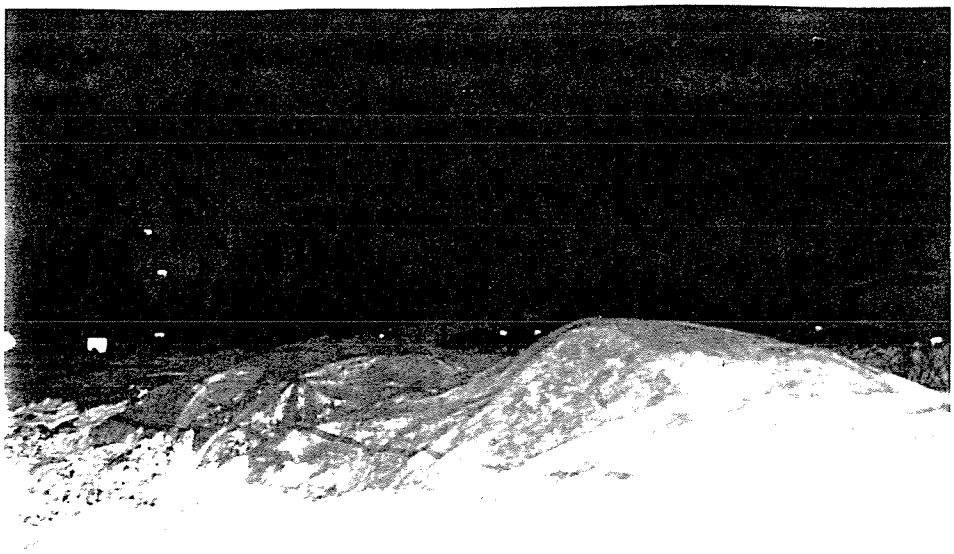
Soil washing was finally completed the last day of December. Samples taken from remediated soils indicate that clean-up objectives had been met and we are now awaiting final closure of the project from ADEC.

c. Fence Post Treatment Site (Moose Research Center)

Kivi spreading gravel to fill the 1990 excavation of a 2000-gallon aviation fuel tank at our Kenai hangar.



Sub-contractor L.C. Services, Inc. used a soil washing machine to clean the 200-cubic yards of aviation fuel contaminated soil removed from the Refuge Hangar in September of 1990. 12/91/JF



Stockpiles of "clean" dirty dirt having been processed through the "Terra-wash" machine to remove hydrocarbons resulting from leaking 2000-gallon aviation tank.
12/91/JF

The old SOCAL well pad 34-27 was the site of treating fence posts with wood preservative contaminating PCB's in the 1960's. Soil samples were taken in 1991 to determine extent of contamination. If necessary, remediation work will begin in 1992. 7/91/JF

Several "dip sites" for treating fence posts were used on SOCAL pad 34-27 within the Moose Research Center in the 1960's. The wood preservative "penta" is now considered a hazardous material. 7/91/JF

Contaminant funds were also made available in 1991 to conduct preliminary field studies at a remote site within the Moose Research Center where an extensive fence post treatment operation was conducted in the 1960's and early 1970's. The posts, used for perimeter fencing for moose enclosures, in "dipped" with "Penta" at a centralized treatment facility. The chemical has since been declared to be hazardous. A number of soil samples were taken from the site in cooperation with Ecological Services. We are still awaiting the results of the laboratory analysis, but assume we will probably be involved in another remediation effort sometime n 1992.

4. Items of Interest

Nothing to report.

5. Credits

Most staff members were involved in preparation of the 1991 annual narrative report either during the writing, typing, or editing phases of production.

K. FEEDBACK

How many times have we heard it said that Alaskan Refuges are unique? Kenai Refuge, which is unique among Alaskan Refuges, proved the truth in that statement again in 1991. Which other refuge can lay claim to two of the top ten news stories for the year in their state? Only in Alaska and only on the Kenai could this happen. However, it was an honor that was not solicited. The events that led to this distinction caused our summer season to be one of the most hectic in years. Of course, the two events were the Pothole Lake Fire and the Hidden Creek personal use dipnet fishery. I suggest you read the accounts on pages 50 and 102, then just hope that you can avoid events such as these in your career. Many thanks to the Regional Office for supporting Kenai financially and with personnel to effectively deal with these events. A special thanks to the Kenai Refuge permanent staff, seasonals, and volunteers for rising to the occasion to make the best out of some unique challenges.