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YUKON DELTA NATIONAL WILDLIFE REFUGE

BETHEL, ALASKA

ANNUAL NARRATIVE REPORT

CALENDAR YEAR 1998

U.S. DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

NATIONAL WILDLIFE REFUGE SYSTEM

Reviews and Approvals

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Refuge Manager

9/17/99
Date

Chief of Refuges Review

Date

Regional Office Approval

Date

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INTRODUCTION

The Yukon Delta National Wildlife Refuge (NWR), largest of Alaska's 16 refuges, encompasses 21,877,769 million acres of land and water on the Yukon-Kuskokwim Delta (Y-K Delta) in southwestern Alaska and stretches from Nunivak Island in the Bering Sea to the village of Aniak, nearly 300 miles to the east. Both the Yukon and Kuskokwim rivers, major salmon migration rivers, traverse the refuge. Over the course of time, these rivers have created one of the largest river deltas in the world. The Mississippi Delta is the only comparable river delta in North America. The delta, a generally flat marshland containing innumerable lakes and ponds, is the dominant landscape of the refuge. Upland areas, the Nulato Hills in the northern part of the refuge and the Kilbuck Mountains along the refuge's eastern boundary, contain peaks of 2,000 to 4,000 feet.

The Y-K Delta supports one of the largest aggregations of water birds in the world. Over one million ducks and half a million geese breed here annually, and in some summers, up to a third of the continent's northern pintails can be found on the refuge. In addition, nearly 100,000 loons, 40,000 grebes, 50,000 swans and 30,000 cranes return to the refuge each spring to nest. Millions of shorebirds use the refuge for both breeding and staging. In terms of both density and species diversity, the Delta is the most important shorebird nesting area in the country, and the vast intertidal zone is the most important wetland for post-breeding shorebirds on the west coast of North America. The Delta meets all of the criteria for identifying wetlands of international importance under Article 2 of the Ramsar Convention.

The abundance of water in the form of lakes, ponds, streams, inlets, bays, and coastal areas provides habitat for waterfowl from all four North American flyways. The refuge supports a varied population of mammals, fish, and birds which are important in maintaining the traditional subsistence way of life of local residents. Nesting and brood rearing habitats for waterfowl, shorebirds, or seabirds give it national significance.

Refuge lands were first set aside as a preserve and breeding ground for native birds by President Theodore Roosevelt in 1909. In 1929, Nunivak Island was set aside as a refuge and breeding ground for wild birds, game, and furbearing animals. In 1930, the small islands and all lands under the waters surrounding Nunivak Island were added to the refuge. Additional lands were reserved by President Franklin D. Roosevelt in 1937 when Hazen Bay Migratory Waterfowl Refuge was established. The Kuskokwim National Wildlife Range, established in 1960, was enlarged in 1961, and its name changed to the Clarence Rhode National Wildlife Range.

On December 2, 1980, President Jimmy Carter signed the Alaska National Interest Lands Conservation Act (ANILCA). With enactment of ANILCA, these existing ranges and refuges were combined and enlarged to establish the Yukon Delta NWR. Two areas within the new refuge were designated as wilderness by ANILCA: the Andreafsky Wilderness Area (1,300,000 acres) and the Nunivak Wilderness Area (600,000 acres).

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A. HIGHLIGHTS

Legislation passed that will add Native corporation land totaling 29,600 acres of combined surface and subsurface estate, 162,000 acres of subsurface estate, and a conservation easement to land managed by the refuge (C.3).

Waterfowl Conservation Committee meetings included a trip to view reported depredation problems in Oregon (D.3).

A single archaeological project continued near the village of Chevak (D.4).

Nearly 38,000 caribou from the Kilbuck and Mulchatna herds reported on the refuge in February (D.5).

Long-term study of western sandpipers initiated at the Kanagayak field station with additional RONS funding (D.5).

Molting ecology of long-tailed ducks study initiated in response to severe population declines on the Yukon-Kuskokwim Delta (D.5).

Cackling Canada goose populations break the 200,000 bird level for the first time in 21 years (D.5).

Study initiated on the distribution, abundance, and productivity of satellite brant colonies within the Clarence Rhode Natural National Landmark (D.5).

Deputy Refuge Manager Denny Strom retires after 15 years on the Yukon Delta Refuge (E.1).

Dave Cannon selected as the first ever Fisheries Biologist for the refuge during the year (E.1).

Seabird colonies on Nunivak Island surveyed for the first time since 1990 (G.5).

Eighteen breeding bird survey routes completed on the Lower Yukon River (G.7).

A moose survey on part of the Lower Yukon River documents a doubling of the population since 1992 (G.8).

Very poor salmon runs recorded on the Yukon and Kuskokwim Rivers (G.11 and H.9).

Over 1,500 pintails banded at Kgun Lake during August (G.16).

National Wildlife Refuge Week activities again draw a big crowd (H.7).

Moose check station reporting on both the Yukon and Kuskokwim is much lower than past years (H.8).

Kisaralik River floater numbers is down from the previous two years (H.9).

The first citations for lead shot possession when waterfowl hunting were issued during the spring harvest (H.17).

A new administrative cabin constructed on Paimiut Slough on the Yukon River during the year (I.1).

B. CLIMATIC CONDITIONS

The refuge is located in a transitional zone, influenced by continental and maritime climates. Summer is cooler than interior Alaska due to coastal clouds and cold seas. Conversely, winter is warmer than interior Alaska due to the influence of the Bering Sea. Coastal areas freeze last, due to Bering Sea warming, and thaw later than inland areas due to the cooling effect of Bering Sea ice.

Winds at Bethel average over 13 miles per hour throughout the year. Maximum high and low temperatures are 84° and -48° Fahrenheit (F), respectively. Freeze-up normally occurs in mid-October and ice breakup in early to mid-May. This year the river broke up on May 6.

Table B1. Climatological data for Bethel, Alaska, 1998.

Month	Temperature (Degrees F.)		Days with Measurable Precipitation	Snowfall (Inches)	Total Precipitation (Inches)
	High	Low			
Jan	37	-22	7	12.0	.57
Feb	37	-12	0	1.1	.08
Mar	46	-8	12	10.5	.88
Apr	57	10	18	10.4	.96
May	63	26	26	7.7	2.61
Jun	76	36	12	0.0	.93
Jul	75	44	12	0.0	2.54
Aug	65	32	21	0.0	3.20
Sep	64	27	17	0.0	3.01
Oct	42	16	13	9.9	1.62
Nov	XX	xx	xx	xxx	xxx
Dec	40	-37	6	5.9	.54
Total			144	57.5	17.04

C. LAND ACQUISITION

2. Easements

A number of Alaska Native Claims Settlement Act (ANCSA) 17(b) easements exist on the refuge which generally provide access across village corporation land to the refuge. Activity took place on one of these easements in 1998.

Late in 1997 the village of Lower Kalskag requested a permit to mark a snowmachine trail across refuge lands from their village corporation lands, north to the Yukon River. As part of this project, the refuge provided funding for reflectors so they could mark the portion of the trail on corporation lands that make up the (17)b easement. The trail was inspected by RM Rearden and ROS Liedberg in late February while doing a snowmachine trip which included a law enforcement patrol and several village meetings. An easement sign was placed on the trail at that time.

3. Other Items

Three land exchanges continued their slow progress during the year. Since 1988 the Calista Regional Native Corporation has been working at the Washington DC level to secure an exchange that would basically give the refuge 29,600 acres of surface and subsurface estate, 162,000 acres of subsurface estate under village corporation lands, and

a 17,000 acre conservation easement along with the subsurface estate on land owned by The Kuskokwim Corporation.

Calista would receive credit for \$39,400,000 of federal surplus lands for this exchange. The Service approved appraisal for the above lands and subsurface interests was approximately five million dollars. A major point of opposition in the past had been the concern that the highly inflated prices involved in the legislation would be used in the future to set fair market values.

However, changes in this bill last year made it, if not supportable, at least suitable enough to stop the Service's opposition. A major change was the treatment of this bill as "social legislation" rather than implying a fair market value purchase or exchange.

The bill, HR 2000, which was included as one of a number of amendments to ANCSA, was passed in October. By year's end, Realty was working with BLM to effect the exchange beginning in priority order with the surface estate, the subsurface acreage, and finally the conservation easement. The goal is to have all realty work associated with this exchange completed by September 30, 1999.

The community of Newtok approached the refuge in November, 1996, with a proposal to relocate their village to refuge land because of erosion along the banks of the Ninglick River. The river has reportedly been taking over 100 feet of river bank each year and is only several years away from undermining the village. Although a lot of correspondence was traded during the year, a minuscule amount of progress was made.

The exchange agreement, which required signature prior to appraisals being done, was not agreed to by the Newtok Corporation. The agreement traded hands several times. A major concern by the corporation was the amount of land included in the exchange. Originally, they had proposed that nearly 20,000 refuge acres be acquired by the corporation in exchange for an equal value amount of land held by the corporation. Midway through the year, the corporation made the case for a much smaller exchange.

Only two meetings were held during the year. The first was on March 20 when ROS Liedberg and Jeb Stuart from Realty traveled to Newtok to discuss the exchange agreement. This was the first look we had at the agreement after Newtok's legal counsel had provided input. The second meeting took place in Anchorage on July 17 and included Newtok's legal counsel and our Realty representatives. The acreage amount included in the exchange was again discussed with the position that the Service was only interested if the full 20,000 acres was included.

By the end of the year no further progress had been made. Meanwhile, plans for new housing and a new school in the village have been delayed.

The NIMA Village Corporation from Mekoryuk on Nunivak Island is entitled to approximately 45,000 acres of land outside of the old Clarence Rhode Refuge boundaries. They have obtained title to, or selected, these parcels near Dall Lake in the southwest portion of the refuge. An exchange with NIMA has been discussed for years whereby the refuge could receive the Dall Lake holdings and NIMA could obtain additional surface, along with some subsurface estate, on Nunivak Island.

In 1997, NIMA wrote the refuge detailing their interest in proceeding with the exchange. The only meeting with NIMA took place during the year (July 20) on this exchange. At the meeting a MOU to initiate the exchange, and their specific land requests were discussed. No other progress was made during the year, largely because part of the corporation's land was involved in the Calista exchange discussed above, and this legislation did not pass until October. Both NIMA and the Service are generally in agreement on all the issues involved and it is expected that significant progress will be made in 1999.

D. PLANNING

1. Master Plan

Very little work took place during the year on the comprehensive conservation planning. Staff members commented on management activity templates that were developed for use with all regional plan updates. The Yukon Delta is not scheduled for plan review until 2000.

3. Public Participation

Y-K Delta Goose Management Plan (GMP) Meetings

The first Association of Village Council Presidents (AVCP) Waterfowl Conservation Committee (WCC) meeting of the year was held from January 14-16 in Portland, Oregon. This was actually a carryover meeting that had been scheduled as the second meeting of 1997. The focus of the meeting was to discuss and view reported cackling Canada goose depredation problems on croplands in the area. Most members of the WCC attended the meeting. The field trip to farm fields did not present a convincing argument for the WCC members that a serious depredation problem existed.

The second meeting, which included a reciprocal trip to the Y-K Delta by several farmers from Oregon, was held on March 26 and 27 in Bethel. The meeting included presentations by research staff of plans for upcoming projects, law enforcement plans for the year with emphasis on steel shot compliance, and other management activities related to waterfowl. A highlight was the travel by several of the Oregon farmers to the village

of Chevak where they were unexpectedly weathered in overnight. The event certainly must have provided a good perspective on the challenges of living in a delta village.

The second meeting of the year which is normally held in November or December was scheduled for January 1999.

Western Alaska Brown Bear Management Working Group (WABBMWG)

The Western Alaska Brown Bear Management Area Working Group met in Bethel on May 18. Project activities were reviewed and cub production and survival data collected to date were presented. The data collected thus far indicate that cub productivity and survival is among the lowest recorded in the state, indicating that the population has a very low threshold for sustaining harvest. The 1997 recollaring effort, and the participation by four Native leaders, was reviewed. The group discussed how individual villages could collect harvest information and forward it to ADF&G and FWS.

Kilbuck (Qavilnguut) Caribou Working Group

Although there was an attempt to get this group together, a meeting was not held during the year. The fact that a portion of the Mulchatna caribou herd now spends a significant amount of the year in the area and provides for a substantial harvest, has led to the decreased involvement of this working group.

4. Compliance with Environmental and Cultural Resource Mandates

Only one archaeological project continued on the refuge in 1998. Lisa Frink, University of Wisconsin, Madison, conducted her third year of work in and near the village of Chevak. Ms. Frink has tailored her work to address some of the goals outlined in a 1996 Community Ethnoarchaeology Project initiated by the Chevak Traditional Council. The goals of this project are: 1) to investigate the archaeological sites of Qavinaq, Kashunak, and Old Chevak, 2) to document village elder recollections concerning subsistence practices and these archaeological sites, 3) to record present subsistence practices of village women, 4) to educate the village youth to the rightness of their cultural heritage, 5) to create a cultural center in which to safely house and display items and information collected during this project, and 6) to foster communication between the people of Chevak and the scientific community.

In an effort to meet some of these goals Ms. Frink conducted the following work during the year. Along with three other villagers, she accompanied Mr. Joseph Tuluk, a village elder, to each of the three sites identified above and interviewed him at each site. Future excavation at each of the sites will be aided by Mr. Tuluk's participation. During the month of June she interviewed women elders about their experience with subsistence practices, especially fish processing and storage. In March, she addressed several of the

high school science classes about her work. In July, she assisted in sending Mary Nanuwak to the Smithsonian Institution Museum Training Seminar. The purpose of the training was to learn how to fund and maintain a cultural center in the village. Lastly, Ms. Frink has been active in information exchange. She is organizing a symposium about the Y-K Delta for the 1999 Alaska Anthropological Association Meeting. She is also providing a connection between the Smithsonian and the village of Chevak. The Smithsonian is interested in having several villagers explore the cultural materials collected by Edward Nelson in the 1700's.

Additional work is planned for 1999 and beyond which will include excavation at each of the sites. Partial funding support for Ms. Frink's work came from the regional archaeologist with a small amount of logistical support and equipment provided by the refuge.

5. Research and Investigations

Cape Romanzof Yellow Wagtail Study

For the third consecutive year, refuge personnel conducted breeding bird studies at Cape Romanzof Long Range Radar Site (CRLRRS). The CRLRRS lies along the shore of the Bering Sea at the western tip of the Askinuk Mountains between Kokechik and Scammon bays. The refuge conducted a preliminary reconnaissance of this area in 1994. That effort was expanded in 1996 to include the establishment of permanent nest-searching plots in both tundra and scrub habitats. A special effort was made to document nesting among Old World species breeding at the eastern edge of their range in Alaska. In 1997, field work included a continuation of the nesting studies initiated in 1996, and a formal fall mist-netting program. Volunteer Heather Moore, a biological technician stationed at CRLRRS in 1997, returned in 1998 as a Master's degree candidate from Cornell University. Moore's thesis project is a study of the population ecology and nesting biology of Alaskan Yellow Wagtails, the most abundant of six paleotropical (i.e., Old World) migrants known to occur at CRLRRS.

Moore and her assistant, Volunteer Mark Hopey, occupied camp from May 28 through August 2. They searched for all yellow wagtail nests in the study area. They then attempted to uniquely color band breeders by mist-netting at active nests, once hatching occurred. They also banded nestlings, once they were old enough to be handled and fit with a band (USFWS, but not color). Finally, an array of 6 mist-nets was operated to observe post-fledging dispersal and to provide additional opportunities to band adults and fledglings missed during the nesting period.

Thirty-four nests were located between June 6 and July 3. Nests were more concentrated than in 1997; this appeared to be greatly tied to the greater, more prolonged, snow cover in 1998. Mean clutch size was 5.53. Twenty-seven of the 34 nests hatched, but no

greater than 14 fledged young. Thirty-seven adults (18 male, 19 female) from 22 nests and 61 nestlings (from 13 nests) were banded at nests.

At least eight of 61 wagtails banded in 1997 returned to nest in the study area in 1998. Six of these eight were recaptured and identities were confirmed. Recapture of previous year's birds and color marking of individuals has enabled Moore to report these most interesting aspects of this population's ecology:

- 1) marked nest site fidelity of males that nested successfully the previous year
- 2) probable natal philopatry
- 3) polygyny

Moore intends to return for one more year of data collection. See Section G.16 and Table G.4 for Moore's banding totals.

Kilbuck Mountains Caribou Study

Surveys of the Kilbuck Caribou Herd (KCH) have been conducted annually since 1986 following an approved study plan. The Kilbuck (Qavilnguut) Herd Cooperative Management Plan (1994) calls for radio telemetry applications to document movement, estimate population size, composition, and calving ratio. These data are used to develop harvest parameters.

Between 1986 and 1998, 91 caribou (10 males and 81 females) were radio-collared; 28 radio-collars continue to function as of late December 1997; another three collars may still be functioning but are not presently on or near the refuge. Aerial telemetry surveys (27 by refuge staff and an additional 9 by Togiak NWR, ADF&G - Bethel, or ADF&G - Dillingham staff) conducted in 1998 documented 224 radio relocations for radio-collared caribou both on and off the refuge.

The highest number of caribou documented on the refuge occurred in February when 37,900 caribou were counted in the Kilbuck Mountains. Caribou began migrating off the refuge to their calving grounds in March 1998, but 19,000 caribou were still on the refuge. In April caribou were still moving to their calving grounds, but several thousand were believed to still be on the refuge. By late May only two radio-collared caribou could be found on the refuge in "traditional" KCH calving grounds. While only 300-500 caribou were found on the "traditional" KCH calving grounds in May and June, many members of the KCH again calved with the Mulchatna Caribou Herd (MCH) east of the refuge in the upper King Salmon River drainage and Shotgun Hills.

Caribou numbers on the refuge during the spring and early summer were generally estimated to be <3,000. In early August only four radio-collared caribou were located on the MCH calving area east of the refuge, but only six radio-collared caribou were located on the refuge. In early September the number of caribou observed in the hills between the

Kwethluk and Kisaralik rivers increased to approximately 10,000. Due to a lack of refuge aircraft, a full census (similar to that conducted in August 1997) could not be conducted. However, despite poor viewing conditions, both ADF&G and refuge biologists involved in managing the KCH agreed that a large number of MCH caribou had moved back onto the refuge and therefore allowed RM Rearden to open the Federal subsistence caribou season on the refuge. This opening was coordinated with the Togiak NWR as portions of Game Management Unit 18 includes that refuge.

By late September approximately 27,000 caribou were being counted during routine survey flights. Caribou were documented moving between the Kuskokwim Mountains in the east central portion of the refuge through the southwestern portion of the refuge during the fall and early winter. Limited aerial telemetry flights in October, November, and December were locating between 5,200 and 13,900 caribou on a small portion of the refuge.

Again, none of the regular, annual surveys (i.e. calf, composition, census) were conducted in 1998 due to the mixing and emigration of the KCH with the MCH. Nine additional caribou were captured and radio-collared on the refuge in 1998; see Section G.16 for more information.

Kuskokwim Mountains Brown Bear Study

While the study to examine the ecology of the brown bear population in the Kuskokwim Mountains remains basically "on-hold", progress was made in 1998. Activities in 1998 largely consisted of tracking existing radio-collared bears, but also included an attempt to census the bear population in the study area using only the existing radio-collared females.

There were only 25 bears with functioning radio-collars in January 1998. During 1998, 26 brown bear telemetry flights (19 by the Yukon Delta Refuge and seven by Togiak NWR, ADF&G Bethel, or ADF&G Dillingham) resulted in 334 relocations of radio-collared bears and 165 locations of non-radio-collared bears. Radio-collared brown bears exited their dens in 1998 much later than in previous years. Only five bears were out of their dens on the May 26 tracking flight. By June 2 17 bears were out of their den; 19 bears were out of their dens on 6 June. All radio-collared bears were out of their dens on the 15 June tracking flight. Nine radio-collared bears had entered their dens between September 28 and October 17. One bear was observed digging her den on October 16 and 17. Weather, aircraft availability, and the caribou capture prevented subsequent flights until November 30 when all bears were located in their dens.

During June 3-9, the refuge, in cooperation with Togiak NWR, ADF&G, and BLM, attempted to census the bear population within a portion of the study area using only the existing radio-collared bears. Normally, capture-mark-resight census procedures require

marks distributed on both sexes, in approximate proportion to their occurrence within the study population. Because we were violating this requirement, the effort was termed a pseudo-census. Both members of the cooperative working group and managers were curious if the existing sample of radio-collared bears was sufficient to conduct a census.

We attempted to locate all radio-collared bears immediately prior to the census. The precensus locations were used to identify those census units that would maximize the likelihood of containing the greatest number of radio collared bears. Locations of bears still in their dens were noted as they could emerge during the census.

The study design called for a minimum of five days where all units could be flown by survey crews. Inclement weather, primarily low cloud ceilings and high winds, limited census flights to only 3 days. The second of the 3 days was truncated due to high winds. On days 1 and 3 that portion of Trail Creek above the 2,500 ft level on the southwest side of the ridge and above the 3,500 ft level on the northeast side of the ridge could not be surveyed due to turbulence; this reduced the Trail Creek search area by 11.9 km² (4.6 mi²). The resulting census area encompassed 1,392.1 km² (537.5 mi²) with a mean of 87.0 km² (33.6 mi²) for each census unit.

We attempted to analyze the data as 2 different datasets. The first set used the 10 census units covered on days 1, 2, and 3; the second set used all 16 census units covered on days 1 and 3.

Mean proportion of the population that was marked in the reduced and total census area was 17.6% and 21.7%, respectively. Mean sightability was 27.3% in the reduced census area and 45.5% in the total census area. Mann-Whitney *U* tests found no significant difference in results produced by the two datasets. Average minimum population sizes, population estimates, and density estimates computed using the two methods (i.e., IEJH and Bear-Days estimators) provided incomparable and inconclusive results.

This effort reinforced that more time over a large area is critical to obtaining a good estimate of the bear population, especially when dealing with a low density population such as that in the Kuskokwim Mountains. Mean sightability of marked bears in the total census area was similar to estimates made by several of the cooperators prior to the pseudo-census effort. The mean number of marked bears within the 16 census units indicates that the number of radio-collared bears needs to be doubled prior to another census effort.

Demography of Western Sandpipers

In 1998, Yukon Delta National Wildlife Refuge initiated a long-term study of western sandpipers at Kanagayak, a permanent field station on the central Yukon-Kuskokwim Delta. Western sandpipers arrived at Kanagayak on May 6. The first eggs were laid on

May 21, and the first clutches were completed on May 25. Preliminary censuses on 4 randomly selected, 16-ha plots yielded densities of 218 birds/km². On an 18-ha intensive study plot, nest-searching revealed 42 nests, for a density of 233 nests/km². Nest initiations spanned 4 weeks, but 76% of all nests were initiated in the first 2 weeks of that period. The modal size of completed clutches was 4 eggs, and the mean was 3.89. Four- and 3-egg clutches comprised 89% and 11%, respectively, of completed clutches. The mean initiation dates for 4- and 3-egg clutches were May 29 and June 7, respectively. Nest fate was determined for 38 of 42 nests: 23 hatched, 12 were depredated, 2 were found abandoned, and 1 was stepped on. Mayfield nest success was 55.5%. Although nests were active from May 21 to July 8, predation only occurred between May 30 and June 23. Among depredated nests, 2 incubating adults were killed by the nest predator (presumably mink), 2 clutches were apparently destroyed by other sandpipers (based on small, round puncture holes in eggs), and 1 clutch was taken by a long-tailed jaeger. Fifty-four breeding adults were captured, banded, and individually color-marked on the 18-ha intensive study plot. Field work in 1999 will focus on demographic variables, including survival and reproductive success.

Molting Ecology of Long-tailed Ducks (*Clangula hyemalis*)

Population indices of long-tailed ducks show a continuous, and statistically significant, decline since 1976, resulting in current population size estimates that are about 50% of the mid-1970's estimates. On the Yukon-Kuskokwim Delta, long-tailed ducks have declined from approximately 292,000 in the mid-1960's to only 42,000 in 1998, a decline of a quarter million birds. As a result, the Service has identified long-tailed ducks as a 'species at risk.' During the course of investigations concerning lead poisoning in sea ducks on the Yukon-Kuskokwim Delta, researchers at one site found lead exposure levels in long-tailed ducks to be comparable to those found in spectacled eiders. Because lead poisoning may have contributed to the decline, and be limiting the recovery, of spectacled eiders, the decline of long-tailed ducks may be partially explained by the same hypothesis.

In 1998, the Alaska Science Center (USGS - BRD), YDNWR, and Migratory Bird Management - Anchorage initiated a collaborative study to address the hypothesis that lead poisoning was negatively impacting long-tailed duck populations on the Yukon-Kuskokwim Delta. The two primary objectives were 1) to identify areas used by post-breeding long-tailed ducks on the Delta, and 2) to quantify lead exposure rates among breeding females and post-breeding birds of both sexes. In addition, we hoped to obtain information concerning distribution of molting long-tailed ducks, identify connections between molting areas, wintering areas, and specific breeding areas, and evaluate potential for long-term monitoring of long-tailed duck annual survival.

In order to locate molting concentrations of long-tailed ducks, nesting females were captured at nests at several sites around Hazen Bay along the coastal Yukon-Kuskokwim

Delta and fitted with either conventional (VHF) or satellite transmitters. In addition to conducting telemetry flights to locate VHF transmitter signals, pilots and biologists flew low-level surveys over wetlands suspected of supporting concentrations of molting long-tailed ducks in late July.

With the help of telemetry, we found that some female long-tailed ducks that nested around Hazen Bay apparently molted very near their nesting areas. Some females, however, were found considerably farther away. Several were detected 100 km to the southeast just north of Baird Inlet, and several others were detected 300 km to the northwest on St. Lawrence Island. Among the four transmittered birds located southeast of Baird Inlet, three were on very large lakes--Puk Palik, Kaghasuk, and Kagalurpak. One of the objectives of the telemetry study was to use transmittered birds to find major concentrations of molting ducks. Low-level surveys of these three lakes, however, found fewer than 500 long-tailed ducks combined. Overall, long-tailed ducks comprised only 2% of all diving ducks counted on the three lakes. Similarly, very few long-tailed ducks (including none with transmitters) were found during surveys at Takslesluk Lake. Takslesluk traditionally supported large numbers of diving ducks, including long-tailed ducks, during the late summer molting period. In the early 1960's, about 4,000 long-tailed ducks molted there annually. In 1998, we found fewer than 400. In fact, we found no large concentrations of molting long-tailed ducks on the Yukon-Kuskokwim Delta during aerial surveys in 1998. Only two lakes supported more than 500 long-tailed ducks: Dall and Kgun, with 911 and 742, respectively. Because of this, we were unable to proceed with our plans to evaluate molting areas for their suitability as long-term banding sites.

The 1998 results yielded more questions than answers. With additional telemetry in 1999, we hope to 1) better determine the number of long-tailed ducks migrating to, and molting on, St. Lawrence Island, 2) confirm whether or not there are any lakes on the Yukon-Kuskokwim Delta currently supporting large concentrations of molting long-tailed ducks, 3) determine if molting areas are used year after year, and 4) expand our understanding of the winter distribution of long-tailed ducks that breed on the Delta.

Arctic Nesting Goose Studies

Current population estimates for the four goose species of special concern continue to show mixed results. Cacklers broke the 200,000 bird level (205,100) for the first time in 21 years in 1997. Due to the mixing of subspecies on the wintering grounds, population status will be monitored with the coastal breeding pair survey conducted on the refuge in June. Emperors (39,750) declined for the second straight year while whitefronts (413,050) continued to increase. The brant population has remained stable and averaged 135,000 birds since 1990. The 1999 estimate is 100,760 and represents a decline for the second year.

Breeding ground aerial surveys also gave mixed results for population trends for cacklers, emperors, and whitefronts. Pair indices increased 1% (ns), 27% ($P < 0.01$), and 47% ($P < 0.01$) for cacklers, emperors, and whitefronts, respectively. Total bird indices decreased by 29% ($P < 0.01$) and 9% (ns) for cacklers and emperors, respectively; and increased 2% (ns) for whitefronts. Censuses of brant are not available prior to the 1980's, but nesting was described as a nearly continuous band along the central western coast. See below for the 1998 estimate.

In general, 1998 break-up, migration arrival, and nesting chronology were considered "average". Float angles of eggs indicated the latest average predicted hatch dates (June 24 for emperors and June 25 for cacklers and whitefronts) for the last five years, but average for all years since the survey began in 1986. Fox and avian depredation was average and generally good weather occurred during hatch.

The annual assessment of nesting goose populations in the coastal tundra region was done by estimating the number of total nests, active nests, and eggs from single searches of randomly located 0.475 x 0.950 km rectangular plots. The ground-based sampling of the coastal region of the Y-K Delta was based on a new single stratum design intended to improve efficiency and precision of estimates. A total of 72 plots were searched by crews from field camps located at Old Chevak, Tutakoke River, Hock Slough, Manokinak River, Big Slough, Aknerkochik River, Opagyak River and Kigigak Island, as well as five mobile crews based at Kanagayak field station. The survey estimated that 104,000 cackler, 27,000 emperor, and 86,000 whitefront nests were initiated on the 4,000 square kilometers of coastal habitat that contains about 90% of all geese on the Delta. These were all increases from the storm tide reduced numbers in 1997.

Clutch sizes were unchanged, except for cacklers which increased 0.5 egg, compared to 1997: brant: 3.7 eggs ($n = 427$), cacklers: 4.5 eggs ($n = 1,482$), emperors: 4.7 eggs ($n = 267$), and whitefronts: 4.3 eggs ($n = 380$). Nest success was good for all species -- brant (88%), cacklers (94%), emperors (95%), and whitefronts (97%).

Migratory Bird Management continued an aerial survey to document emperor goose production. Data from an aerial transect survey, aerial photography, and estimates of detection rates estimated about 15,000 goslings during late brood rearing. This is more than double the 1997 estimate of 7,000 goslings during a year with poor egg production due to flooding. Comparison of the estimated number of eggs laid with the number of young in the October population indicates high mortality (average from 1986-1998 was about 89%) between mid- to late incubation and fall staging. An estimate of the number of young geese surviving to late in brood rearing is needed to determine how mortality is partitioned among various periods of the life cycle. The apparent survival rate from eggs in mid-/late incubation to goslings late in brood rearing was 7% in 1994, 6% in 1997, and 10% in 1998. In 1998, an estimated 48% of goslings apparently perished between brood-rearing and arrival on fall staging areas.

The U.S. Geological Survey's Biological Resources Division (BRD) in Alaska conducted several projects on the refuge.

The first BRD project was aerial videography of brant colonies. Total nests estimated from five colonies (16,386) at Kokechik Bay, Tutakoke River, Kigigak Island, Baird Peninsula, and Baird Inlet Island were inexplicably down 28% compared to 1997 (22,711 nests). The only colony to show an increase was Baird Island which had unusually low nesting due to flooding in 1997.

The second BRD project was the fourteenth year of a cackler, emperor, and whitefront nesting ecology study near the Kashunuk River. Nesting plots in this area were first established in 1974. The continuing work provides the best long-term nesting ecology information for these three species. Break-up and nest initiation chronology for the study area was the latest in five years, although only slightly later than long term averages. Nest densities of whitefronts and emperors were the highest recorded, while cackler nest density equaled peak values in the 1970's. Clutch sizes of cacklers and whitefronts were slightly less than long-term averages, while clutches of emperors were 10-20% smaller than long-term averages. Nest success for cacklers was approximately equal to long-term averages while those for emperors and whitefronts were equal to or higher than other years of the study. Plans for 1999 are under review.

The third BRD project was the eighth year of a study of duck research on the lower Kashunuk River. The total of 606 nests found on the 24 square kilometer study area were primarily spectacled eider, northern pintail, common eider and greater scaup. Overall nest success was high, with relatively few nests lost to flooding or predators. Apparent survival rate for 54 radio tagged spectacled eider ducklings from 28 broods during the period from 30-60 days post hatch decreased slightly to 0.65 in 1998 compared to 0.71 for 56 ducklings from 28 broods in 1997. Causes of mortality were gull (1), mink (5), fox (5), unknown raptor (1) and unknown (4). Apparent survival rate for adult females during the same period also decreased in 1998 (0.89) compared to 1997 (0.93).

This was the second year of observing female spectacled eiders during incubation breaks. Behavior and habitat use during a break were recorded by observers in towers. Nest temperature was recorded with the use of dummy eggs as an indication of break duration. Females were trapped at mid incubation and again at hatch to also determine change in body condition during nesting. Forage availability was assessed through invertebrate sampling; conducted at randomly selected ponds, in addition to ponds frequently used by observed females on an incubation break. Invertebrates were collected in the benthos and water column using standard methods. Analyses are ongoing.

The first year of sampling was conducted in new lead settlement exclosures. This study follows a similar design as the previous experiment, but instead uses five 10 m X 1 m seeded exclosures, divided into one square meter plots. A one square meter plot from

each enclosure will be sampled per year using an ice coring device or a modified sediment corer. The new enclosure sites were randomly selected within the previous habitats. All shot in the new enclosures was recovered in the top three centimeters after one year of settlement.

The fifth BRD project was the fifth year of an emperor goose nesting ecology study at Manokinak River. Nest plots searched each year since 1993 resulted in 60 marked emperor geese observed on nests in 1998. An additional 123 other emperor goose nests were also located. During the study, a total of 12 known age geese (ones banded with tarsal bands as goslings) have been observed on nests. No one or two year old geese have been observed nesting and the frequency of three year olds may be lower than that for older geese. This pattern of age-specific reproduction is similar to that seen for whitefronts in Canada. The estimated annual survival rate of tarsal banded adult females is 80% (SE = 6-7%). This survival rate is higher than that for geese with neck collars, indicating that neck collars have a negative effect on survival. There are no plans to continue this study in 1999.

The sixth BRD project was a continuing effort to document the effect variation in vegetation green-up and food availability had on cackler gosling growth. On the day of hatch, one gosling was taken from 50 nests. These 50 goslings were collected in two groups of 25 goslings within the first (early hatched) and last (late hatched) two days of the 10 day hatch period. Because vegetation grows rapidly throughout this period and maturation of plant tissue is negatively correlated with its quality, this allowed testing the hypothesis that any growth differences detected between these groups of goslings was due to decline in vegetation quality during hatch. Gosling mass differed among groups with early hatching goslings heavier (480 g) than late hatching goslings (351 g) at 25 days of age. This suggests gosling growth is sensitive to vegetation quality. Only a seven day variation in vegetation maturity resulted in a 100 g difference in gosling mass. Similarly, availability of preferred food affected gosling mass. Goslings allowed to graze within enclosures were heavier (480 g) than those utilizing pre-grazed areas (409 g). Forage availability had similar effect on both early- and late-hatching goslings. These results suggest gosling growth varies spatially because availability of preferred forage varies among brood-rearing areas within the Kashunuk River study area. Neither availability nor stage of vegetation maturity had an effect on gosling structural size. Differences in culmen, head, and tarsal lengths did not differ among groups at 25 days of age. Primary growth was initiated on the same calendar date for both early and late-hatching goslings suggesting photoperiod is a proximate cue for feather growth initiation in cackler goslings. Plant biomass and nutritional quality laboratory analyses are continuing.

The seventh BRD project is the final year of a study of lead exposure rates for spectacled eiders. Primary objectives were: (1) describe extent of lead exposure for spectacled eiders nesting throughout the Y-K delta, (2) compare lead exposure rates among high

density nesting areas, and (3) describe correlations of lead exposure to demographic and geographic features of the Y-K delta. Results indicate that eiders eat lead shot while feeding in refuge wetlands and that lead shot remains on the wetland surface more than three years. Eiders can survive with very high blood lead levels, but those with elevated levels have lower survival than those with no or "non-toxic" concentrations. Preliminary analyses indicate exposure rates vary considerably (15-60%) among areas within the Y-K delta. This variability may be related to soil type of pond bottoms, land to water ratio, presence or absence of traditional hunting areas, and hunting pressure.

Since 1984, the University of Alaska, Fairbanks, supported a study of brant ecology at Tutakoke River. The demographic aspect of the work included leg banding for the first time, observing previously banded birds, recapturing an additional previously banded birds, and web tagging goslings. Analyses of results indicate: (1) handling during banding has no negative effect on first year survival; (2) by age 5 years virtually all females breed every year; (3) as colony size has increased, gosling size and clutch size of females <5 years old have decreased significantly but no trend was detected in clutch size of older females or for the colony as a whole, and first year survival has declined from about 70% for the 1986 cohort to about 45% for cohorts in the early 1990's; (4) the largest goslings at capture survive at essentially adult rates (ca 80%) and the lower average first year survival is the result of poor survival by small goslings and explains the decline in first year survival of more recent cohorts. Study of controls over plant communities involved: (1) manipulation of frequency of tidal flooding, (2) manipulation of grazing intensity on *Carex subspathacea*, and (3) use of greenhouses and clipping and fertilization to examine effects of warmer temperatures on production and species composition of coastal communities. Preliminary analysis indicates little effect of weekly flooding. Trampling by biologists associated with performing the experiment converted *C. ramenskii* into *C. subspathacea*, and indicated that trampling by geese plays an important role in maintaining their preferred grazing areas. Vegetation reaches nearly one meter in height inside greenhouses and litter from the additional production of vegetation in salt marsh areas trapped several centimeters of silt during fall floods providing some insight into beach ridge development. Results from 1998 are unavailable at this time.

In conjunction with development of a brant population model by Dr. J. Sedinger of the University of Alaska, Fairbanks, the refuge initiated a study of distribution, abundance, and productivity of satellite colonies located within Clarence Rhode Natural National Landmark. This study area was chosen in part because a portion of the study was funded by the National Park Service. Objectives included: (1) document chronology of migration arrival and nest initiation, (2) document distribution, abundance, and productivity of colonies, (3) document presence of color-marked birds, and (4) leg band birds in molting flocks with metal and colored, individually coded plastic bands. Two, two-person camps were established near the mouths of Big Slough and the Aknerkochik River. Personnel arrived at camp on May 7. Brant were first observed on May 8 and 9 at

Aknerkochik River and Big Slough camps, respectively; but may have been present on arrival. Documentation of migration arrival at Big Slough was interrupted on May 21 when camp was evacuated due to flooding. Prior to that date, migration arrival had been increasing from May 15-19. Personnel returned on May 28 and initiated nest searching. Peak arrival occurred at both camps about May 16. Peak nest initiation was May 26-28 and May 27-29 at Aknerkochik River and Big Slough, respectively. A total of 523 and 425 nests with complete clutch sizes of 4.2 eggs were located at Big Slough and Aknerkochik River, respectively. Peak hatch occurred between June 21-24 and 23-26 at Aknerkochik River and Big Slough, respectively. Seventy-five percent of nests were successful at Big Slough compared to 93% at Aknerkochik River. An average of 1.2 unhatched eggs remained in 39 and 54 successful nests at Big Slough and Aknerkochik River, respectively. Successful nests sustained depredated egg loss of an average 1.3 eggs (n=6) and 1.5 eggs (n=26) at Aknerkochik River and Big Slough, respectively. No banding of molting birds occurred due to an inability to locate brood rearing areas. It is anticipated that the study will continue at both camps in 1999.

The refuge also initiated a survey to delineate the westernmost breeding distribution of Taverner's Canada geese and the easternmost breeding distribution of cacklers. Fifty-eight, 24 km long transects were identified. Transects were spaced six kilometers apart and each began 16 km from the refuge's west coast. It was hoped that the nesting contact zone for these subspecies would be located within transect boundaries. A helicopter flying at 30 m and 48 km/hr surveyed a total of 26 of the central most transects and 29 nests were located on 12 of them (average = 2.4, range 1-5). Nesting habitat was characterized and contour feathers were collected for subspecific identification by DNA analysis. Genetic information was obtained from 26 of the 29 samples, 23 of which were identified as Canada geese. Seven were classified as cacklers, two as Taverner's, and 14 were unclassified. None of the six village corporations contacted would allow surveyors to land the helicopter on their land to collect data. Work in 1999 will continue as funding allows.

Spectacled and Common Eider Nesting on Kigigak Island

In response to listing spectacled eiders as a threatened species, field work on Kigigak Island was conducted for the eighth year. A field camp staffed by two refuge personnel was maintained from April 29 - July 8 with the following objectives:

1. Monitoring spectacled and common eider nesting chronology and productivity.
2. Capturing and marking nesting female spectacled eiders to estimate annual survival.
3. Capturing and placing radio transmitters on oldsquaws to document molting areas.
4. Eliminating arctic fox from the island.
5. Assisting with coastal goose/eider production survey.

Two arctic fox observed on the island were found dead prior to nest initiation. No active dens were located.

Spectacled and common eiders were first observed on Kigigak Island on May 15, approximately a week later than the last five years. Nest initiation was later and 10 days shorter than 1997. Eighty-five percent of nests were initiated within a two week period (May 26 - June 8). Peak hatch periods were June 25-30 for spectacled eiders and June 23 - 26 for common eiders.

A total of 186 eider nests were found, including 111 spectacled and 75 common. Productivity data are presented in Table D.1.

Table D1. Common and Spectacled Eider Productivity, Yukon Delta NWR, 1998.

Category	Spectacled Eider	Common Eider
Nesting Success (Mayfield)	83.5% (n = 111)	65.9% (n = 72)
Mean Complete Clutch Size	4.5 eggs (n = 104)	5.4 eggs (n = 69)
Egg Hatching Success (successful nests)	90.1% (n = 93)	96.3% (n = 47)

Fifty-nine female spectacled eiders were nest-trapped between June 16 and July 2. All females not previously banded were fitted with a colored, uniquely numbered, plastic tarsal band and Service leg band (steel). Spectacled eiders also received a uniquely numbered nasal disk. Blood was taken for lead and DNA analyses.

Twenty-nine females were new captures, yielding 239 adult female spectacled eiders marked on Kigigak Island since 1992. Thirty females were recaptures, originally banded on Kigigak Island. Seventy-four previously banded spectacled eider females were identified in 1998, including three originally banded as ducklings in 1992 and 1995. Only two of these females were not observed on nests. One was observed with a male before nesting and the other with a brood. In addition, six marked females were not identified. The observed return rate was 71.8%.

6. Other

For the tenth consecutive year, Migratory Bird Management and the refuge cooperatively conducted a household survey of subsistence waterfowl harvest. Harvest coordinator Cynthia Wentworth (MBM) and refuge information technician/field coordinator Abraham Andrew carried out the survey with assistance from other refuge information technicians and by the refuge interpreters. The survey covers a 38 village area of the Y-K Delta,

which is divided into six regions. An attempt is made to survey 24 of the 38 villages, and 25% of all households on the Delta.

Y-K Delta residents harvested approximately 126,000 birds for subsistence in 1998. This compares with the 10-year, 1989-1998 mean of 105,000 total birds harvested. The 1998 harvest estimate was 37,000 birds higher than in 1997, when only 89,000 birds were estimated taken, but is similar to 1996, when 127,000 birds were taken. The increase in 1998 was due to large increases in white-fronted goose, cackling Canada goose, lesser Canada goose, pintail, mallard, scaup, scoter, and ptarmigan harvests compared with 1997. Total goose harvests in 1998 (47,000 geese) were well above the 10-year mean (34,000 geese), and total duck harvests (50,000 ducks) were also above the 10-year mean (43,000 ducks). In 1998, approximately 47,000 (37%) birds harvested were geese, 50,000 (40%) were ducks, 10,000 (8%) were swans and cranes, and 16,000 (13%) were ptarmigan.

Harvests of all goose species were higher in 1998 than in 1997. Cackling Canada goose harvest estimates in 1998 were the highest recorded since this survey began in 1985, at over 15,000 cacklers. Pacific white-fronted goose harvests (12,400) were the second highest recorded. The emperor goose harvest estimate (1,900) was above 1997's estimate (1,500) but was below the 10-year mean (2,200). The lack of participation by the key south coast villages of Kipnuk, Kongiganak, and Kwigillingok again in 1998, as well as the lack of participation of these and other key coastal villages in other years, decreases our confidence in emperor harvest estimates. The black brant estimate (4,100) was slightly higher than in 1997 and exceeded the 10-year mean (3,100). Black brant harvest estimates for the Y-K Delta are also affected by the lack of participation of Kipnuk, Kongiganak, and Kwigillingok to an unknown degree.

Approximately 50,000 ducks were harvested in 1998, up significantly from 1997's harvest of 33,000 ducks and above the 10-year mean of 43,000 ducks. Harvests of pintails and mallards were up substantially from the 1997 and very close to their 10-year means. Greater scaup, goldeneye, oldsquaw, and scoter harvests were all substantially above 1997 estimates and above their 10-year means. Common, king, and spectacled eider harvests were below 10-year means in 1998. King eider harvest was 2,300 birds, below the 10-year mean of 2,700 birds and well below the 3,400 birds estimated taken in 1997.

Estimated tundra swan harvest in 1998 was 5,900 birds, above the 1997 harvest of 5,500 but still down substantially from the 1995 and 1996 swan harvests of 9,500 and 8,900 birds respectively. The 1998 swan harvest was below the 10-year mean of 5,700 swans. The estimated 1998 sandhill crane harvest (3,900) was well above 1997's harvest of 2,400 cranes and above the 10-year mean of 3,400 cranes.

Survey results for 1998 continued to show that spring is the most important season for waterfowl and other bird hunting. In 1998, 68% of all surveyed households in

communities other than Bethel caught birds and/or gathered eggs during the spring survey period. Over half (55%) of all birds taken in 1998 were taken in the spring.

Since 1985, reported egg harvests have been highly variable. This is related to the fact that a relatively small percentage of households on the delta report any egg harvesting. However, in 1998, total reported egg harvest (22,000 eggs) was the highest recorded since the survey began in 1985. Total reported goose egg harvest was also the highest recorded (8,000 goose eggs).

In 1998, 1,098 household in 31 Delta villages participated in the survey during the spring survey period. This was the largest number of villages and households ever to participate in the survey. Our 1998 sample was actually an oversample of villages in some regions. As in 1997, all villages in the mid coast and Yukon regions were surveyed. The reason for this was to continue to get a more accurate estimate of what was being harvested on the Yukon River, especially compared to the mid-coast, which on average is the region of highest waterfowl harvest. Thus we feel that the 1997 and 1998 harvest estimates from both the mid coast and Yukon River are the most accurate we've collected to date.

In the south coast region, two of the required three villages participated in the survey: Eek and Tuntutuliak. However, none of the three villages at the mouth of the Kuskokwim (Kipnuk, Kongiginak, or Kwigillingok) participated in 1998. This, as in previous years, was the major weakness of the 1998 survey. These villages are located near prime coastal emperor and brant staging habitat, so it is an educated assumption based on conversations with villagers that emperor and brant harvests are important. Also, Eek and Tuntutuliak, from which the regional estimate is derived, do very little emperor and brant hunting, even though they take a lot of cacklers and white-fronts. This means the emperor and brant harvest estimates from the south coast region are probably low, making the Y-K Delta emperor and brant harvest data least credible.

In the Kuskokwim region, ten villages participated in the harvest survey in 1998 - more than the required number. We made progress in the Kuskokwim region in that the village of Atmauthluk participated fully in the survey for the first time, and the village of Napaskiak participated for the first time since 1990. However, the consistent lack of participation by the village of Akiak continued, as did the nearly consistent lack of participation by Kasigluk. This prevented the sample from being random in this region.

A total of \$65,000 went directly into local village economies as payments to surveyors. Each surveyor earned an average of \$1,550.

E. ADMINISTRATION

1. Personnel



Kovach, Jennings, Morgart
Albright, Rearden, Moran, Wege, Paniyak, Anvil



Liedberg, McCaffery, Walters, Cannon, Perry



Kelly, Andrew, Sipary, Littlefish, Isaac
Jimmy, Moses, Nick, Asuluk, Hunt

Permanent and Intermittent Staff

1. Michael B. Rearden Refuge Manager, GS-0485-14, EOD 6/95, PFT
2. Dennis W. Strom Deputy Refuge Mgr., GS-0485-12, EOD 8/83, Ret. 9/30/98 PFT
3. Paul A. Liedberg Refuge Operations Spec./Pilot, GS-0485-12, EOD 6/96
4. Dave Cox Refuge Operations Spec., GS-0485-9, EOD 9/95, PFT
5. John R. Morgart Supv. Wildlife Biologist, GS-0486-12, EOD 8/87, PFT
6. George Walters Airplane Pilot, GS-2181-12, EOD 7/87, PFT
7. Charles F. Hunt Native Contact Representative, GS-1040-12, EOD 1/79, PFT
8. Alex S. Nick Interpreter, GS-1040-9, EOD 11/84, PFT
9. Lorrie J. Beck Outdoor Rec. Planner, GS-023-11, EOD 3/93, PFT
10. Michael L. Wege Wildlife Biologist, GS-0486-11, EOD 4/83, PFT
11. Brian J. McCaffery Wildlife Biologist, GS-0486-11, EOD 10/86, PFT
12. Steve Kovach Wildlife Biologist, GS-0486-11, EOD 12/96, PFT
13. David Cannon Fisheries Biologist, GS-0482-11, EOD 7/5/98, PFT
13. Bernice M. Albright Computer Specialist, GS-0344-9, EOD 12/96, PFT
14. Martha Perry Refuge Clerk, GS-0303-4, EOD 2/87, PFT
15. Phillip P. Paniyak Refuge Clerk, GS-0303-5, EOD 1/92, PFT
16. Peter W. Tony Maintenance Mech., WG-4749-9, EOD 8/91, PFT
17. Pat Jennings Maintenance Worker, GS-4749-8, EOD 12/97
18. Michael A. Jimmy Refuge Info. Tech., GS-1001-8, EOD 11/84, P (Seasonal)
19. Abraham Andrew Refuge Info. Tech., GS-1001-8, EOD 11/91, P (Seasonal)
20. Moses D. Littlefish Refuge Info. Tech., GS-1001-6, EOD 1/93, INT

21. James Sipary	Refuge Info. Tech., GS-1001-7, EOD 2/96, INT
22. Joe Asuluk Sr.	Refuge Info. Tech., GS-1001-7, EOD 1/94, INT
23. Leo Moses Sr.	Refuge Info. Tech., GS-0404-7, EOD 6/90, INT
24. Jacob Isaac	Refuge Info. Tech., GS-1001-7, EOD 2/97, INT
25. Andrew Kelly	Refuge Info. Tech., GS-1001-6, EOD 7/5/98, INT
26. Chris Harwood	Biological Tech., GS-0404-7, EOD 3/91, PFT
27. Henry E. Ivanoff	Biological Tech., GS-0404-5, EOD 8/91, INT
28. Raymond Ayogan	Biological Tech., GS-0404-5, EOD 4/96, INT
29. Christine L. Moran	Student Trainee, GS-0404-5, EOD 9/95

Temporary Employees

Stanley Johnston	Biological Tech., GS-0404-5, EOD 4/6/98, LWD 9/30/98
Victor Anvil	Laborer, WG-3502-3, EOD 6/11/97
Ronnie Vanderpool	Biological Tech., GS-0404-5, EOD 9/17/98, LWD 10/16/98
Grady Harper	Biological Tech., GS-0404-5, EOD 4/12/98
Chris Nicholai	Biological Tech., GS-0404-5, EOD 4/12/98, LWD 9/25/98
Eli Hoffman	Biological Tech., GS-0404-5, EOD 6/1/98, LWD 8/20/98
Jimmy Andrew	Biological Tech., GS-0404-5, EOD 6/29/98, LWD 8/10/98
James Lefor	Biological Tech., GS-0404-5, EOD 4/12/98, LWD 8/6/98
Kimber Wolfe	Biological Tech., GS-0404-5, EOD 4/20/98, LWD 7/31/98
Laird Hamblin	Biological Tech., GS-0404-5, EOD 4/14/98, LWD 6/26/98
Lisa Saperstein	Biological Tech., GS-0404-5, LWD 1/3/98
Thomas Olson	Biological Tech., GS-0404-5, EOD 4/15/98, LWD 7/24/98

Volunteers

Jeff Birchem	Joe Cayou	Keith Edman
Dave Kuehn	Heather Moore	Mark Hopey
Zach Fairbanks	John Barclay	Jimmy Andrew
Ross Boring	Carl Williams	Maureen Harwood
Nancy O'Mera	Margie Wells	

The most significant personnel change occurred in September of the year when Deputy Refuge Manager Denny Strom retired after serving in that position since 1983. Denny took part in many of the major changes that took place on the refuge during those 15 years. Some of them included construction of a new office complex and nine new residences, initiation of the Y-K Delta goose management plan, the I&E effort associated with the non-toxic shot requirement, the start and maturing of a Refuge Information Technician program, and a doubling of the number of staff. A sendoff was held for Denny on August 14. Shortly thereafter he moved to Wrangell, Alaska where as he put it, his wife was going to support him in a lifestyle of hunting and fishing.

Another significant personnel event was the addition of a first-ever Fisheries Biologist position to the staff. Dave Cannon transferred to the refuge from the fisheries assistance office in Jackson Hole effective July 5. Dave hit the ground running with multiple trips on the Kwethluk, Togiak, and Andreafsky rivers before the season ended in mid October. Funding for the position originated with the Subsistence program.

A number of other personnel actions took place during the year. Computer Specialist Bernice Albright was upgraded to her GS-9 full performance level on June 7. Biological Technician Chris Harwood was promoted to his position's full performance level of GS-7 on August 17. RIT's Joe Asuluk, James Sipary, and Jacob Isaac were upgraded to GS-7 on September 27. RIT Michael Jimmy moved from his home in Emmonak on the Yukon River to Bethel to fill a position vacated by Alex Nick last year. As part of the move his position was changed to full time seasonal. To replace Michael in Emmonak, Andrew Kelly was hired effective July 5.

3. Other Manpower Programs

Under the Resource Apprenticeship Program for Students (RAPS) program, Zach Fairbanks was hired to assist with a neotropical bird nesting project. Zach spent the better part of two months based at the Kanagyak field camp where he assisted in nest searches, banding, and production surveys. Funding for this program was provided by the refuge.

4. Volunteer Programs

Fourteen volunteers worked on the refuge in 1998. They provided 4,434 hours of resource and public use support.

Dave Kuehn, Jeff Birchem, Joe Cayou, and Keith Edman spent a combined total of three months at Kisaralik Lake greeting recreational users as they began their trip down the Kisaralik River. Supervisory Biologist John Morgart volunteered one week of his time at Kisaralik Lake providing information to rafters and anglers before their trek.

Heather Moore, and her field assistant Mark Hopey, continued their population ecology and nesting biology study of yellow wagtails at Cape Romanzof, Alaska.

Zach Fairbanks assisted WB McCaffery on a breeding bird nesting survey of western sandpipers at Kanagyak.

As part of a nation-wide nutrition contaminant study, Professor John Barclay collected greater scaup eggs from nests across the Y-K Delta.

Jimmy Andrew, Ross Boring, and Carl Williams provided valuable assistance in several rainbow trout research projects. Mr. Andrew assisted with the logistical coordination and organization of the Kwethluk River float trips. Mr. Boring and Mr. Williams participated in a catch-and-release rainbow trout tagging float trip on the Kwethluk. Later in the summer, Mr. Boring assisted with a trout collection study on the Kisaralik River.

Maureen Harwood assisted with bird walks and bird slide shows throughout the year.

Volunteers Nancy O'Mara and Margie Wells assisted ORP Beck with opening the Visitor Center on select Saturdays, from July through December. They provided valuable visitor assistance, as well as managing the ANHA sales outlet.

5. Funding

The funding table for the past five years and a discussion follow.

Table E1. Funding for the Yukon Delta NWR, FY-94 thru FY-98.

<u>Activity Code</u>	<u>FY-94</u>	<u>FY-95</u>	<u>FY-96</u>	<u>FY-97</u>	<u>FY98</u>
1230/31 (Mig Birds)	28K	67K	56K	40K	40K
9100 (Fire Mgt)	25K	32K			
1260 (Refuge Ops)	2,166K	1,915K	1,993K	2,080K	2,340K
1971 (Reimb)				76K	19K
1113 (End. Species)				13K	
Total	2,219K	2,014K	2,049K	2,209K	2,399K

As was normal for the past several years, funding to operate the refuge came from a number of sources. Through the National Park Service (NPS), the refuge was given \$25,000 in FY97 to study satellite black brant colonies in the Clarence Rhode National Natural Landmark which encompasses portions of the former Clarence Rhode NWR. This program directs the NPS to support National Natural Landmark landowners in the protection of landmark resources. A portion of the funding was used in FY97 for reconnaissance of the study area with \$19,000 carried over for field work in FY98. Funding for FY99 is expected to continue the project.

A challenge cost share proposal to fund the Western Alaska Natural Science Camp was again approved and \$20,000 was allocated for the project. A second cost share project was funded to conduct a steel shot trade in the villages. In this project, Ducks Unlimited provided steel shot to be exchanged for lead shot in villages located mainly along the

coast where lead poisoning is affecting eider populations. The cost share agreement provided \$5,000 for the refuge to make flights for the exchange.

The subsistence division again funded several projects. One wildlife biologist position along with overhead and support was funded for a total of \$73,000. In addition they provided \$55,000 to continue the Kilbuck brown bear study and coordination which included a census, \$5,000 to conduct a moose survey, and \$10,000 for the Kilbuck caribou herd working group support. Subsistence funding provided \$143,000 - approximately 6% of the station budget.

Migratory Birds (1231) provided \$25,000 for mallard and pintail banding, \$10,000 to support part of the Kigigak Island eider research, and \$5,000 to conduct cackling Canada goose banding.

Four Maintenance Management System projects were funded which included \$20,000 to insulate and install forced air furnaces in the metal storage building, \$2,000 to repair roofing on the Kanagyak field station buildings, \$15,000 for new boardwalks at Kanagyak, and \$128,000 for installing vinyl siding on three of the refuge residences. Funding for the vinyl siding was provided directly to Engineering and Contracting negotiated with a minority firm for the installation.

The most significant funding news this year came in the form of increased base funding for refuge programs identified in the Refuge Operating Needs System (RONS) program. The increase in base funding for the refuge system was largely a result of lobbying by the Comprehensive Alliance for Refuge Enhancement (CARE) group and amounted to some 40 million dollars nationwide. For this station, we were provided with \$32,000 for incorporating traditional and ecological knowledge into our program, \$53,000 for public use monitoring of rivers, \$70,000 for additional wildlife inventory plan work, and \$32,000 for fixed and overhead costs. The funding of \$187,000 was a boon to address areas in need of attention throughout the refuge.

6. Safety

Refuge Safety Officer Chuck Hunt wrote all the safety material for each month or season, such as boating and water safety for summer, and made certain each staff member received a hard copy or through the refuge e-mail system.

Bear and Firearms Safety Instructor/Biologist Steve Kovach conducted bear and firearms safety training for 16 refuge staff, six volunteers, six Alaska Department of Fish and Game staff (cooperator), one Association of Village Council Presidents, Inc. (cooperator), one law enforcement, and two Kenai Fisheries staff during the spring and summer of 1998. During the Western Alaska Youth Science Camp at NYAC, Alaska, Refuge Safety Officer Chuck Hunt conducted Bear Safety Training for 20 students and 14 staff.

Assistant Interpreter Alex Nick and Refuge Information Technician Abraham Andrew provided bear safety throughout the duration of the science camp which ran from June 22-27.

On April 29-30, 1998, Dale Robinson, Safety Specialist, from the Regional Office's Division of Engineering and Safety came to Bethel and conducted the refuge facilities pre-inspection to determine compliance with safety/health requirements and assist the refuge with any safety concerns.

Major safety concerns by the safety specialist were observed in the Hazard Communication Program, Confined Space Program, Blood borne Pathogen Program, and Job Hazard Analysis. These were corrected prior to the refuge inspection conducted July 13, 1998. The safety specialist during his inspection was assisted by Refuge Safety Officer Chuck Hunt and Maintenance Mechanic Pat Jennings.

The July 13, 1998 refuge inspection gave the refuge a clean bill of safety and health. Housekeeping throughout the facility was considered outstanding and violations from previous inspections had been corrected.

7. Technical Assistance

The refuge continued to be involved in meetings concerning the Hovercraft project which began providing bypass mail and transportation on the Kuskokwim River in 1997. The project is a US Postal Service demonstration project contracted to Lynden Transportation Services. RM Rearden and SWB Morgart attended meetings as part of an advisory panel for environmental studies related to the project.

F. HABITAT MANAGEMENT

1. General

Yukon Delta NWR encompasses approximately 21.9 million acres within the northern boreal zone of southwestern Alaska. About 70% of the refuge is below 100 feet in elevation and consists of a broad, flat delta dotted with countless waterbodies. The delta was created by the Yukon and Kuskokwim rivers and their tributaries. The Yukon River delta is in the process of building up, while the Kuskokwim delta is slowly being eroded by normal river processes. Many streams and sloughs are former tributaries of the two major rivers. Flooding of riverine and lowland areas is common, particularly in spring. The refuge's coastal plain is scarcely above sea level and is frequently inundated by Bering Sea tides.

The coastal plain, including the Yukon Delta Refuge, is contrasted by uplands and mountains to the north, east, and south. Several small mountain groups are scattered across the coastal plain. The southern extension of the Nulato Hills is located near the refuge's northern boundary. These rounded hills, rising from 1,000 to 3,000 feet in elevation, are the western extension of this large geographic feature. The Askinuk Mountains are located along the refuge's western coast, immediately south of Scammon Bay. They are approximately 10 by 40 miles in size and are the only part of the coastal plain that has been glaciated. The Kusilvak Mountains are located approximately 40 miles west of the village of St. Mary's and are directly south and east of Nunavaknuk Lake. They are eight miles from north to south, and five miles east to west, rising 2,300 feet. The Ingakslugwat Hills north of Baird Inlet are a group of small volcanic cones, lava flows, and craters. The tallest of these is 650 feet. These hills may be one of the most recently active volcanic areas on the Delta. The Kilbuck Mountains are the southern extension of the Kuskokwim Mountains and are located in the southeast part of the refuge. These mountains range from 2,000 to 4,000 feet in elevation.

Two major islands are located within the refuge. The million-plus acre Nunivak Island lies 20 miles off the coast and is of volcanic origin with several peaks from 1,000 to 1,600 feet. Coastal bluffs range from 100 to 450 feet high. Sandy beaches along the southern coast merge into active sand dunes greater than 100 feet in height. These dunes are particularly susceptible to erosion because protective foredunes and extensive beaches are absent. The second largest island is Nelson Island which is separated from the mainland by the Ninglick River to the north, Baird Inlet to the northeast, and the Kolavinarak River to the east. The southern portion of the island is low-lying and covered with small lakes and streams. To the north, the terrain becomes more rugged with several peaks ranging over 1,300 feet in elevation.

Refuge vegetation is primarily subarctic tundra, underlain by permafrost, and includes a variety of scrub, peatland, heath meadow, marsh, and bog habitats. Tall scrub and forest habitats are found in the eastern interior areas. Alpine tundra occurs in the mountainous areas at higher elevations. Most of these habitats remain essentially untouched by man. Virtually no habitat management as practiced in the lower 48 states occurs on the refuge. Habitat related activities involve mapping and inventory efforts associated with specific wildlife studies and wildlife management.

2. Wetlands

The two largest Rivers in Alaska, the Yukon and the Kuskokwim, flow across the refuge and are the primary elements which created the refuge's landscape. Approximately half of the refuge is covered by water, with innumerable ponds, lakes, and sloughs. For the most part, aquatic habitat on the refuge is considered to be relatively unaltered, but past and present mining activities have simplified stream habitat in several areas adjacent to

the refuge boundary (e.g., Tuluksak River), and may have reduced those streams overall productivity levels.

Most of the refuge is a vast, flat wetland/tundra complex dotted by countless ponds, lakes, and meandering rivers. The refuge's most productive wildlife habitat is the coastal region bordering the Bering Sea. This narrow strip of land is unquestionably the most productive goose nesting habitat in Alaska. As a result of the Alaska Submerged Lands Act, additional selected acreage on and adjacent to this coastal strip could eventually be conveyed to Native corporations.

3. Forests

Less than five percent of the refuge is forested. Narrow bands of riparian, black spruce-hardwood, mixed black spruce-balsam poplar, and balsam poplar woodlands extend onto the delta along the Yukon and Kuskokwim Rivers and their tributaries. In addition, pockets of black spruce and white spruce are interspersed throughout the Kilbuck and Andreafsky Mountains. None of the wooded areas contain commercially harvestable timber.

7. Grazing

As one of the establishing criteria for the Yukon Delta National Wildlife Refuge, Section 303(7)(C) of ANILCA states that "...subject to such reasonable regulations as the Secretary may prescribe, reindeer grazing, including necessary facilities and equipment, shall be permitted within areas where such use is, and in a manner which is, compatible with the purposes of this refuge." Currently, the only special use permit authorizing reindeer grazing on the refuge is for Nunivak Island.

Reindeer were first brought to Nunivak Island in 1920 by the Lomen's, a private company with commercial reindeer operations on the mainland. Nunivak was an ideal location to establish a herd because it was considered unclaimed open range; it was large (>1.0 million acres); lacked major competitors and predators; provided favorable habitat (in terms of an abundance of critical lichen winter forage); restricted reindeer movements to a controllable area; and had a cheap local labor force (Cu'pik Eskimo residents of the island). Eighty-one reindeer comprised the first transplant. Ten caribou bulls were introduced to the island in 1925 in an effort to cross-breed reindeer and caribou and improve the overall breeding stock. In 1928 an additional shipment of 523 female reindeer were released on the island. Following this latter introduction, the reindeer population expanded dramatically.

On April 15, 1929, Executive Order 5095 created the Nunivak Island Reservation and reserved it, in part "...for the use of the Department of Agriculture in conducting experiments in the crossing of reindeer and caribou." On September 1, 1937 the U.S.

Congress passed the Reindeer Act (50 Stat. 900, 48 U.S.C. para. 250). In essence, this Act authorized the purchase of all non-Native reindeer by the U.S. Government, restricted ownership of reindeer to Alaska Natives, turned responsibility for management of reindeer over to Native people, and directed the Bureau of Indian Affairs (BIA) to aid them in establishing a self-sustaining reindeer industry. In effect, the Lomens maintained ownership and control of the reindeer on Nunivak Island until 1939 when the Secretary of the Interior purchased their 17,000 head of reindeer.

The BIA continued directing commercial reindeer meat production on Nunivak Island until 1970 when management of the herd was finally transferred to the village of Mekoryuk. Reindeer ownership was transferred to the residents of Mekoryuk in 1990.

Reindeer numbers on Nunivak Island have fluctuated widely over the years, generally because herd managers lacked an understanding of realistic carrying capacities, and the lack of a tightly controlled herd management program. Reindeer numbers have fluctuated from an estimated high of 30,000 animals in the mid-1940's to a low of <1,000 in the mid-1970's. Overgrazing throughout the years has caused a serious degradation of lichen range sites that provide critical winter forage for reindeer. Approximately 32% of the island (330,000 acres) is considered lichen range. Most lichen-producing ranges on Nunivak Island exhibit years of grazing damage; 75% of the winter lichen range is in poor to fair condition.

In 1992, the U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, Alaska Soil and Water Conservation District, Bering Sea Reindeer Products Inc., Bureau of Indian Affairs, NIMA Corporation, and Soil Conservation Service (renamed Natural Resource Conservation Service), signed a cooperative management agreement for reindeer (and muskox) on Nunivak Island. At the time the management plan was signed, the reindeer herd was estimated to be in excess of 7,000 animals. Part of the terms of the agreement is to reduce the reindeer herd to 2,000 animals as measured in March or April of each year. Maintaining a pre-calving herd size at this level should allow lichen ranges to begin the slow process of recovery, yet allow the island herders to remain commercially viable.

An aerial survey to count reindeer on Nunivak Island was not flown in 1998 because of exceedingly poor weather conditions throughout the month of March, and the loss of snow cover in April. The last survey was flown on March 19, 1997 when a total of 3,510 animals were counted.

In 1994, the refuge received a request from Ted and Marie Katcheak for a permit to graze reindeer on the mainland of the refuge. Prior to making a decision on the request, the refuge has had to undergo an extensive compatibility determination process. A range survey was conducted in late summer of 1995 and 1996 to estimate the quantity and quality of potential winter range in the grazing allotment and determine if habitat in the

area could support a reindeer herd without detriment to the natural abundance, diversity, and quality of existing plant communities. Work continued on the compatibility determination in 1998 and is expected to be complete by mid 1999.

9. Fire Management

After an unusually active 1997 wildfire year for the Y-K Delta, 1998 returned to more normal conditions. No wildfires were recorded on the refuge for the whole season which was consistent with the low fire activity throughout the state.

This year marked the 15th operating season under the Alaska Interagency Fire Management Plan used by all agencies and most private landowners in the state. The plan incorporates four management options for wildfire suppression, ranging from limited to critical suppression areas. Approximately 50% of the refuge is contained in the modified category, which dictates suppression during critical burning dates, but allows less suppression after those dates. The remainder of the refuge is in the full suppression category.

Fire suppression responsibilities on the refuge have been delegated to the Alaska Fire Service. The State of Alaska, Department of Natural Resources, conducts wildfire suppression on the refuge from their base of operations in McGrath - some 150 miles from the nearest point on the refuge and 450 miles from the farthest refuge holding.

12. Wilderness and Special Areas

Two wilderness areas occur on the refuge, the Andreafsky Wilderness which contains approximately 600,000 acres, and the Nunivak Wildernesses containing approximately 300,000 acres. Both were established by ANILCA in 1980. Both are remote and receive little public use.

Little activity occurred during the year on a requested commercial reindeer herding operation on portions of the Andreafsky Wilderness Area. Ted and Marie Katcheak from St. Michael applied for a permit several years ago to graze part of the refuge which includes the very northern part of the Andreafsky Wilderness. An environmental assessment in progress was delayed awaiting additional information from Mr. Katcheak regarding his plan of operations. A range survey was completed in 1997 concluded that adequate forage was available for the number of reindeer proposed for the area.

The Andreafsky River and all its headwaters, including its East Fork, were designated as a Wild River under ANILCA. This designation covers approximately 265 miles, of which approximately 198 are within the Andreafsky Wilderness, 54 miles cross private lands, and 13 miles cross non-wilderness refuge lands. There are presently no commercial fishing, wilderness, or float-boating guides operating on the Andreafsky River. The

upper half of both forks of the river receive almost no float-boat use because of limited aircraft access, and a lack of suitable landing locations.

Portions of the old Clarence Rhode National Wildlife Range and the Hazen Bay Migratory Waterfowl Refuge were designated the Clarence Rhode National Natural Landmark in 1968. This is the only "Special Area" presently designated within the refuge. A plaque identifying this designated area is displayed in the refuge headquarters entry.

G. WILDLIFE

1. Wildlife Diversity

The refuge hosts approximately 80% of the continental breeding population of black brant and nearly all emperor geese. As mentioned earlier, the brant population has remained stable and averaged 135,000 birds since 1990. The 1998 population for emperor geese - 39,750 - remained depressed. This species has not responded well to the local goose management plan. Cackling Canada and Pacific greater white-fronted geese numbered about 400,000 and 500,000, respectively, 30 years ago. The 1998 estimate for cacklers is approximately 198,000. The 1998 estimate for whitefronts is 413,050. While still below estimates from 30 years ago, current population estimates of these two species are some four to eight times those from the early eighties. Undoubtedly, these four species have been a significant factor in shaping the coastal ecosystem.

Despite the reduction in geese from historical levels, the refuge still supports large numbers of ducks. The 1998 breeding pair survey estimated over 1.5 million ducks on the refuge in early June. The principal species were northern pintail, green-winged teal, and greater scaup. Mallards, American wigeon, and northern shovelers are also regularly reported in good numbers. Harlequin ducks breed in many of the watersheds draining the Kuskokwim Mountains, as well as other suitable habitats. Common eiders are locally "common" in the vicinity of some brant colonies, while Steller's eiders are virtually extinct as a breeding species. The formerly abundant spectacled eiders have declined precipitously over the last 25 years. From an average breeding population of about 100,000 birds in the early 1970's, the population declined to a low of about 1,800 breeding pairs in 1993. The 1998 estimate was about 3,600 breeding pairs. Sea ducks in general have been declining throughout the continent and region; oldsquaw and black scoter have been added to the refuge's list of species of concern.

The refuge supports an abundance of both resident and anadromous fish populations that are important to the region's and the state's economies, as well as residents' subsistence life style. But more importantly, decaying salmon carcasses provide marine derived nutrients which are linked to both aquatic and terrestrial ecosystem productivity levels.

Aquatic insects quickly respond to the annual enrichment of salmon carcasses. Carcasses which are washed out or carried away from the streams by terrestrial vertebrates are also quickly colonized and processed by microbes and terrestrial invertebrates, facilitating nutrient cycling and energy flow back to streams.

Five species of salmon (chinook, chum, pink, sockeye, and coho), sheefish, arctic lamprey, and numerous other species migrate through the refuge or utilize many refuge streams for spawning and rearing. Other common refuge species include smelt, northern pike, lake trout, blackfish, stickleback, burbot, five species of whitefish, rainbow trout, arctic char, and grayling. The Kuskokwim River drainage is the rainbow trout's northerly most extent of their native range. Nearshore waters around Nunivak Island include many marine species such as halibut, truecod, flounder, and herring, while its many rivers hold dolly varden, Alaska blackfish, and all five species of salmon. All told, at least 44 species of fish occur in refuge waters.

2. Endangered and/or Threatened Species

Small numbers of threatened Steller's sea lions haul out on the rocks at Cape Romanzof and on Nunivak Island. Two races of peregrine falcons occur on the refuge, the American (endangered) and the Arctic. Peregrine falcons (subspecies unknown) have been reported nesting at St. Michael, in the Askinuk Mountains, and along the Yukon River; the species is more widely distributed in migration. Yukon-breeding peregrines probably belong to the American race. The identity of peregrines nesting on the refuge away from the boreal forest is unknown. Eskimo curlews formerly staged in both spring and fall on the tundra near St. Michael, but they have not been detected there in this century. In 1993, the spectacled eider was listed as a threatened species under the Endangered Species Act. Field work on spectacled eiders is described in Section D.5. Much of the world's population of Steller's eiders stages each spring along the refuge's southern coastline prior to moving to their arctic breeding grounds, and tens of thousands migrate south past Cape Romanzof in the fall. In addition, several thousand molt each fall along the shoreline of Nunivak Island. The Alaska breeding population of Steller's eiders represents only a small fraction of the world's population, and was listed as threatened during the summer of 1997. It has yet to be determined whether the flocks migrating and/or molting along the refuge's coast include any individuals from this threatened population. Evidence continues to accumulate that a tiny breeding population of Steller's eiders exists on the coastal tundra of the refuge.

3. Waterfowl

In 1998, SWB Morgart and Biological Technician Harwood conducted the harlequin duck breeding pair survey on May 28 along the same 181 km of streams surveyed from 1994-1997, including the upper Kwethluk River (27 km), Gold Creek (17 km), North Fork (26 km), Quicksilver Creek (38 km), and the upper Kisaralik River from Quartz Creek to

Kisaralik Lake (73 km). In 1998, 312 harlequins were counted along the five survey streams, up progressively higher from the counts of 242, 245, 268, and 284 in 1994, 1995, 1996, and 1997, respectively.

Pintail banding was again conducted in 1998 as part of a cooperative program within the Pacific Flyway. Swim-in traps were used within marshy areas of Kgun Lake, which is located in the north-central part of the refuge. See Section G.16 for 1998 totals.

On September 4-5, WB McCaffery conducted a helicopter duck brood survey along streams in the Kilbuck and Kuskokwim mountains. The primary focus of this survey was harlequin ducks. Because of the difficulty in distinguishing some female harlequin ducks from older Class III ducklings and the uncertainty of female departure dates, tightly-bunched ducks are referred to here as "groups" rather than "broods." The survey area included 99 km of streams within the Kisaralik watershed which have been surveyed during brood-rearing annually since 1995. Thirty-two, 25, 11, and 12 harlequin duck groups were detected in this area in the years 1995-1998, respectively. These groups included 172, 104, 50, and 47 total birds (i.e., young and hens) during the same four years, respectively. Outside of the Kisaralik watershed, eight, seven, and three harlequin duck groups were detected along the Eek River, Kwethluk River, and Fork Creek, respectively, in 1998. These groups included 30, 31, and 10 total birds.

Aerial survey data indicates that the western breeding population of black scoters (*Melanitta nigra americana*) has been declining steadily for four decades. The majority of this population nests on the Yukon-Kuskokwim Delta. The biology of the black scoter is virtually unknown; consequently wildlife managers have little or no data on which to base sound management decisions. Yukon Delta NWR hopes to address this problem by initiating a study to collect baseline ecological and demographic data on the refuge's black scoter breeding population.

The first phase of this effort was an intensive aerial survey designed to locate a suitable site for such a study. Overall, black scoters are widely dispersed as breeders, primarily in non-coastal areas. On June 18-19, 1998, WB McCaffery and ARM Liedberg flew 17, 68-km transects over a 1,958 km² area straddling Aropuk Lake, north of Baird Inlet. Previous aerial surveys (at lower transect densities) by Migratory Bird Management indicated that this area supported reasonably high densities of breeding black scoters. The 1998 transects sampled 230 km², or 11.75% of the study area. Black scoter observations included 347 pairs, 73 solo males, and 23 solo females. Expanding by both area and a visibility correction factor yielded an estimate of over 8,300 scoters in the study area. McCaffery and T. Rattledge (Yukon Aviation) conducted a helicopter brood survey in specific sections of the greater black scoter survey area from August 11-14, and located 30 broods. The data on breeding pair and brood locations will be evaluated to determine the best site for a long-term study of black scoter breeding ecology.

WB McCaffery also surveyed areas around the mouth of the Kuskokwim in search of molting and/or staging black scoters. The surveys included nearshore waters (within a few km of the coast) from the mouth of the Kuskokwim west to Kwigillingok and south to Jacksmith Bay. These fixed wing surveys flights were flown on July 13 (ARM Liedberg - pilot), July 23 (G. Walters - pilot), September 9 (ARM Liedberg - pilot), and September 17 (RM Rearden - pilot). Totals of 10, 190, 4,997, and 3,352 black scoters were counted on the 4 surveys, respectively. The vast majority of birds seen on the two September flights were > 1 km offshore between Jacksmith Bay and Quinhagak.

4. Marsh and Water Birds

Loons, grebes, and sandhill cranes are widely distributed on refuge wetland areas. Populations of red-throated loons have declined dramatically in the tundra habitats of western Alaska over the last 20 years. On the Y-K Delta, populations estimated from aerial surveys have declined from over 11,000 in 1977 to fewer than 6,000 in 1997. Aerial survey data indicate that populations of Pacific loons have remained stable over the same period. Surprisingly, however, data from nest searches on ground plots suggest a 21% decline in the population size of nesting Pacific loons on the outer Y-K Delta over the last decade. The reason for the discrepancy between the surveys is not clear. Sandhill cranes are quite abundant on the refuge and constitute an important component of the ecosystem, including subsistence harvest.

5. Shorebirds, Gulls, Terns, and Allied Species

Shore and water birds visiting the refuge each year number in the millions. Many shorebirds come to breed on refuge tundra, shorelines, and mountaintops. By August, they flock to coastal, lacustrine, and riparian mudflats to build fat reserves for long migrations. Over half a dozen bays on the Y-K Delta's outer coast would independently qualify as hemispheric reserves under the criteria of the Western Hemisphere Shorebird Reserve

Arctic terns are common and widespread breeders on the refuge, and Aleutian terns have nested at several widely scattered sites as well. As in 1996-1997, Caspian Terns were again seen in the vicinity of Cape Romanzof in 1998. In 1996 and 1997, 3 pairs nested on Neragon Island, the first confirmed nesting records for the species in Alaska. Unfortunately, we were unable to visit Neragon Island in 1998.

Gulls, particularly glaucous gulls, are common along the entire refuge coastline from spring through autumn. Glaucous-winged, mew, herring, Sabine's, and Bonaparte's gulls also nest on the refuge. The only continental nesting records for slaty-backed gulls are from Aniktun Island in Kokechik Bay. One pair nested there in 1996 and 1997. Slaty-backed gulls are also rare but regular visitors to Nunivak Island.

Cliffs on the southwest side of Nunivak Island provide nesting sites for an estimated 500,000 seabirds, primarily common murres and black-legged kittiwakes, but also pelagic and red-faced cormorants, glaucous-winged and glaucous-winged/glaucous gull hybrids, horned and tufted puffins, parakeet and crested auklets, and pigeon guillemots. Fork-tailed storm-petrels are not known to nest on the refuge, but they are occasionally seen near shore during autumn storms.



BT Harper censuses kittiwakes and murres at Nunivak Island seabird cliffs. (LJB 7/98)

Seabird Monitoring at Nunivak Island

For the first time since 1990, a crew returned to the enormous seabird colonies at Nunivak Island to conduct monitoring and assess productivity at the permanent study plots established in 1987-88. Eighteen census plots and 10 productivity subplots in the Ingri Butte cliffs area again served as the site for common murre and black-legged kittiwake censusing and productivity. This area, plus the Datheekook area, was searched for pelagic cormorant nests to assess their productivity.

Project leader BT Harwood, ORP Beck, BT Harper, and BT Lefor occupied camp at Dooksook Lagoon from July 15 - August 2. In general, adequate conditions (not to mention one week of "bluebird" weather!) prevailed for fieldwork. For the first time ever, we were able to reach (and exceed!) our goal of 10 days of censuses.

Black-legged kittiwake and common murre census means and 95% CI's (1498 ± 88 and 4305 ± 253 , respectively) were well within the ranges encountered in 1988-90. Pelagic cormorant productivity, was approximately half the average brood size for the period 1987-90 (2.61 ± 0.12). Conversely, 1998 productivity was well within range of those described statewide in 1997. It is possible that different protocols can account for some of the difference between this year's productivity and that of 1987-90. However, we recorded zero 4-chick nests, while between 1987-90, no fewer than 5 (maximum of 14) nests per year contained 4-chick broods.

Although three visits were paid to the 10 common murre productivity subplots, the brief span (8-9 days) over which data were collected probably does not lend itself to an accurate portrayal of common murre productivity. Although our 1998 data could not realistically be compared to current statewide data sets, we should be able to compare them with 1987-90 Nunivak data sets. One interesting observation was the complete failure of subplot #7. On July 24, there were 53 adults and 13 confirmed progeny (egg or chick); on July 29, there were 30 adults and no progeny. We suspected local avian predation (raven?), given the inaccessibility of the cliff to terrestrial predators. No other subplot suffered complete failure so it was not a colony-wide bust.

Because protocol has been modified since our last visit to Nunivak, our black-legged kittiwake productivity data can more appropriately be compared with recent statewide figures, rather than with 1987-90 Nunivak data. At the time of our last visit, 74% ($n = 1055$) of the nests were still active. A conservative estimate of chicks fledged per nest (i.e., all chicks present assumed to have fledged, but all active eggs assumed to have failed) was 0.68 ± 0.03 ($\bar{x} \pm 95\%$ CI). If we assume that all extant eggs hatched and fledged, then productivity is 0.76 ± 0.03 . These results exceed those from 16 colonies reported in the 1997 statewide results.



Murre productivity within the subplot on this cliff was reduced to zero, seemingly by avian predators; no other subplot suffered this fate. (CMH 7/98)



Refuge personnel contracted with Nunivak Island Experiences to ferry them to the study site and back to Mekoryuk during the Nunivak seabird project. The ride upheld the company name. (LJB 8/98)

6. Raptors

Seventeen species of raptors have been recorded on the refuge, including golden eagles, bald eagles, and peregrine falcons. The Kisaralik River is among the most important areas on the refuge for nesting raptors, and supports one of the densest population of breeding golden eagles in North America. For the eighth consecutive year, the refuge conducted an aerial survey for cliff-nesting raptors in the Kisaralik watershed (to include the Kisaralik River and Quicksilver Creek). Along approximately 100 km of river, we located 27 active nests, including 12 golden eagle, 2 bald eagle, 3 gyrfalcon, and 5 rough-legged hawk nests.

See next section (G.7. Other Migratory Birds) for raptor data from Lower Yukon River Breeding Bird Survey

7. Other Migratory Birds

WB's Wege and McCaffery continued documenting migration chronology, winter presence, and plumage of McKay's and snow buntings at Bethel. Thirty-five birds were trapped in 1998 and marked with metal and colored tarsal bands. Recaptures included one bird banded in 1994, four banded in 1996, and one banded in 1997.

The refuge supports an abundance of neotropical migrants, particularly passerines. Habitats supporting large numbers of migrant passerines (forests, woodlands, thickets) total over 2.5 million acres, an area larger than the states of Rhode Island and Delaware combined.

In addition to work at Cape Romanzof (Section D.5) and Lower Yukon River (see below), the refuge monitored populations of neotropical migrants and other landbirds with two Breeding Bird Surveys (BBS). BT Harwood and SWB Morgart conducted the Gweek River BBS for the fifth consecutive year and WB McCaffery and RM Rearden conducted the St. Mary's BBS for the sixth consecutive year.

Lower Yukon River Breeding Bird Survey

Between June 6 and July 1, BT Harwood and RIT Isaac conducted breeding bird surveys of 18 sloughs and side-tributaries of the Lower Yukon River, between Holy Cross and Emmonak (Fig. 1). The purpose of the project was three-fold: (1) to evaluate the feasibility of a Refuge-specific monitoring program (2) to evaluate the feasibility of monitoring "Species of Concern" for the Western Alaska Bioregion (3) to remedy the lack of ornithological data in the study area. Harwood presented the results of this project at the "Boreal Partners in Flight" meeting in Anchorage in December, 1998.

The project began and ended in Holy Cross. Sixteen of 18 routes were completed; the other 2 routes were 40 (obstructed by beaver dam) and 25 stops (thunder/lightning danger), respectively.

Including official surveys and incidental observations, 100 species of birds were detected during the project. While most species were detected on the BBS's proper, some were only detected during village stops or during travel along the Yukon River proper (some 265 miles between Holy Cross and Emmonak). Comparisons of species abundance and distribution presented here are restricted to detections made during official survey periods, except where indicated otherwise.

The most abundant species (based on individuals detected per stop) on the survey was Bank Swallow (Table G.1). This is somewhat misleading because 75% of its detections occurred on merely one route (essentially, two huge colonies). Northern waterthrush and yellow warbler were neck and neck (90% and 89%, respectively) in terms of detection frequency. This illustrates to some degree just how widely these two species were distributed. Species distribution and relative abundance will be more exhaustively analyzed once our GIS technology is available.



Several thousand bank swallows nested in this approximately two mile long colony on lower Paimiut Slough. (CMH 7/98)

Abundance indices for "Species of Concern" (SOC) were also analyzed. The 11 species for the Western Alaskan Bioregion (as determined at the 1997 "Alaskan Boreal Partners in Flight Working Group" meeting) include: Rough-legged Hawk, Golden Eagle,

Gyr Falcon, Short-eared Owl, Arctic Warbler, Gray-cheeked Thrush, Northern Shrike, Blackpoll Warbler, Golden-crowned Sparrow, McKay's Bunting, and Rusty Blackbird. It appears from detection frequencies/rates that this survey can help to monitor no greater than 5 of the species. Two of the passerines (golden-crowned sparrow and McKay's bunting) were not detected, while one was rarely detected (northern shrike). Only one of the raptors (rough-legged hawk) of concern was detected with any regularity, though two non-SOC species (red-tailed hawk, great horned owl) showed comparable detectability.

Funding permitting, this survey will be conducted annually. While it is clear that we cannot annually replicate this year's effort (i.e., 18 routes), by doing half of the routes every other year, we will still be able to monitor trends in a reasonable time frame. We may investigate the possibility of adding routes from the Kuskokwim River to increase our pool of routes. Finally, it has been suggested that habitat analyses of all route stops complement the surveying.



RIT Isaac won an "On The Spot" award for his exemplary work during the Yukon breeding bird survey. (CMH 6/98)

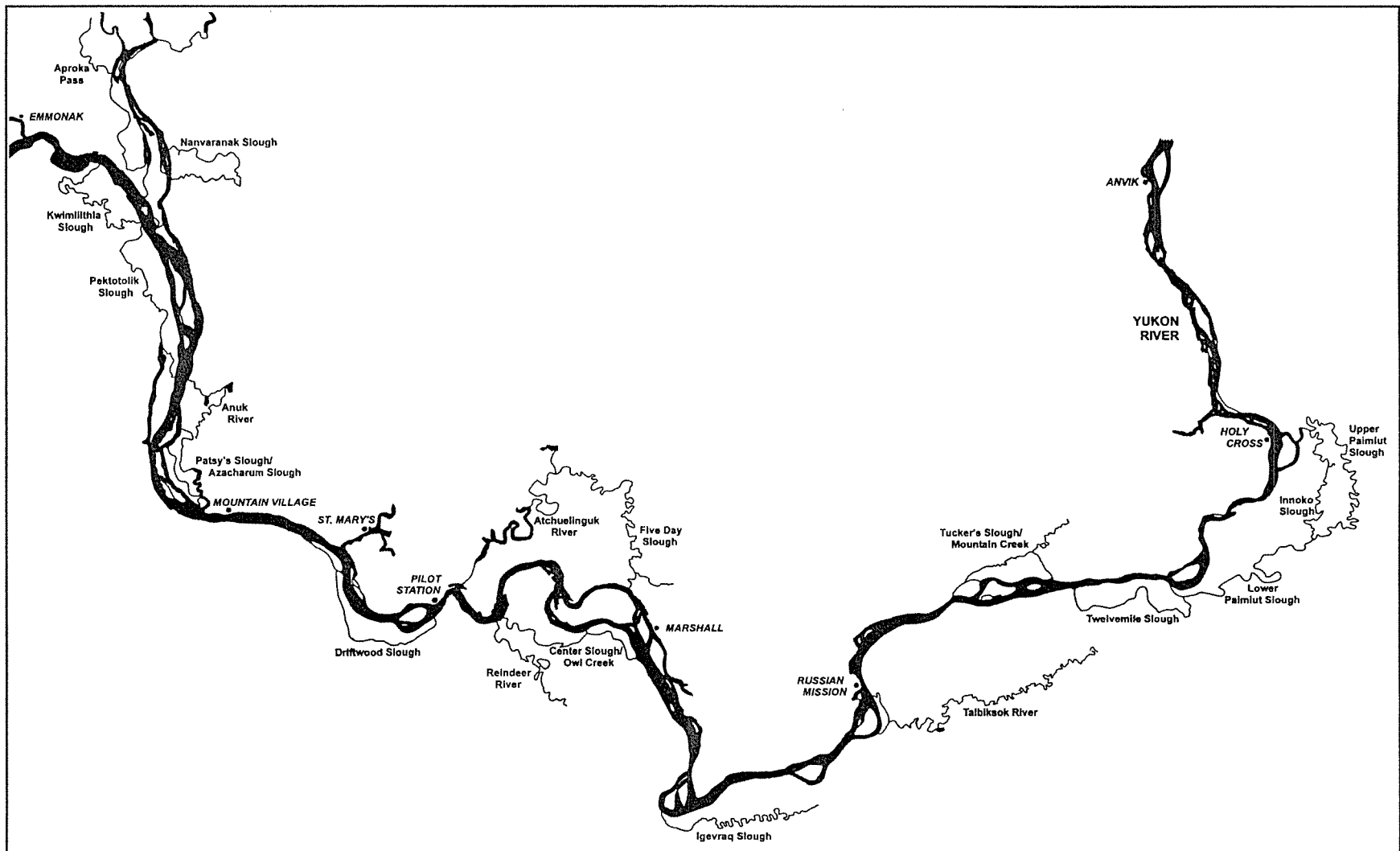


Fig. 1. Distribution of 18 BBS routes in the Lower Yukon River watershed, 6 June - 1 July, 1998.

Table G.1. Species ranked by abundance (individuals detected per stop), Lower Yukon River BBS, 6 June - 1 July, 1998.

Rank	Species	Indiv/Stop
1	Bank Swallow	4.47
2	Yellow Warbler	2.64
3	Northern Waterthrush	2.39
4	Fox Sparrow	1.19
5	Blackpoll Warbler	0.97
6	Varied Thrush	0.95
7	Gray-cheeked Thrush	0.84
8	Yellow-rumped Warbler	0.80
9	Tree Swallow	0.72
10	Alder Flycatcher	0.58

Table G.2. Species ranked by detection frequency (percentage of stops on which detected), Lower Yukon River BBS, 6 June - 1 July, 1998.

Rank	Species	% Stops
1	Northern Waterthrush	90
2	Yellow Warbler	89
3	Fox Sparrow	75
4	Blackpoll Warbler	67
5	Varied Thrush	56
6	Gray-cheeked Thrush	52
7	Yellow-rumped Warbler	46
8	Tree Swallow	42
9	Common Snipe	40
10	Redpoll spp.	40

8. Game Animals

Muskox are probably the refuge's most important game mammal in terms of public use and interest. Muskox were introduced to Nunivak Island from Greenland in 1935. The population grew at an average rate of 16.2% from 1947 to 1968 when it was estimated to number 750. Hunting of muskox on Nunivak Island was initiated in 1975. Hunters are allowed to harvest 70-90 muskox/year (evenly split between bulls and cows). This harvest regime is designed to maintain the island population at 500-550 animals.

In 1967 and 1968, muskox were transplanted to Nelson Island from Nunivak Island. Muskox numbers on Nelson Island typically range between 200-300 animals. Nelson

Island muskox have dispersed onto the Y-K Delta for the past 20 years, crossing frozen rivers between the island and the mainland. Growth of the mainland muskox population is limited by illegal hunting. Both the Service and ADF&G are attempting to promote growth and expansion of the refuge's mainland muskox population and are working with local villages to obtain their support.

A combined muskox and reindeer fixed-wing aerial survey of Nunivak Island is generally conducted in mid-March of each year. The survey was not conducted in 1998, however, because of poor weather conditions. A muskox composition survey of Nunivak Island was flown by ADF&G in a Bell Jet Ranger on August 3-5. The animals immediate response to the helicopter is to run, but upon overtaking, they immediately bunch and face the hovering aircraft. Larger herds were easily broken up into smaller units to facilitate classification. Muskox were scattered across the island as single males, small bands of bachelor males, and breeding herds. Breeding herds were often comprised of the harem bull, one to five older cows, and several two-year-olds and yearlings of both sexes. In addition, there were often several three-plus-year-old bulls associated with each herd as well. The dominant harem bull generally kept other bulls at the periphery of the main herd, however. A total of 634 animals of the following age and sex composition were observed: 164 four-year-old and greater males; 147 four-year-old and greater females; 45 three-year-old males; 55 three-year-old females; 50 two-year-old males; 75 two year old females; and 98 short yearlings. The herd appears healthy, however, herd size currently slightly exceeds population levels established in the cooperatively developed Nunivak Island Reindeer and Muskox Management Plan.

Finally, a muskox composition survey was flown of Nelson Island on August 3. The survey was flown with a Bell Jet Ranger and 293 muskox of the following age and sex composition were classified: 34 four-plus-year old males; 66 four-plus-year-old females; 32 three-year-old males; 34 three-year-old females; 27 two-year-old males; 32 two-year-old females; and 68 yearlings. The notably different ratio of adult males:females observed on Nelson Island vs. Nunivak Island may be explained because of dispersal off the island by animals, particularly young males, in the winter.

Prior to 1950, moose were rarely seen on the Y-K Delta. During the following years, their numbers increased as they colonized the refuge's eastern boundary and riparian woodlands along the Yukon and Kuskokwim rivers. Moose numbers are highest on the refuge (particularly in winter) along the Yukon River between Russian Mission and Holy Cross. In summer, moose are more widespread and are occasionally found as far west as the Bering Sea Coast. Overall, moose numbers are very low on the refuge.

Five census areas are currently identified on the refuge: three are along the Yukon River; one along the Kuskokwim River; and one in the Kilbuck Mountains. The refuge, in cooperation with ADF&G, attempts to conduct one census each winter. Complete snow cover is required to conduct a census. Ideally, censuses would be conducted prior to the

antler drop in December so that herd composition data could be collected during the census. However, the refuge rarely has adequate snow cover in November to conduct a census. Therefore, censuses have traditionally been conducted in late February or early March when snow cover is more predictable and day-light hours are longer. Inadequate snow conditions in 1996 and 1997 prevented any census from being completed.

Plans were made to attempt two censuses in 1998 if snow conditions permitted. The first effort, on January 27-31, 1998, was in the Paimiut census area; this census area encompasses 4,123 km² (1,592 mi²) along the Yukon River from Paimiut Slough to Pilot Station. The second effort was to immediately follow the first, but snow conditions deteriorated in the Kuskokwim Mountains census area thereby causing cancellation of that census for the third year in a row.

Following standard Gassaway survey procedures, 45 randomly selected survey units, encompassing 1,308 km² (505 mi²) were censused. The census required 69.5 hours to complete. The 1,253 moose observed yielded an estimated population of 2,024 moose at the 95% confidence interval and an estimated density of 1.5 moose/km². The only other time this area had been censused was in February/March 1992. In that effort, the estimated population was 994 moose at the 95% confidence interval with an estimated density of 0.9 moose/km².

Historically, caribou occurred on the Y-K Delta in large numbers and were the most abundant ungulate. Numbers peaked in the 1860's and during this period, caribou ranged over much of the refuge, even crossing the ice pack to Nunivak Island. Caribou subsequently disappeared from the region with the exception of small, remnant herds in the Kilbuck and Andreafsky Mountains. In recent years, the Western Arctic Caribou Herd (WACH) has occasionally migrated as far south as the middle portion of the Andreafsky River, but generally remain only a few weeks. A small segment of the WACH was documented on the refuge as far south as the Yukon River in January 1998. Residents of Marshall reported harvesting caribou just south of the Yukon River near that community in December 1997.

An aerial survey by ADF&G in January 1998 documented mixing of the WACH and the MCH along the Yukon River between Russian Mission and Holy Cross. This was the first documented mixing of these two herds in recent history. These herds had been speculated as routinely mixing in winter on the Y-K Delta prior to 1900.

After nine years of intensive study, we have a better understanding of population status and distribution of the small resident Kilbuck Caribou Herd (KCH). Before 1985, the KCH was considered by many to be part of the expanding MCH; however, we have documented two distinct calving sites in the Kisaralik Lake area (1987 to 1994). Movements of radio-collared caribou over a six-year period (1988 to 1994) indicated the herd is expanding its range as evidenced by changes in seasonal distributions of bulls and

cows. During the course of the initial study (1986 to 1992) and subsequent surveys (1993 to present), the KCH has increased in size. Although the original study supports the hypothesis of a distinct, resident herd, significant increases in numbers and radio telemetry observations have documented annual mixing with the MCH since 1995.

Seasonal distribution of caribou in the Kilbuck Mountains starts with movement to higher, wind-swept slopes in January and February to forage on open ridges. When previously snow-covered browse at lower elevations is exposed, usually after April, there are movements to these areas. Cows return to the high mountains near North Fork or to tundra lowlands east of the refuge in May to calve. Bulls remain at lower elevations along major drainages during May. After calving, the cows, calves, and yearlings congregate in large groups to feed in the lower river valleys, but remain separate from bulls. Snow fields are frequented during summer by both herd segments for relief from biting insects and heat. In late September and October, the sexes mix at the lowest elevations of the year for the rut. They remain in the lowlands where exposed tundra is available during late fall and early winter.

A discussion of the Kilbuck Mountains caribou herd study is found in Section D.5.

9. Marine Mammals

Bering Sea marine mammals add an interesting diversity to the refuge's wildlife plus provide a vital subsistence resource for coastal villages. Pacific walruses, spotted seals, ringed seals, and Pacific bearded seals are hunted on the ice in spring, and some seal hunting continues during summer in bays and estuaries. Other marine mammals include harbor and Dall porpoises, northern fur and harbor seals, and beluga, fin, gray, killer, and minke whales.

The Marine Mammals Division, Ecological Services, Anchorage, manages polar bears, walrus, and sea otters in Alaska. The National Marine Fisheries Service, National Oceanic and Atmospheric Administration, has responsibility for all other marine mammals. This is part of the delta's ecosystem, but is treated like a separate entity.

Alaskan Natives who dwell on the refuge coast (primarily Yup'ik Eskimos) may take walrus and other marine mammals for subsistence purposes. Sport or recreational hunting of marine mammals is illegal. Authentic Native articles of handicrafts or clothing may be sold or transferred to a non-Native, or sold in interstate commerce as long as the materials for these crafts were taken incidental to the subsistence harvest. Furthermore, handicraft articles must be "significantly" altered. For example, polishing or carving initials or signature on an ivory tusk would not qualify as a significant alteration. New Service regulations require that all walrus tusks, polar bear hides and

skulls, and sea otter hides and skulls taken by Native hunters be marked and tagged by a designated tagger. Resident Native taggers are now located in many coastal villages.



Up to 15 Steller's sea lions (a threatened species) could regularly be found loafing below this cliff during the Nunivak Island seabird project. (LJB 7/98)

10. Other Resident Wildlife

A reindeer census, normally conducted in conjunction with the muskox census in March of each year, was not completed this year due to poor weather conditions

11. Fisheries Resources

Nearshore ocean habitats harbor Pacific herring, Pacific halibut, starry flounder, and Pacific Tomcod. The Yukon and Kuskokwim Rivers, which flow through the refuge, support internationally significant salmon fisheries and provide habitat for at least 35 other species of fish. Tributary streams throughout the refuge contribute substantially to the salmon stocks in Kuskokwim Bay and Norton Sound, and support anadromous runs

of five species of Pacific salmon; chinook, chum, coho, sockeye, and pink. Other important species include several species of whitefish, sheefish, Alaska blackfish, burbot, northern pike, grayling, and lake trout.

This past decade, southwestern Alaska experienced several severe economic and social hardships as a consequence of unusually poor salmon runs. Besides a lack of fish, other anomalies have been noted: later run timing, smaller than average fish, altered migration pathways, and reports of higher incidences of parasites and increased signs of predation. Present thinking is that these anomalies are the result of unusual marine environmental conditions in the Bering Sea. One consequence of this may be a reduced ability of juvenile feeding success during early marine life.

Significant documented changes (e.g.; warmer water temperatures (up to 10°F), lighter winds, lower levels of nutrient upwelling, and algal blooms) in the North Pacific Ocean and Bering Sea may have had profound effects on the entire marine ecosystem as well. Unusual sightings of southern species of fish and mammals were observed throughout Alaska; an albacore tuna fishery even developed off Kodiak Island. These rare conditions also led to significant mortalities of seabirds which included short-tailed shearwaters, black-legged kittiwakes, and common murre. These conditions demonstrate how complicated ecosystems can be, and that far-off environmental influences can have significant implications here on the refuge.

Fisheries Enumeration Projects

The vast size, remoteness, and fluvial diversity of the Yukon and Kuskokwim river drainages presents tremendous challenges in determining accurate salmon escapement numbers. Successful management requires accurate and timely knowledge about migration periods, run strength, and escapement levels. Within these drainages there are numerous projects operated individually by agencies or organizations, or through cooperative efforts. Unfortunately, considering the complexity of the systems, comprehensive information is generally deficient regarding the abundance and in-season dynamics of local salmon spawning populations. Any addition to the existing inventory of knowledge would make a significant contribution to the overall management of the aquatic resources.

Salmon runs were very poor in the Yukon River during 1997 and 1998. The 1998 harvest level for chinook salmon (42,219) was less than half of the preseason projected outlook and was the lowest on record since Alaska statehood. Preliminary results show that summer chum salmon commercial catch was extremely low (28,118), and was 76 percent below the previous five year average. During 1995 and 1997, 3.6 million and 1.4 million summer chums were estimated to have passed the ADF&G's Pilot Station sonar. This past year, only 831,000 summer chums were estimated to have passed the sonar. The 1998 fall chum salmon estimate of 397,377 fish passing the site was 55 percent of the

previous five year average of 722,000. Further upstream in the Chandalar River, only 16 percent (29,300/184,500) of its average numbers passed the sonar by September 14.

Similarly, the 1998 Kuskokwim River salmon runs were among the weakest on record. Results from aerial surveys conducted by ADF&G revealed that the minimum escapement objectives for chinook salmon was only met in one out of six survey index streams.

Perpetuating healthy salmon runs is essential for the following reasons: 1) local people have relied heavily on the abundant aquatic resources for subsistence use, sustaining cultural values, and providing incomes, and 2) adequate salmon escapement is crucial for maintaining ecosystem health. Decaying salmon carcasses provide "marine derived nutrients" which are linked to both aquatic and terrestrial ecosystem productivity levels.

East Fork Andreafsky River Salmon Escapement Study

The Service has been operating the Andreafsky River (tributary of the Yukon River) weir since 1994, after the catastrophically low chum salmon returns of 1993. The original intent was to monitor chinook and chum salmon escapement into the East Fork of the Andreafsky River. The best location for the site was downstream of refuge administered land, on Nerklikmiut Native Corporation lands. A lease agreement was signed to allow operation of the weir, set up a seasonal camp, and store the weir components. In 1995 weir operations were extended into September primarily to include the coho salmon runs, but this also allows for additional pink salmon data collection. The extension was prompted by a growing interest to develop a late-season commercial coho salmon fishery and was funded through a partnership with the Bering Sea Fishermen's Association. The Association has continued to provide assistance with the project, and this year provided two crew members who were from the village of St Marys.

Although the weir facilitates Service monitoring of refuge spawning salmon stocks and other resident species, scale pattern analysis, age/sex/length, and run timing and abundance data are shared with ADF &G. The State uses the information for managing the commercial and subsistence chinook and summer chum salmon fisheries. Information is also used in the Yukon River Joint Technical committee U.S./Canada Pacific Salmon Treaty negotiations.

The weir was operated from June 23 to September 12. The chum salmon escapement of 67,591 was poor relative to the 1994-1996 escapements which ranged from 108,450 to 200,981 fish, but was higher than the 51,139 fish counted in 1997. A total of 4,011 chinook escaped into the river compared to 3,186 in 1997. The past two year's chinook returns were also low relative to 1994 and 1995, 7,801 and 5,841, respectively. This past year, a total of 5,412 coho salmon returned to the river, well below the 1995 and 1996 returns of 10,901 and 8,037 fish, respectively. Other salmon returns included 185

sockeye and 227,208 pinks. In addition, 20 dolly varden, 4,082 whitefish, and 35 northern pike were counted passing through the weir.

Strong pink salmon runs occur during even years on the Andreafsky River, when counts have been as high as 316,530 such as in 1994. Picket spacing on newer weir panels was made wide enough to permit passage of most pink salmon; therefore, counts for pink salmon may represent only $\frac{1}{2}$ to $\frac{2}{3}$ of the actual escapement, and are primarily used to indicate run timing and relative abundance.



East Fork Andreafsky weir in full operation during low water conditions.
(DJC 7/98)



East Fork Andreafsky River weir during high water. One advantage of the floating weir is that large woody debris normally passes over the weir requiring less maintenance. (DJC 7/98)

Kuskokwim River Tributary Salmon Escapement Studies

Chinook and chum salmon returning to refuge waters of the lower Kuskokwim River must pass through an intense mixed stock commercial fishery, as well as one of the state's largest subsistence fisheries. The local commercial fishery in the Kuskokwim River is directed primarily at chum and coho salmon, while chinook salmon are the principal target of subsistence users; however, substantial numbers of chinook salmon are taken incidentally by the commercial fishermen. In previous years chinook salmon were harvested in a directed commercial fishery, but because of low escapement numbers and increasing subsistence harvest levels in the late 1980's, state management biologists eliminated their directed harvest. Although coho salmon in the Kuskokwim River drainage are heavily exploited, little information is known about run timing, spawning distribution, and population dynamics for virtually all tributaries. Similarly, little information exists for pink salmon or other exploited species such as northern pike, sheefish, burbot, various species of whitefish, and Alaska blackfish.

Several previous efforts by the Service to enumerate salmon abundance in the Lower Kuskokwim have ceased before comprehensive salmon life cycle data had been collected. The Kenai Fishery Assistance Office operated a fish weir in the Tuluksak River from 1991 to 1994, and on the Kwethluk River in 1992, but local opposition to both projects

arose and they were discontinued. Unfortunately, these were the only projects which provided important annual fisheries data for Kuskokwim River tributaries on the refuge.

A fish counting tower has been in operation since 1996 on the Kwethluk River, and is discussed below. Talks were initiated with the Association of Village Council Presidents (AVCP) and ADF&G late in 1997 to resurrect the Tuluksak project using potential disaster relief funding through the Department of Commerce and State of Alaska funds. Since the Tuluksak River remains an important river from which to index other systems in the lower Kuskokwim River drainage, local support is continually being sought by AVCP and other interested groups. All other presently operating escapement projects are located upstream of the refuge, in what is considered to be the middle portion of the Kuskokwim River between the towns of Aniak and McGrath.

Kwethluk River Fish Counting Tower

For the past three years, the Association of Village Council Presidents has obtained funding from Bering Sea Fisherman's Association to operate a counting tower on the Kwethluk River on refuge administered land (the Kenai Fishery Resource Office has provided several weir panels). Tower operations commenced on July 24 and continued through August 18. Due to early and late season high water levels, the tower was not operable during much of the chinook and chum salmon migrations. As a result, only 120 chinook, 720 chum, 120 sockeye, 4,398 pink, and 2,367 coho were observed passing the tower. When escapement projects (such as the weir in 1992) have operated throughout the season, as many as 9,675 chinook, 30,596 chum, 1,316 sockeye, 45,952 pink and 45,605 coho salmon were estimated to have escaped into the system. A disadvantage of the counting tower is that no age, sex, or length data are collected which are important in assessing the run's population dynamics.



View from the Kwethluk River counting tower on August 1. The tower was in operation between July 24 and August 18. (DJC 8/98)

Kwethluk River Rainbow Trout Survey

Over the past few years, anglers and recreationists have shown a growing interest in the lesser known streams of southwestern Alaska. Several streams on the refuge are gaining popularity with anglers as other rivers have become more heavily used. Increased angling pressure is of concern to fisheries managers because rainbow trout in the Kuskokwim River drainage are at their northern most distribution, are slow growing, and mature after 6-8 years which makes them vulnerable to over-exploitation. Fish population shifts demonstrated by declines in abundance and size structure alterations has prompted ADF&G to enact seasonal gear and harvest restrictions in other systems in southwestern Alaska (e.g.; Kanektok and Goodnews Rivers).

To better understand the population dynamics of the Kwethluk River, a mark and recapture study was conducted between June 30 and July 10, and July 22 and August 1, to estimate rainbow trout age, sex, and fork length composition in a 79 km section of river. See the Marking and Banding Section of this report for more detailed information.

14. Scientific Collections

As part of a study by Dr. J. Barclay, Univ. of Connecticut, of the presence of heavy metal, pesticides, and PCB contamination in greater scaup eggs, 25 eggs were collected from study areas on Kigigak Island and Aknerkochik River. Analyses are currently underway.

16. Marking and Banding

The USGS-BRD banded 1,230 cackling Canada geese near Old Chevak in July as part of their demographic study. Refuge personnel banded 313 cacklers at the usual banding location 16 km northwest of Chevak. As part of project to determine what effect ten years of habitat restoration, preservation, and management have had on waterfowl wintering in the Central Valley of California, neck collars containing a radio transmitter were placed on adult female whitefronts. Twenty-five and 34 females were trapped by refuge personnel and USGS-BRD, respectively. USGS-BRD personnel also banded 158 emperor geese and 108 whitefronts as part of a continuing demographic study.

At Kigigak Island, refuge personnel banded (metal Service and yellow plastic tarsal bands with letters and numbers) 59 spectacled eider females as part of continuing nesting ecology study.

The refuge continued to participate in a cooperative program to band mallards and northern pintails within the Pacific Flyway. Ducks were trapped along the northwest shoreline of Kgun Lake and adjacent lakes from July 31 - August 31. Waterfowl concentration areas were baited with whole corn and birds were captured using swim-in traps. This year was the debut of the long awaited cloverleaf style trap. It worked with resounding success. A total of 1,530 northern pintails, 130 green-winged teal, and 16 mallards were banded by refuge staff. Five, three, four, four, eight, seven, and 29 pintails banded at Kgun Lake in 1991, 1992, 1993, 1994, 1995, 1996, and 1997, respectively, were recaptured in 1998. Two of the five birds banded in 1991 were also recaptured in 1992 and a third was recaptured in 1993. One of the eight birds banded in 1995 was also recaptured in 1996 and a second was recaptured in 1997. Seventeen of these 60 birds were banded as AHY males, 18 as AHY females, 11 as HY males, and 14 as HY females. Additional recaptures included a male mallard and a male teal, both of which were originally banded as adults in 1996 and 1997, respectively.

Table G3. Total numbers, age, and sex of waterfowl leg and/or neck-banded under station permit on Yukon Delta NWR, 1998.

<u>Age and Sex</u>						
<u>Species</u>	<u>AHY-M*</u>	<u>AHY-F</u>	<u>HY-M</u>	<u>HY-F</u>	<u>Unk.</u>	<u>Total</u>
Cackling Canada geese	140	173	0	0	0	313
Northern pintail	875	403	146	106	0	1530
Green-winged teal	46	20	49	15	0	130
Mallard	15	1	0	0	0	16

*AHY = after hatch year; HY = hatch year; M = male; F = female.

Cape Romanzof LRRS Landbird Banding

Both nest trapping and fall migration mist-netting were again conducted at Cape Romanzof Long Range Radar Site, as part of volunteer Moore's Master's thesis project on yellow wagtails (see Section D.5). Moore and volunteer Hopey banded 31 of 37 adult yellow wagtails (18 male, 19 female), captured at nests between June 24 and July 6. Six of the birds had been banded on site in 1997. They also banded 61 nestling wagtails.

They operated mist-nets on 18 days, from July 11 through August 2, for a total of 657 net-hours. Twenty-one species, totaling 438 individuals, were banded. Twelve individuals (8 species) banded at Romanzof in 1997, as well 10 yellow wagtails banded in 1998 as nestlings, were also captured. Capture totals are detailed in Table G.4.

Table G.4. Fall mist-netting at Cape Romanzof, 1998.

Species	Number Newly Banded	Recaptures of 1997 Banded Birds
Western Sandpiper	2	0
Alder Flycatcher	1	0
Olive-sided Flycatcher	1	0
Tree Swallow	1	0
Bank Swallow	1	0
Bluethroat	1	0
Hermit Thrush	9	0
Yellow Wagtail	3	6 ^a
American Pipit	3	1
Yellow Warbler	7	1
Northern Waterthrush	1	0
Wilson's Warbler	18	2
American Tree Sparrow	6	0
Savannah Sparrow	203	2
Fox Sparrow	1	1
Lincoln Sparrow	1	0
Golden-crowned Sparrow	19	1
White-crowned Sparrow	7	1
Lapland Longspur	1	0
Snow Bunting	1	0
Redpoll (spp.)	62	3

^a - Technically, these 6 birds were not recaptured during fall migration, but rather at nesting. Ten juvenile wagtails, banded at the nest in 1998, were recaptured during fall migration mist-netting.

Bethel Fall Migration Mist-netting Station

From August 12 - September 14, BT Harwood and BT Harper, along with intermittent help from WB McCaffery, operated a fall migration mist-netting station near Hangar Lake in Bethel. Twenty-four species, totaling 727 individuals, were banded during the period (Table G.5). American tree sparrow (35%) and gray-cheeked thrush (14%) comprised nearly half of all bandings. Neotropical migrants (Types A or B) comprised 49% of all bandings. There were no foreign captures.

Because of conflicting projects, mist-netting probably began well into migration (ideally we should have begun one month earlier). The highest capture dates for individuals and species were August 22 (283/100 nh) and August 27 (15 spp.), respectively. The last date for captures exceeding 1 bird/nh was 3 September; captures dwindled steadily thereafter.



BT Harwood bands a tree sparrow at the Hangar Lake banding station.
(GH 8/98)



BT Harwood working the mist net at the Hangar Lake banding station in
Bethel. (MFH 8/98)

Table G.5. Birds banded during fall mist-netting at Hangar Lake, Bethel, 1998.

Species	Number Banded
Three-toed Woodpecker	1
Alder Flycatcher	12
Gray Jay	1
Black-capped Chickadee	20
Arctic Warbler	5
Golden-crowned Kinglet	2
Ruby-crowned Kinglet	4
Gray-cheeked Thrush	102
American Robin	26
Varied Thrush	16
Northern Shrike	3
Orange-crowned Warbler	10
Yellow Warbler	68
Blackpoll Warbler	1
Northern Waterthrush	12
Wilson's Warbler	13
American Tree Sparrow	250
Savannah Sparrow	25
Fox Sparrow	37
Lincoln's Sparrow	3
White-crowned Sparrow	44
Rusty Blackbird	4
Common Redpoll	47
Hoary Redpoll	21
Total	727

Kwethluk Rainbow Trout Tagging

A multiple-census method for estimating the rainbow trout population in the Kwethluk River was conducted this past summer on a particular stretch of river. A total of 251 fish were captured on the first marking trip, and 997 were captured and marked on the second trip. Relatively low numbers of fish were marked on the first trip due to high water conditions. Each fish was tagged with numbered floy anchor tags, and coordinate locations and fork length measurements were recorded before releasing them at the point of capture. Two additional sample periods are planned for the summer of 1999. Recaptures during these sampling trips will provide the data needed for a population estimate. Future recovery of tagged fish will allow for monitoring growth rates and provide a better insight into fish movement patterns.

Kilbuck/Mulchatna Caribou Capture

Working with ADF&G, SWB Morgart and WB Kovach used a Bell 206 Jet Ranger helicopter and a net gun to attempt to capture and radio collar up to 30 caribou in November 1998. The radio collars also carried a 6-inch wide blue identification collar to facilitate aerial observation of radio-collared individuals. Nine female calves were fitted with new radio-collars. A male calf was captured and released. Three additional females, two yearlings and one calf, were also captured. One of the yearlings died of stress during the handling process. The other two females died from broken necks.

A 5% mortality rate is generally deemed an acceptable loss rate for many capture operations in Alaska. With a goal of 30 caribou, the acceptable mortality rate was two caribou. All three mortalities occurred on the same day. Coincidentally, warming weather the previous two days had eliminated the snow cover in the capture area. Observations by WB Kovach and the pilot indicated that the caribou were running faster on this particular day; without the snow cover, netted caribou were not sliding as on previous days. The broken necks were believed to occur as the forward momentum of the netted animals stopped immediately as they hit the frozen tundra. Despite three other caribou being successfully netted that same day, it was decided that conditions had changed enough that it was no longer safe to capture caribou and the capture operation was halted.

17. Disease Prevention and Control

While lead poisoning has long been known as a cause of waterfowl mortality, it has been only recently been seen as a possible or partial cause for the Y-K Delta spectacled eider population's decline. Eiders are exposed to lead by eating lead shot as grit. Intensive sampling conducted along the Kashunuk River in western Alaska by BRD revealed that one out of 10 spectacled eider females captured in spring had eaten lead. Twice as many females as males had eaten lead. By hatch (approximately mid-June) one out of four females had eaten lead. By late August, one out of two females and one out of nine ducklings had eaten lead. Sampling conducted elsewhere on the Y-K Delta showed that exposure to lead by spectacled eiders at Manokinak River and Kigigak Island was similar and lower than, respectively, the Kashunuk River. Other species sampled for exposure to lead include greater scaup, oldsquaw, common eider, and emperor geese. Approximately 2% (n = 57), 4% (n = 28), and 20% (n = 24) of greater scaup, common eider, and oldsquaw, respectively, samples contained evidence of lead exposure. Only one emperor goose sample contained trace amounts of lead. See section D.5 for further discussion on this BRD lead exposure study.

National Fish Health Survey - The Kisaralik River

The recent outbreak of whirling disease in the lower 48 states has decimated several non indigenous rainbow trout populations and is believed to have impacted some native species of cutthroat trout, salmon, and steelhead. Ecological and economic consequences have resulted from the infestation, and has focused scientists' attention on the fact that very little is known about diseases among wild fishes. Susceptibility of Alaska's fishes to diseases such as whirling disease is unknown at this time, but because valuable fish stocks might be at risk, additional information is needed to prevent or control future possible outbreaks.

As part of the National Fish Health Survey the Service, the ADF&G, the National Park Service, and the U.S. Geological Survey collected fish pathology samples from numerous river systems throughout the region to determine the distribution of pathogens in rainbow trout and selected other species. The collection was part of a national effort to provide fishery managers with baseline information to preserve and protect wild native fish stocks. Information collected will be included in a national fish health database to monitor the health of our nation's fisheries resources.

During August 8-12 and October 10-14, 72 rainbow trout between 78 and 598 millimeters long were collected and sampled. Most samples were sent to ADF&G's fish pathology laboratory in Anchorage to be evaluated for bacterial pathogens, viruses, and parasites. Whirling disease samples were sent to the Service's Olympia, Washington Fish Health Center. Results are due in the summer of 1999.

H. PUBLIC USE

1. General

More than 90% (estimated) of the refuge's public use involves subsistence activities (hunting, fishing, trapping, and berry picking). Other public use activities include sport hunting, mainly for moose, caribou, bear and muskox; fishing for salmon, rainbow trout, grayling, dolly varden, and other species; river floating; and wildlife viewing.

The refuge is isolated from common tourist travel routes in Alaska. Once people arrive in Bethel, they still must travel great distances to get to mountains, coast, or river systems other than the Kuskokwim River. Travel to scenic refuge areas is expensive and keeps the number of non-local visitors low.

The major public relations activity in 1998 continued to be the information and education efforts associated with the Y-K Delta Goose Management Plan and the four goose species of concern. The Refuge Information Technicians (RIT) conducted 39 school programs

during the year, discussing the Goose Management Plan with approximately 3,355 students. While in the villages, they presented programs to 600 community and council members.

The goose calendar contest also helped facilitate the educational effort. Of 1,670 entries for the 1999 calendar contest, over half (1,088) of the posters and literature entries were submitted from schools located on the refuge. Fifteen schools across the Y-K Delta participated in the contest and 12 students from these schools were recipients of prizes and awards. The prizes were supplied by the National Audubon Society -Alaska/Hawaii Region. Once again, Ducks Unlimited, Incorporated, contributed \$40,000 towards the publication of the calendar. Approximately 7,000 calendars were distributed to school children and community members on the Y-K Delta.

Distance Delivery Consortium

The Distance Delivery Consortium (DDC) is a distinctive partnership formed in 1990, to promote effective distance-delivered education and telecommunications in rural Alaska. The Bethel-based DDC is composed of several public, private, medical, and educational institutions within the Y-K Delta. The refuge continues to utilize the DDC to communicate with the local community, as well as with staff and students in 33 school sites across the Delta.

2. Outdoor Classrooms--Students

The Western Alaska Natural Science Camp held one seven-day session from June 22-29, hosting 17 students (ages 13-16) from across the Y-K Delta. It was again held at Nyac, a gold mining camp in the Kilbuck Mountains. Students learned about plants, birds, fish and their habitats. They also compared and contrasted traditional Alaska Native natural resource knowledge with western scientific approaches to resource management. Yup'ik elders and traditional leaders from the Y-K Delta attended the camp and provided information on traditional Eskimo culture, values, and knowledge. RIT's Abe Andrew and Alex Nick provided bear protection for the camp and campers. NCR Hunt provided bear safety training for staff and students. ORP Beck was one of the teaching assistants during camp.

The camp was made possible through the Challenge Cost Share program. Matching grants and in-kind contributions were provided by our partners --the Association of Village Council Presidents, Alaska Department of Fish and Game, National Audubon Society, Calista Corporation, and the Lower Kuskokwim School District.

In conjunction with the East Fork Andreafsky River weir, a science camp for juniors and seniors of the Andreafsky High school in St. Marys was held during the last two weeks of August; eight students and two adults participated. Unfortunately during the first week,

heavy rains resulted in the weir being inoperable. Water levels rose above the counting chutes and visibility was extremely poor. However, by the second week the water had receded and the students were able to observe and partake in most of the daily operations. The students participated in water chemistry analyses, fish seining, population estimate techniques, and Japanese gotaku fish printing on teeshirts.



Students of Andreafsky High School collecting fish with a beach seine.
(DJC 8/98)



Students conducting water chemistry analyses near the Andreafsky River Weir.
(DJC 8/98)

3. Outdoor Classrooms--Teachers

Teachers have been directly and indirectly involved with the refuge's many information programs. Much of the interest centers around the annual goose calendar contest; "Teach About Geese" and "Wetlands and Wildlife" curricula and activities; and our resource learning library, featuring videos and books available for loan.

We conducted four teacher workshops during the year for 40 teachers. The focus was on the educational materials and resource support that we can provide to teachers and students, as well as an introduction to the various curricula created by the Service, such as Arctic Nesting Shorebirds and Life of Seabirds. In conjunction with the Shorebird and Seabird teacher workshops, we presented 40 programs to 700 students in three coastal villages where shorebirds and seabirds are abundant.

6. Interpretive Exhibits/Demonstrations

The refuge visitor center is known as a location in Bethel for learning about big game, birds, and wildlife habitat, as well as Yup'ik culture. During 1998, twenty programs were presented in the visitor center to 250 students, teachers, and community members. Videos and activities from the "Teach About Geese" and "Alaska Wildlife Week" curricula were often used during these presentations.

7. Other Interpretive Programs

Bird Walks/Slide Shows

BT Harwood conducted three bird slide shows during the first three months of the year, attracting 65 community members. His five bird walks (April 25, May 2, 8, 9, and 22) attracted 40 participants. During the International Migratory Bird Day walk, the five watchers spied 37 species.



A Bethel resident provided a good site for BT Harwood and his group to observe 350+ waterfowl at Hoffman Lake. (MH 5/98)

National Wildlife Refuge Week

Events to celebrate the 4th annual National Wildlife Refuge Week were held October 17 and October 30. We hosted a Family Fun Run on Saturday, October 17. Fifteen runners, walkers, and bikers participated. Refreshments were provided with Alaska Natural History Association (ANHA) funds. On October 30, over 250 people attended our community Open House festival which was held at the Yup'ik Cultural Center. Highlights included a life-sized fish weir; a mock research field camp, complete with weatherport, tent, and Zodiac raft; plaster cast tracks of common mammals; geese art projects and coloring sheets; balloons and Blue Goose tattoos; refreshments; a lead/steel shot exchange program; displays on the Protocol Amendment, spectacled eiders, oldsquaw, rainbow trout, subsistence harvest survey data, emperor goose population data; and an introduction to aircraft safety and the role of refuge plane and pilots in management activities. Inclement weather prevented the arrival of two live rehabilitated birds and their handlers from the Bird Treatment and Learning Center, in Anchorage.

8. Hunting

Big game guides reported taking the following animals as part of their operations on the refuge in 1998.

	Clients	Days Hunted	Species Taken
Ed Shavings Sr., Nunivak Island Guide Service	11	15	11 mskx
Fred Don Sr., Nunivak Outfitters (did not hunt)	0	0	0
Bob Adams, Adams Guide Service (did not hunt)	0	0	0
Eruk Williamson, Eruk's Wilderness Floats (did not hunt)	0	0	0

The transporters permitted to operate on the refuge reported the following animals taken as part of their operations.

Abe David, Nunivak Island Experiences	12	20	9 mskx
Charlie Spud, Spud's Transporting and Tendering	5	6	5 mskx
Steve Williams, Ptarmigan Air (no activity)	0	0	0

One emergency order affecting hunting seasons was carried over from 1997. An order opened the caribou season south of the Yukon River on August 25, 1997 and closed it on March 31. Caribou were still in the unit and being harvested until the closure took effect. Sixty-nine hunters reported hunting caribou during this period based on ADF&G harvest tag information. Fifty-nine successful hunters reported taking 82 bulls and 33 cows for a total harvest of 115. It is known that this harvest figure is a severe under-reporting of the actual harvest.

Two emergency orders to open or amend existing regulations were issued concurrently by the Alaska Department of Fish and Game and the Federal Subsistence Board. Because of the poor commercial salmon harvest on the Yukon River, the residents of the lower river requested that the moose season be opened five days early - beginning September 1 instead of the 5th as published. Both boards approved this request with the stipulation that the season would also close five days earlier than published. It was felt that the moose population could not sustain the additional harvest of an extended season but flexibility in the season dates could be accommodated. As the season was about to close, calls were received requesting an extension but no extension was given.

The second emergency order affected the caribou season south of the Yukon River. The influx of the Mulchatna caribou herd into Game Management Unit 18 took place in late August and early September. As a result, the emergency opening became effective September 5 and was scheduled to run through March 31, 1999.

Moose Check Stations

The refuge continued to cooperate with the local ADF&G biologist in running moose check stations on both the Yukon and Kuskokwim rivers. As in previous years, the refuge provided logistical and personnel support. In 1998, one RIT was placed at each check station to assist ADF&G. The check stations were instituted by ADF&G with

assistance from the refuge to improve both harvest reporting and to obtain better information on the locations moose were being harvested. Specifically, the Yukon River check station is used largely to determine the number of moose harvested up-river of the refuge, by residents from the refuge. The Kuskokwim River check station is used largely to determine the number of moose harvested from the upper portions of the refuge and up the Kuskokwim River by those residents down-river from Aniak.

This was the thirteenth year the Yukon River check station has been operated and only the third year the Kuskokwim River check station has been operated. As in 1997, the Yukon River station checked more moose while the Kuskokwim River station (Table H.1), however the recorded harvest and the number of hunters checking through the Yukon River station was well below normal. This lower hunter effort could have been a result of several things. The commercial salmon harvest on the lower Yukon River was the lowest on record and there may not have been money around to travel the long distance to hunt moose. Several major public works projects were underway in the lower Yukon villages and many people were unable to leave jobs during the moose hunting season. Lastly, the moose survey recently conducted in the area below the check station showed a doubling of the moose population since 1992. At least some of the hunters that normally travel further upriver probably were successful before reaching the check station.

This year the Kuskokwim check station was moved from its former location on the river below the village of Kalskag to the village of Aniak. It was thought that more hunters would be contacted when they stopped to purchase gas at Aniak. In past years it was assumed that no more than 30% of hunters stopped at the check station. Moving the station to Aniak however, proved to be of little benefit as only 73 hunters stopped to register 39 animals. One reason for this low reporting could have been a competition for the fuel business as the village of Crooked Creek upriver from Aniak began selling fuel this year also. This allowed many hunters to travel all the way back to Bethel without stopping for gas (or to report moose harvest) in Aniak. Consideration will be given to the location next year and whether the data collected is of enough benefit to the refuge to continue to support the station.

Table H1. Moose check station summary, 1998.

	<u>Yukon River</u>	<u>Kuskokwim River</u>
Dates Open	September 2-25	September 5-25
Boats	86	Not Recorded
Hunters	244	73
Moose	67	39
Other Species	3 Black Bear	13 Caribou

A refuge muskox season is held yearly on Nunivak and Nelson Islands. The Nunivak Island drawing hunt for one bull and registration hunt for one cow took place from February 1 through March 15 and September 1 through September 30. Twenty five permits for cows and 21 for bulls were issued for the late winter hunt. Five permits for cows and nine for bulls were issued for the fall hunt. Fifty nine of the sixty possible animals were harvested. A single cow permit was not filled during the fall hunt when the hunter did not participate.

The Nelson Island herd has only a winter hunt. Ten bull and 10 cow permits were issued and all were filled during the season which ran from February 1 through March 25.

Two registered big game guides - Ed Shavings and Fred Don - have traditionally taken out hunters in need of those services. However, in the past several years the two transporters working on the island - Abe David and Charlie Spud - have taken a significant amount of business from the guides. Most hunts last only a day or two and the major component of the guiding or transporting service is to simply get the client to the animals. Consequently, although the definition and regulations related to the two services differ, in effect, there is a small amount of difference in the actual operations of the two services on Nunivak Island. The transporters of course charge considerably less for their services.

It is thought that the illegal harvest of muskox on Nunivak Island is minimal. The illegal harvest on Nelson Island is not known.

The reported harvest of caribou is unreliable at best. Harvest tags are required for all caribou hunts in the unit but it is assumed that many are not returned to ADF&G. Although caribou from what is most likely the Western Arctic Caribou Herd occasionally enter the refuge through the Nulato Hills in the north, only a small number are available for harvest.

Regulation Proposals

No proposals were submitted during the year for specific GMU 18 regulation changes and no previous changes took effect during the year.

9. Fishing

With an estimated 500,000 lakes and ponds, and the two largest river systems in the state running through the refuge, sport and subsistence fishing are very important activities for many of the region's residents. Though only a small number of non-local residents travel to the refuge for sport fishing, this contingent is expected to increase along the higher quality fishing waters of the Kwethluk, Kasigluk, and Kisaralik Rivers. During the

winter months, ice fishing, both for sport and subsistence, takes place on many of the lakes and rivers in the region. Rainbow trout, dolly varden, grayling, pike, and all five species of salmon are sought by sport fishers. Burbot, whitefish, Alaska blackfish, herring, sheefish, and threespine and ninespine stickleback are all harvested at various levels for subsistence.

For the third year running, the refuge placed volunteers at Kisaralik Lake to monitor the number of floaters departing from the lake - the main access point for the Kisaralik River. Although we expected to see steady increases yearly, the last three year's data show little or no increase as detailed in Table H.4. The camp was operational from late June through early September and was staffed by individuals employed by the Minnesota DNR and a retired National Park Service employee.

Table H2. Individuals and Groups Rafting the Kisaralik River.

	<u>1996</u>	<u>1997</u>	<u>1998</u>
Number of Individuals	148	150	127
Number of Groups	34	33	28

In 1997 a management plan for the Kisaralik River was finalized. It contained a decision that no commercial guiding permits would be issued for the river. Although it is likely there are some commercially guided trips occurring, we have limited authority due to the navigable status of the river and have done little law enforcement.

For the first year to our knowledge, use by floaters of the Kwethluk River began to increase. Although we have no accurate counts, we are aware of at least 16 people in five groups that floated the river. One group of anglers traveled up the Andreafsky by boat for sport fishing. Boats were chartered in the village of St. Mary's for the trip. Sport/subsistence fishing is done by residents of Bethel on the Kwethluk, Kisaralik, and Kasigluk Rivers for salmon and rainbow trout, but we are not aware of significant additional sport fishing done on the refuge.

Refuge staff were again involved in issues dealing with whitefish netting near the village of Kasigluk - an issue which has carried over from 1997 and doesn't appear likely to be resolved soon. Again this year the refuge received complaints of overfishing near the outlet of Nunavakpak Lake. The area was flown at least two times to collect information which was provided to the Alaska Fish and Wildlife Protection officers. Although some of the nets were placed contrary to state law by being too close together, we did not document the same degree of problem as in 1997. The FWP officers were notified of the problem but no action was taken. The issue was originally brought to light by elders in the communities who were concerned about a possible depletion of the whitefish population.

Regulation Proposals

This was the first year that new sport fishing regulations took effect for the Kwethluk and Kisaralik Rivers. The regulations require that only unbaited, single-hook artificial lures be used year round. In addition, a special rainbow trout regulation requires that for most of the Kwethluk River, the bag and possession limit is one fish 14 inches or less in length. Most of the Kisaralik River was declared catch-and-release-only water and rainbow trout cannot be possessed or retained on this river.

Subsistence Fishing

The population of the Yukon-Kuskokwim Delta is among the largest of any similar native/aboriginal occupied region in Alaska. Throughout much of the refuge, subsistence use of salmon is of great importance. Fish play an important part in the subsistence cash economy and account for 30-60 percent or more of the yearly food supply in most Yukon-Kuskokwim Delta villages. Approximately 1,300 families participate in the annual harvest of salmon in the Kuskokwim drainage alone. Chum, chinook, and coho salmon are the most heavily exploited salmonids, while several whitefish species, northern pike, sheefish, Alaska blackfish, burbot and Pacific herring are also harvested. As evidenced by the following discussion, most of the available subsistence information pertains to salmon; with very little known about the other species. Over the years, questions have arisen about the population status of whitefish and northern pike for several areas within the refuge.

In 1997 on the lower Yukon River, 64,535 summer chum salmon were harvested compared to the previous five year average of 69,041; 8,599 fall chum were harvested compared to the previous five year average of 11,799; 23,211 chinook salmon were harvested compared to the previous five year average of 21,242; and 5,013 coho were harvested compared to the five year average of 7,409. Results from the 1998 subsistence harvest will not be completed until the spring of 1999, but restrictions on subsistence fishing were imposed throughout much of the drainage in an attempt to attain escapement goals.

During 1993 the Kuskokwim River chum salmon run was well below average so the subsistence fishery was closed for the first time for a portion of the season. The closure was enacted to allow for more escapement into tributaries, and since that time the runs have increased enough to allow for subsistence and commercial harvest. However, commercial use was again curtailed in 1997 and 1998 to accommodate subsistence needs. Subsistence harvest in the entire Kuskokwim River drainage for chinook salmon alone generally ranges between 85,000 and 90,000 fish. In 1997, the lower portion of the Kuskokwim River yielded 65,533 chinook salmon; 31,888 chum salmon; 30,466 sockeye salmon; and 21,578 coho salmon for subsistence use. Results from the 1998 subsistence

harvest will not be completed until the spring of 1999. Unlike the Yukon River, there were no subsistence harvest restrictions imposed in the Kuskokwim River drainage.

Commercial Fishing

The commercial harvest of salmon from within the refuge on the Kuskokwim and Yukon rivers is of economic and nutritional importance to local residents of the Y-K Delta. Commercial fisheries within the refuge are concentrated in the mainstem rivers, and along the western coastline and Nunivak Island. The commercial harvest of salmon in the Kuskokwim River began in the early 1900's and has grown dramatically from 1960 to the present. The local commercial fishery in the Kuskokwim River is directed primarily at chum and coho salmon. Commercial salmon fishing began in the Alaska portion of the Yukon River about 1918, and presently occurs along the entire 1,200 mile length for chum and chinook salmon. The majority of effort (75 percent) occurs from Anvik downstream to its mouth. All of the salmon fisheries are comprised of mixed stocks, which complicates management.

During 1998, the chum salmon returns were below normal and fishing periods were reduced severely in the Kuskokwim River. A total of 615 permit holders participated in Districts W-1 and W-2, the lower Kuskokwim River fishery. These commercial fishermen were paid only \$983,642, or an average of \$1,599 per permit. Effort on the entire Kuskokwim River was the lowest on record since 1976, with only 702 permit holders participating when there are normally over 800. In the lower Yukon River, 643 permit holders participated in the fishery and received \$1.9 million for their catch, or an average of \$ 3,014 per fishing permit. These amounts were down from the 1988-1996 averages of \$3.9 million on the Kuskokwim and the five year average (1991-1995) of \$6.9 million on the Lower Yukon River. Because incomes are low and other types of employment are scarce, the importance of sustaining adequate harvest levels becomes very clear.

Although the coho salmon harvest was the second lowest for the Kuskokwim River since 1983, they were still the most important species bringing fishers 52 percent of the total value of the entire commercial catch. Sockeye salmon was the next valuable species providing 21 percent of the earnings, followed by chum, chinook, and pink salmon. From an economic standpoint, coho salmon significance in the Kuskokwim River has steadily grown in recent years and harvest levels have averaged more than 500,000 over the past ten years. Although the significance continues to grow, knowledge of timely escapement data from refuge rivers has not kept pace. In fact, comprehensive information on the status of individual coho stocks returning to refuge rivers is nonexistent. Improved harvest efficiency of the commercial fleet in a mixed stock fishery may place refuge stocks in jeopardy of being over-fished during years of low returns.

Commercial fishing for whitefish is limited, but could expand in the future. Because there is little known about this fishery, and since subsistence use is quite extensive, more biological data is needed to properly manage this species. Pacific herring are harvested in three commercial districts along the refuge coast, Cape Avinof, Nelson and Nunivak islands.

Sportfishing

Sportfishing pressure on the refuge is currently low, but tributaries feeding the Kuskokwim and Yukon rivers provide anglers with an excellent variety of trophy fish. Some of these rivers are just now being discovered by people from outside the region. Salmon, rainbow trout, dolly varden, Arctic grayling, northern pike, whitefish and sheefish make up the list of fish accessible to anglers on many of the refuge tributaries. Favored rivers for sportfishing include the Aniak, Kwethluk, Kasigluk, Kisaralik and Andreafsky. People from the village of Akiak were the first in the lower Kuskokwim River to enter into the sportfish guiding business. For some time, anglers and floaters have been accessing the Kisaralik River from Dillingham and Anchorage via float planes. The current river management plan does not allow for guided use on the Kisaralik River, but anglers (and outfitters) will continually search out new uncrowded waters. Because of an ever increasing demand, air taxi operators in the Bethel area have added a De Haviland Beaver with floats to carry anglers to the remote lakes and rivers on the refuge. Data collected for the Kisaralik River the past three years has shown an increasing amount of recreational use. The need for such information exists, and should be considered in concert with commercial and subsistence fisheries uses to ensure that fish stocks are maintained.

10. Trapping

Furbearer trapping continues to be a supplemental source of income for many local residents although depressed fur prices for a number of years have greatly reduced the number of villagers that derive significant income from the activity. Trappers focus their efforts on beaver, otter, mink, fox, and muskrat. Other less abundant species such as wolf, wolverine, marten, and lynx are also sought. Trappers of beaver, otter, wolf, wolverine, and lynx have mandatory sealing requirements under State regulation. Trapping success during the past five years is well below historical average harvest, mostly due to low fur prices paid for raw pelts.

Only five species of furbearer are required to be sealed by the State of Alaska. Many of the furbearers, and especially beaver and land otter, are crafted into hats, mittens, etc. and used or sold in the local area. It is known that many of these are not made available to the Department for sealing.

Regulations Proposals

One regulations proposal related to furbearers was submitted during the year. Late in the year, an individual from Emmonak submitted a proposal for consideration by both the Federal Subsistence Board and the Alaska Board of Game. It addressed the rapid increase in beaver in the area, and the concern that they were stopping the passage of fish in the small waterways. The proposal addressed both hunting and trapping of beaver and was worded as follows in the proposal to the Federal Subsistence Board:

Hunting; 50 beaver; July 1 - June 30; Beaver may be taken with a firearm at any time. Only beaver hides sold or commercially tanned must first be sealed by an authorized representative of ADF&G

Trapping; No limit; July 1 - June 30; Beaver may be taken with a firearm at any time. Beaver may not be taken with snares or traps from June 11 - October 31. Only beaver hides sold or commercially tanned must first be sealed by an authorized representative of ADF&G.

Action on this federal proposal is scheduled for the May, 1999 meeting of the Federal Subsistence Board.

12. Other Wildlife Oriented Recreation

Other recreational activities, such as backpacking, boating, camping, hiking, birding, photography, and river floating occur to a small extent on the refuge. Power boating and camping are generally associated with subsistence hunting and fishing. Since the refuge is so remote and costly to access, this use is low in comparison to that of many other refuges. Activities associated with rafting include camping, fishing, hiking, wildlife observation, and photography.

15. Off-road Vehicling

Transportation on the refuge is limited to aircraft, boats, and snowmachines. Snowmobiles are used heavily, both for recreational and subsistence uses. Three-and four-wheeler use is common in and around villages, but is not permitted on refuge lands. This is not to say that they are not used on the refuge. We are aware of at least several instances where ORVs have been or are beginning to be a problem.

Snowmachine use in the spring, after much of the snow has melted, has caused disturbance of the surface vegetation mat on many established trails. The regulations state, in essence, that snowmachines are allowed as long as there is adequate snow cover to prevent resource damage. Snowmachine travel is a way of life in villages throughout Alaska where they provide necessary transportation between villages or for winter and spring hunting. When spring arrives it is not uncommon to have snowmachines traveling

on trails or overland when there is less than fifty percent snow cover. With some 20,000 village residents living in villages surrounded by over 20,000,000 acres of refuge land, the regulation is difficult at best to enforce. Our practice has been to focus enforcement on the gross misuses of the machines.

16. Other Non-wildlife Oriented Recreation

Sled dog racing remains a popular winter sport. The most popular race in the area is the "Kuskokwim 300" which occurs in January each year. The race route originates from Bethel, follows the Kuskokwim River to Aniak, then goes overland to Whitefish Lake and Tuluksak before rejoining the Kuskokwim River on its way back to Bethel. Though most of the race occurs on Native Corporation lands, it does cross refuge lands for a short distance along the trail's northern portion. A permit was issued during the year to the non-profit corporation that sponsors and directs the race.

17. Law Enforcement

This was the first year that enforcement of non-toxic shot for waterfowl hunting took place on the Y-K Delta. Although the use of lead shot was legally banned in 1991, enforcement was delayed until an adequate information and education effort had been conducted and steel shot shooting workshops had been held in most villages.

Only one special agent worked the spring waterfowl season on the refuge. Refuge pilots provided flying support for two other agents that worked the Chavgan Bay area on the Togiak Refuge. Five citations were issued to village people for non-toxic shot violations in popular hunting areas near Napaskiak and Napakiak. Four of the five hunters paid their fines of \$100 with a bit of coaxing but otherwise without incident. For the last hunter, numerous calls were required along with the notification that he would be arrested if the fine was not paid. The fine was finally paid in early 1999. The agent also spent several days in the village of Toksook Bay conducting enforcement and lead/steel shot exchanges and school programs.

Several winter flights were made along the Yukon River to patrol for out-of-season moose hunters. No violations were noted. A special agent from Fairbanks worked with the Alaska Fish and Wildlife Protection officer for several days in January but weather kept him on the ground for the better part of a week. One illegal moose kill was found and the FWP officer finally made a case on it late in the summer.

Refuge Officer Dave Cox attended FLETC from January through March to obtain his initial officer training. He is scheduled for the two week Refuge Officer Basic School in 1999. With the retirement of Denny Strom in September, the station was left with two officers. The Special Agent position held by Mike Wade which had been stationed in

Bethel, was transferred to Nome early in the year. At this time there are no plans to replace the position in Bethel.

Several patrols were made by RO's Liedberg and Cox during the fall moose hunting season. One patrol on the Gweek River led to an investigation and confiscation of a female moose calf by two people from a nearby village. They had shot two calves but were lucky enough to have one of them be a bull (the cow was shot the previous week). The case was turned over to the FWP officer in Bethel. The two individuals appeared in court in late October and pled no-contest to charges of taking a cow moose. They were each sentenced to a \$1,000 fine, 10 days in jail, and two years of probation. Five hundred dollars of the fine and the 10 days in jail were suspended.

In August, RO Liedberg assisted the FWP officer on an investigation in the village of Pilot Station. Cases were made against seven individuals for illegal harvest of two moose and a grizzly bear. Parts of the moose, the bear claws and gall bladder, and a rifle were confiscated.



Refuge Officer Cox beginning an investigation of the remains of two moose calves that were taken in the Gweek River area. The party went to extra effort to cover the kills, hide the meat, and dispose of spent cartridges under water, but to no avail. (PAL 9/98)

18. Cooperating Associations

The refuge operates a small sales outlet for the Alaska Natural History Association (ANHA). For FY98, sales decreased 15% from FY97. The ANHA educational materials were displayed and sold at several cultural and craft shows during the year --National Wildlife Refuge Week celebration, Bethel Council on the Arts Craft Show, and the spring Camai Dance Festival. Almost 30% of our annual sales originated from these four special festivals. Approximately 20% of our total sales came from the sale of topographic maps. We're quickly becoming known as the only local place to purchase topographic maps.

ANHA co-sponsored the Family Fun Run (October 17) and the National Wildlife Refuge Week Community Open House (October 30). Over \$100 worth of ANHA materials were sold at the Open House which was attended by 250 community members.

By the end of August, we had recruited four volunteers to work in the visitor center and run the bookstore on Saturdays. The volunteers are being trained and will be a valuable asset to our outreach program.

I. EQUIPMENT AND FACILITIES

1. New Construction

Paimiut Slough, located 35 miles downriver from Holy Cross on the Yukon River, was selected as the construction site for a new 15' x 17' Panabode cabin. Constructed by Refuge maintenance staff, volunteers and engineering staff from the Regional Office, this cabin will be used as a hunter check station, as a base to conduct law enforcement patrols, and for conducting biological surveys. The cabin was a joint effort by USFWS and ADF&G and dedicated to Randy Kacyon, an ADF&G biologist who was killed in an aircraft accident in November 1996.



This Panabode cabin was constructed on Paimiut Slough with force account labor in cooperation with the Alaska Department of Fish and Game. (PAL 9/98)

A 100' x 35' sand pad was constructed to be used as a storage/parking area adjacent to the headquarters bldg.

2. Rehabilitation

Three residential units were re-sided with vinyl siding. These houses were originally sided with wood siding which was deteriorating from the effects of the severe climate. Vinyl provides a good weather barrier, looks good, and preliminary indications are that it will lower heating costs.

The aircraft hangar glycol heating pipes were insulated which significantly reduced heating costs and kept the building much warmer.

An insulated floor, overhead door, and two 140,000 BTU oil fired furnaces were installed in the warehouse. These improvements provide for a warm storage and work area and make preparing for field season much more efficient.



Q's 1, 4, and 7 received vinyl siding late in the summer. It is hoped that this material will provide a suitable alternative to wood which is a high maintenance item in this environment. (PAL 10/98)

3. Major Maintenance

Most of the headquarters office spaces received a fresh coat of paint. The exterior of Kanagyak field station buildings were sprayed with an oil based preservative to lessen the harmful effects of wind, sun, and moisture.

4. Equipment Utilization and Replacement

Two new 4 x 4 crew cab pick up trucks were purchased to replace part of the aging fleet of vehicles. A Boss V snow plow was purchased to facilitate timely and quality snow removal of the headquarters building, hangar, and residential units. An 18' Alweld boat with a 50 h.p. Honda motor and a 22' Alweld with a 90 h.p. Honda motor were purchased to use on the river system. Two 1998 Ski-doo 500 Scandic snowmobiles were purchased for law enforcement patrols, and to enable Refuge Information Technicians to travel to neighboring villages.

A 25 ft. Genie manlift was purchased to access the overhead spaces of the hangar and headquarters building.

J. OTHER ITEMS

2. Other Economic Uses

A permit was issued to the Alaska Department of Transportation to conduct test drilling on refuge lands near Chefnak for the purpose of assessing if suitable materials were available for construction of a new runway. Specifically, they were looking for volcanic material near Tern Mountain that could be used to top the runway. The work took place in February using a small crawler tractor and a drill rig which operated on compressed air. Suitable material was not found which spared us the decision of whether or not to make it available.

Although the option of providing refuge material for a project such a runway or a water and sewer project would be an easy decision for most refuges, that is not always the case here. When funding for basic sanitation and other public works projects is extremely tight, and the alternative is to barge thousands of tons of material from hundreds of miles away, the decision takes on a new element. We have provided material for these projects in the past and will continue to make decisions on a case by case basis.



Although this photo is slightly off the refuge near the village of Chefnak, it shows test drilling being done by a State of Alaska crew as preliminary work for construction of a new airport. The village and the existing runway can be seen in the background. (PAL 2/98)

A fair amount of correspondence exchanged hands between the refuge and the Alaska Department of Transportation (DOT) over trail markers being placed to identify winter snowmachine trails. The DOT have been issued several permits over the years for marking trails that cross a small portion of refuge lands. The markers consist of a piece of rebar driven into the ground and a plastic tube with reflectorized material attached to the rebar with hose clamps. After receiving reports of missing markers and seeing markers either leaning or fallen over, we began to question how wise it was to potentially leave a foot high piece of rebar sticking above the ground with no reflective marker on a major snowmachine trail. In negotiations with the State, they agreed that tripods would be used for any additional marking. Whether coincidence or not, no more marking projects are planned between villages on the refuge in the near future.



Markers consisting of a piece of rebar with plastic reflectorized pipe attached have been used to mark snowmachine trails between villages on the Delta. Environmental conditions have taken their toll and these markers will no longer be used. (PAL 2/98)

4. Credits

The biological staff of SWB Morgart, WB's Wege, McCaffery, and Kovach, FB Cannon and BT Harwood teamed up to write sections D.5, F.1-3, 6 and 7, G1-11 and 14-17. ORP Beck wrote sections H.1-3, 6, 7, 11, 12, 15, 16 and 18. NCR Hunt wrote the Safety section - E.6. ROS Cox wrote the maintenance sections I.2-4. RM Rearden provided the Feedback. ROS Liedberg wrote sections C.2 and 3, D.1-4, and 5, H.15, J.1, 3, and 4, and compiled, edited, and finalized the report.

K. FEEDBACK

"The last great frontier", and "our last great wilderness" are just two of the names frequently associated with Alaska. The refuges in Alaska certainly live up to those names. Truly, there are places in this refuge, and others in Alaska, where you can stand in complete silence without sight of the trappings of civilization. But that is changing.....

We spend a lot of time, and rightly so, discussing compatibility with refuge resources. We're looking at the big ticket items, like deciding if we will allow commercial operators to run pack trains through a wilderness area, or allow commercial guides to operate on refuge lands and waters. Those are decisions that need to be made very carefully, with an eye to the future. But the activities that are much more insidious are the ones that are slowly eating away at and degrading our refuge resources and wilderness values.

The outer boundary of this refuge encompasses nearly 27 million acres--of which over 6 million acres are private in holdings. The total population is only a bit over 20,000 people settled in 43 villages. That is a lots of land for a few people--but it is estimated that this is also one of the fastest growing populations in America. The natural resource base traditionally was what supported the people living in this region. There were many very small communities scattered about the delta region, and people accessed the fish, birds and other wildlife on foot or small dog teams. Even then, there were very difficult times and even death by starvation.

Today, these 42 villages are expanding in population and in acreage and the natural resources can scarcely keep up. Everybody owns a snowmachine and/or an off-road vehicle. The areas around many of these villages is sometimes aptly described as a "biological vacuum". The scarification of the tundra from travel by ever-improving snowmachines and other vehicles without adequate snow cover is increasing at an alarming rate. People need to go further now to obtain resources and they are leaving private lands and in some cases causing damage to refuge habitat. There is a trail on the tundra west of Bethel that was made by an oil exploration crew driving several small

dozers in the winter nearly 40 years ago. The trail looks today as if it could have been made very recently. The tundra is extremely fragile, and heals very slowly.

With declining access to resources and a burgeoning human population there is greater need for store bought items--that means increased airplane traffic to the village runways. Increased airplane traffic means more development and enlargement of village runways--and a cumulative loss of valuable habitat. Twenty years ago, it was common that a village would receive only a couple of flights a week. Nowadays, villages typically have 10-15 flights per day! The effects of continuous overflights on wildlife has not been evaluated, but is probably significant.

Treatment of human waste is very difficult in villages that are situated on permafrost, so it is frequently "stored" in large settling ponds that are frequently inundated by groundwater, or rising flood waters. That is, if there has been a sanitation project in the village recently. Many villages have no running water and rely on "honey buckets" for human waste. Much of the human waste is inappropriately disposed of causing serious health problems for human inhabitants, and unknown effects on the lands and wildlife downstream...

Garbage dumps, most often a natural depression or lake near the village, are overflowing and are often inundated by groundwater.

These are the things that are going to sneak up on us and degrade the habitat and water quality of our refuges. These are the things that will have long lasting effects on even the largest wildlife refuges in our system--come to think of it, these are some of the same things that caused the destruction of habitats on refuges in the "lower 48".

The problem is very large, slow growing, and hard to visualize, but at our current rate of expansion and degradation, my vision of the what the delta will look like 50 years from now, is not pretty.

The answer? As usual, is education, enforcement, and prevention. We are close neighbors with these villages, and truly, the future integrity of this refuge and many others in Alaska, is tied directly to the future of the inhabitants. Educating people about the long term effects of soil erosion, compaction, and habitat degradation will help address the access issues. Encouragement and cooperation with other agencies to employ clean water and sewage disposal systems in villages will help ensure that we maintain clean waters and healthy environments. Aiding villages in development of land use plans will encourage a long-term view toward maintaining important wildlife and human habitat.

These efforts will go further toward maintaining the viability of our refuges than anything else we do. They are not conventional pursuits for a typical refuge perhaps, but these refuges are far from typical.