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YUKON DELTA NATIONAL WILDLIFE REFUGE
BETHEL, ALASKA

ANNUAL NARRATIVE REPORT
CALENDAR YEAR 2002

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
NATIONAL WILDLIFE REFUGE SYSTEM

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Reviews and Approvals

YUKON DELTA NATIONAL WILDLIFE REFUGE

Bethel, Alaska

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Calendar Year 2002

MSB Read 6/20/03 _____
Refuge Manager Date Refuge Supervisor - South Review Date

Regional Chief - NWRS Approval Date

INTRODUCTION

The Yukon Delta National Wildlife Refuge (NWR), second largest of Alaska's 16 refuges, encompasses 19,166,094 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 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 40,000 loons, 40,000 grebes, 100,000 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 (the Alaska Lands Act). With enactment of the Alaska Lands Act, 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 the Alaska Lands Act: the Andreafsky Wilderness Area (1,300,000 acres) and the Nunivak Wilderness Area (600,000 acres).





The headquarters for the refuge is located in Bethel, a community of approximately 6,000 people on the Kuskokwim River. The community, which is off the road system 400 miles west of Anchorage, is the transportation, health care, and governmental hub for the region. Thirty-five villages ranging in size from 40 to 1,100 residents are located within or immediately adjacent to the boundary of the refuge.



The Kwethluk River typifies a refuge river flowing from the Kilbuck Mountains. The headwaters for the Kwethluk is in the Togiak Refuge which can be seen in the extreme upper portion of this photo. (RS 8/02)

Yukon Delta

National Wildlife Refuge

-  Private Lands
-  Refuge
-  Designated Wilderness
-  Refuge Headquarters
-  Refuge Boundary

Land status represents USFWS interpretation of BLM records.



INTRODUCTION

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K. FEEDBACK

A. HIGHLIGHTS

Senate Bill 2016 was introduced to effect the land exchange between the village of Newtok and the refuge. Although voted out of committee, action was never taken in the full Senate or introduced in the House, and the bill died with the 107th Congress. C.3

An estimated 20,000 caribou occupied portions of the refuge between the Kuskokwim River and Kilbuck Mountains until mid-May. These caribou, which have been similar in numbers since 1994, did not arrive in the fall and by the end of the year only 2,000 to 3,000 animals were present. Coincidentally, the regulations were changed this year to provide a set opening date of August 1 to hunt this herd. D.5

The fifth year of western sandpiper studies took place at the Kanaryarmiut Field Station. Nest density was the lowest recorded to date. Predation was high and overall, only 4% of clutches initiated resulted in fledged young. D.5

No less than five papers were published/presented during the year on shorebird studies on the refuge. WB McCaffery lead the effort or had a large role in all of these. McCaffery also authored the paper, "Refuge Biologists--the Other Refuge Resource," for the *Putting Wildlife First* symposium at the North American Ornithological Conference. D.5

Breeding ground aerial surveys showed decreases for all categories for all species: cackler, emperor and whitefront pair indices decreased 14%, 9%, and 18%, respectively. Cackler, emperor, and whitefront total bird indices decreased 33%, 28%, and 20%, respectively. D.5

New studies on the refuge included documentation of the survival and productivity of common eiders (University of Alaska - Fairbanks) and a study of the post-fledging survival and habitat use of emperor geese (University of Alaska - Fairbanks, USGS). D.5

ROS Kenton Moos, WB Jody Oyen, WB Michael Swaim, and RIT Evan Polty Sr. all filled permanent positions with the refuge during the year. E.1

The Kisaralik River overflowed its banks and cut a new channel to the Kasigluk River. Most of the water flowed through the new course throughout the summer and the lower 20 miles of the Kisaralik could be significantly changed permanently. F.1

Nuniwarmiut Reindeer and Seafood Products was again contracted to conduct the reindeer count on Nunivak Island. Four thousand three hundred eighteen reindeer were located which is 67 more than last year. In the 2001/2002 season, 888 reindeer were slaughtered from this herd. F.7

Three wildfires occurred on the refuge during the summer burning 20,804 acres. The largest of these was the 20,047 Aropuk Lake fire which began on June 18 and was declared out on July 21. F.9

Bar-tailed godwit migration was monitored at Tutakoke and Tern Mountain coastal field camps in August and September. Flagged godwits were found at both sites which included individuals originally banded in Australia, New Zealand, Japan and China. G.5

Moose surveys were completed on both the Yukon River and Kuskokwim River census units. Moose populations on the Yukon River continue to expand, especially on the lowest portion, while on the Kuskokwim the population remained virtually unchanged from the last census in 2000 with an estimate of 117 moose. G.8

The year was considered average to above average for subsistence fishers on the Kuskokwim River. For the second year, the subsistence fishery was reduced from seven to four days per week. This schedule was lifted on June 28 when adequate escapement was forecasted. Over half of the projects on the river reached escapement goals. G.11

Forty-two radio transmitters were implanted in rainbow trout on the Kwethluk River, adding to the 49 implanted in 2001. Very little movement took place by the fish tagged in 2001, contrary to what was expected. G.14

Several successful "Wildlife in the Classroom" workshops were held during the year for village school administrators and teachers. H.3

An active LE program took place again during the year. Extensive subsistence fisheries patrols were conducted on both the Kuskokwim and Yukon rivers. Two refuge officers were detailed up from the Lower-48 to provide assistance. NOV's totaling \$13,100 were issued for 2001 closed season waterfowl violations. Increased focus was placed on investigating the sale of raw walrus ivory. H.17

B. CLIMATIC CONDITIONS

Normal precipitation and above normal temperatures were recorded for the year. Early 2002 snowfall was above normal. In 2002 the Kuskokwim River in Bethel officially broke up on May 14. Leaf-out occurred May 22 and refuge aircraft were moved to Hangar Lake May 22-24. High water levels in May delayed installation of the Kwethluk River weir until late June. The summer proved to be one of the nicest in recent history with a lot of sunshine and somewhat low precipitation which contributed to lower water levels. Dry summer conditions also contributed to a 23,000 acre wildfire near Aropuk Lake. Airplanes were pulled off floats September 27th. The Kuskokwim River froze in October, but very mid temperatures opened the river again in November allowing for

travel by boat. Most precipitation late in the year was in the form of rain with very little snow accumulation.

The 2002 Annual Climatological Data for Bethel, Alaska is included for temperature and precipitation reference.

2002

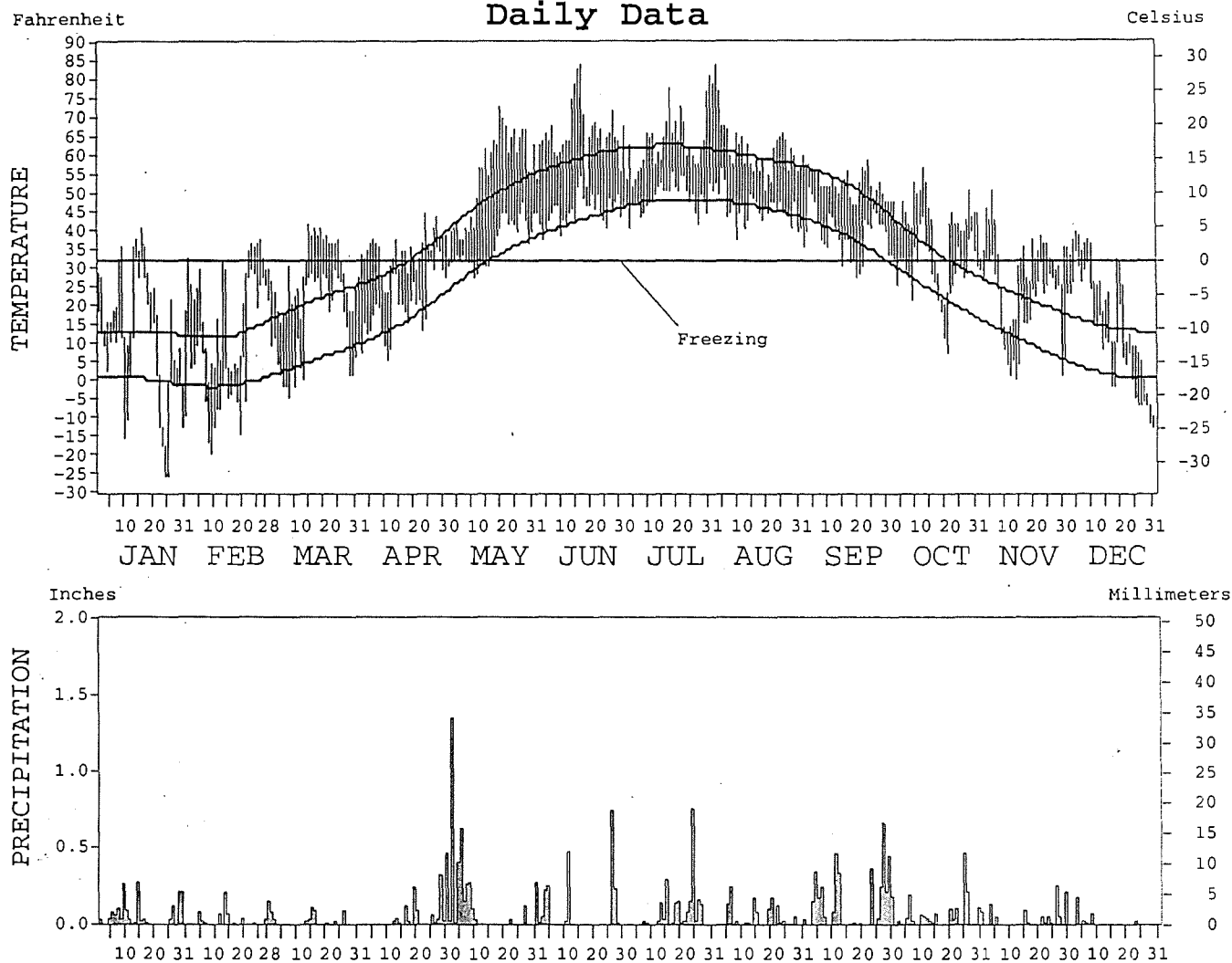
LOCAL CLIMATOLOGICAL DATA ANNUAL SUMMARY WITH COMPARATIVE DATA



ISSN 0197-9620

BETHEL,
ALASKA (BET)

Daily Data



C. LAND ACQUISITION

2. Easements

Last year we reported that a 17(b) easement was being rerouted near the village of Toksook Bay to allow for construction of a new airport. In the review and negotiation process, it was determined that the current location of this easement would not interfere with the airport and action underway to make this change was halted.

3. Other Items

For six years now, the refuge and village of Newtok have been negotiating a land exchange that would provide a new site for the village on the uplands of Nelson Island. This land exchange was proposed by the village in 1996 because erosion along the banks of the Ninglick River threatened to undermine parts of the village in the near future.

Significant action (though no progress) took place on this exchange during the year. In 2001 we learned that the village had decided to pursue a legislative solution to the impasse that had developed over a couple of elements of the exchange - mainly the acreage involved and the appraisal process. Legislation finally was introduced in 2002 in the form of Senate Bill 2016. This bill was preceded by much work from Senator Murkowski's staff (soon to be Governor Murkowski) to hear concerns from both parties and iron out differences as best possible toward a bill that would not draw significant opposition.

SB 2016, as introduced, would transfer approximately 11,600 acres to the village while the refuge would receive approximately 12,111 acres. Although this figure was smaller than what the refuge had been supporting throughout the process, it did incorporate prospective material sites for a new village and several sections of land that in previous negotiations had been left isolated between Newtok and other village corporation holdings.

In the end, the Senate Bill passed out of committee but no further. A companion bill was never introduced in the House and with the end of the 107th Congress, the process ended. Although it would seem that little resulted from the year's events, there was a lot of progress toward compromise that was reflected in the bill. Hopefully those gains can be carried into the future for a resolution to this exchange that has been drawn out for too many years already. No meetings were held with the Newtok Corporation representatives or their council during the year. The Corps of Engineers (COE) did a preliminary geotechnical overview of the site late in the summer and subsequently published a report. It was the understanding of all parties involved (except apparently the COE) that the COE would do soil tests during the year but this did not happen, much to the consternation of those at the Congressional level who worked hard to move this project forward.

The other exchange underway during the year involved the NIMA Village Corporation from Mekoryuk on Nunivak Island. NIMA is interested in acquiring additional surface as well as subsurface estate on Nunivak Island in exchange for holdings they have near Dall Lake some 50 miles from the island. Approximately 20,000 acres will be involved in the exchange. There are no known conflicting issues but little progress was made during the year. Partially this was the result of NIMA needing to identify the lands they want to acquire, but also the short staff in our Realty office probably contributed to delays.

The Alaska Native Veterans Allotment Act passed as part of ANCSA amendments in 1999. The application period ended on January 31, 2002. As of this writing we do not have information on the number of allotments filed for but believe it to be far fewer than the 250 that were projected. Many potential beneficiaries of this legislation were disenchanted with the fact that the parcels of land that they qualify for have been largely taken already by the village corporations and are not available for selection.

The process to review all ANCSA 17(b) federal easements across corporation lands began in 2000 but no work was done on the refuge this year. BLM, with significant involvement of the refuge will be responsible for the review, and recommendations to retain or abandon the easements. This will be a significant amount of work when we finally start the review.

D. PLANNING

3. Public Participation

Neither the Western Alaska Brown Bear Management Working Group (WABBMWG) nor the Kilbuck (Qavilnguut) Caribou Working Group met during the year. The WABBMWG largely was initiated to review and provide input on the brown bear collaring project taking place on the refuge. With more acceptance of the study and its near completion (in 2003 when collars are removed) the interest in the group has diminished. Similarly, the Kilbuck Caribou Working Group was initiated to provide input toward management and utilization of that herd. With the influx of Mulchatna caribou into the region each winter, the need for this working group has diminished.

5. Research and Investigations

Spectacled Eider Nesting Ecology Research on Kigigak Island

Field work at Kigigak Island continued for the twelfth consecutive year as recommended by the Spectacled Eider Recovery Team. Spectacled eiders were listed as threatened in May 1993. This year their status was monitored by WB's Wege and Oyen, and BT Wiseman of the refuge along with UAF graduate student Heather Wilson. The crew

participated in collecting productivity information from May 25 - July 1 and conducting brood trapping from July 23-29. Study objectives included:

1. monitoring spectacled eider nesting chronology and productivity.
2. capturing and marking female spectacled eiders to estimate annual and brood survival.
3. capturing and marking spectacled eider ducklings to document natal philopatry.

Nest searches began May 25 and ended June 15. Forty-five plots were searched and 145 spectacled eider nests located.

Nest initiation occurred between May 18 and June 10, and peaked between May 22 and 28. Hatch occurred between June 10 and July 1, peaking between June 16 and 21. Spectacled eider mean clutch size was 5.2 eggs. The nest success estimate was 70.7% (Mayfield). 20.3% of nests sustained partial depredation and lost a mean of 1.3 eggs. Forty-six nests contained at least one inviable egg, and five clutches were completely inviable.

Seventy two female spectacled eiders were nest-trapped, marked, and measured between June 8 and 30 (30 new captures, 42 recaptures). All females not previously banded were fitted with a colored, uniquely numbered, plastic tarsal band and nasal disk, and a steel, Service leg band. Approximately 30 days posthatch, 42 spectacled eider broods were captured, including 35 adult females, 81 juvenile females, and 66 juvenile males. Male spectacled eiders were banded with the tarsal bands. Several captures involved multiple broods and eight adult females were new captures.



WB Jody Oyen conducted nest searches during the 12th year of a spectacled eider study on Kigigak Island. (MLW 6/02)

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 1993 it was believed that the Kilbuck Caribou Herd (KCH) was distinct from the Mulchatna Caribou Herd (MCH). The MCH was first noted to utilize the refuge in large numbers in the fall of 1994. Since that time the KCH has become indistinguishable from MCH as they mix together throughout the year. Due to this mixing, management of the two herds was combined in 2001.

Between 1986 and 2000, 100 caribou (10 males and 90 females) were captured and radio-collared on the refuge south and east of the Kuskokwim River; a capture was planned for April 2002, but weather conditions prevented the capture from going forward. As of December 2002, 23 radio-collars (deployed on the refuge) were believed to be functioning. Uncertainty in the number of functioning radio collars comes from the fact that several have begun to malfunction and are transmitting in mortality mode despite the animal still being alive. Aerial telemetry surveys (11 by refuge staff and an additional 15 by Togiak NWR, ADF&G - Bethel, or ADF&G - Dillingham staff) conducted in 2002 documented 340 radio relocations for radio-collared caribou both on and off the refuge. Sixteen radio collared caribou were found dead during routine radio telemetry flights; the increased number of mortalities was largely attributed to capture related mortalities from caribou captured northeast of Dillingham in April 2002.

Conditions during early 2002 were not conducive to obtaining quality counts of the number of caribou utilizing the refuge south and east of the Kuskokwim River. Rough estimates place the number of caribou utilizing the refuge in the January through May 2002 period at 10,000. Caribou did not began migrating off the refuge to their calving grounds until mid-May 2002; this is the latest date recorded since most of the caribou began calving east of the Kilbuck Mountains in 1995.

While 2,000-3,000 caribou were observed on the refuge in August and September, large numbers of caribou never arrived on the refuge in the fall as has happened every year since 1994. In previous years RM Rearden opened the Federal subsistence caribou hunting season when large numbers of caribou were present on the refuge. This year the regulations were revised so that a set season was opened on August 1, 2002.

The refuge again assisted ADF&G with a fall composition count. Bull:cow:calf ratios for the 5,734 caribou classified on this and the Togiak NWR was 25.7:100:28.1, respectively. The ratio of bulls is virtually identical to that recorded in 2001 while the ratio of calves is much higher than last year.

WB Kovach worked with biologists at the Togiak NWR to compile more than 20 years of data on caribou throughout southwest Alaska. The population dynamics, composition, and mortality data were analyzed for inclusion in a review paper to be submitted for publication in 2003.

Kuskokwim Mountains Brown Bear Study

During 2002, 34 brown bear telemetry flights (19 by the Yukon Delta Refuge, 12 Togiak NWR, and three by ADF&G Dillingham) resulted in 350 relocations of radio-collared bears and 31 locations of non-radio-collared bears.

A project update was prepared in 2002. The update report covered work from 1996 through 2000 in detail and summarize findings since the study began in 1993. Findings of the project to date include: mean litter size for litters out of the den was 2.0; mean litter size for litters at weaning is 1.6; and mean age of offspring at weaning is 3.0 years. Survival of offspring to weaning increased to 36%. Age of first reproduction was established at 7.2 years; however, age of first successful reproduction was 8.9 years. Mean annual Kaplan-Meier survival estimate for radio collared females dropped to 95.6%. Minimum convex polygon home ranges varied from 233 km² to 2,740 km².

Nunivak Island Range Conditions Study

In 1989 and 1990 10 study sites were established on Nunivak Island to monitor range conditions as they relate to grazing primarily by reindeer, and secondarily by muskox. The study sites were selected by an interagency team composed of YDNWR, Soil Conservation Service (now Natural Resources Conservation Service), and University of Alaska. The study was established to document the condition of primary forage species (primarily lichens) utilized by reindeer and muskox during the winter and to measure recovery of the habitat as agreed upon in the Nunivak Island Grazing Plan. Sites were to be revisited on a five year basis. The first revisit occurred in 1995; the second revisit occurred in 2001.

Data collected in 2001 were cleaned up and all data entry verified. Scientific names of all plant species were updated. Data collected in 1995 was stored in spreadsheets, or were in summary form only. The spreadsheet files were converted over to a database manager while the summarized data were reentered and verified. It was discovered that the original data collected in 1989 and 1990 and stored on a main frame computer were no longer available. A service contract for \$2,490 was made with Daniel Harter to clean up the 1995 data and enter the 1989/1990 data. As of December 2002, the 1995 and 2001 data are currently being summarized for analysis by range conservationists and botanists and the 1989/1990 data entry are being verified. A final report is not expected until late 2003.

Western Sandpiper Studies at Kanaryarmiut Field Station

In 2002, we completed the fifth consecutive year of shorebird studies at our long-term study site on the central Yukon-Kuskokwim Delta. In mid-May, WB McCaffery trained BT Spies and BT Fitzpatrick on the field protocols for the project at Kanaryarmiut Field Station. Upon McCaffery's departure in late May, BT Spies assumed day-to-day responsibility for the project, which was completed with the assistance of BT Fitzpatrick and BT Opsahl. As in past years, western sandpipers (*Calidris mauri*) were the focus of our investigation. Spring break-up in this region was early compared to both 2001 and the long-term (15-year) average. Weather was cool, wet, and windy in the first half of May, but then generally drier and warmer through mid-June.

The first western sandpiper clutches were initiated on May 17, which was eight days earlier than in 2001, and two days earlier than the previous early date at our site (May 19 in 1999). In 2002, 50% of first nests were initiated as of May 23. By comparison, in 2001, it was June 5 before 50% of first nests had been initiated. In past years, nest density has been calculated as simply the number of nests found divided by the study area size (= 16 ha). By this measure, nest density in 2002 was the lowest recorded to date, 2.63 nests/ha versus a mean of 3.01 nests/ha (range 2.95–3.06) for 1999–2001. The number of nests found, however, is at least partially a function of nest predation (i.e., fewer nests found when predation rates are high). Nest predation in 2002, probably primarily by mink, was very high; Mayfield nest success was only 0.11, compared to a mean of 0.34 (range 0.21–0.55) for 1998–2001. When rates of nest loss are considered, nest density in 2002 may have been as high as 4.56/ha.

High rates of nest loss led to high rates of re-nesting; 35% of pairs that lost nests re-nested. The mean interval between the loss of a first nest and the initiation of a pair's second nest was 6.4 days. There was no correlation between the age of the nest lost, and the interval required to initiate the second clutch. By eliminating second nests from consideration, we estimated the density of breeding pairs on the study area (i.e., number of pairs that initiated at least one clutch) to be 3.56 pairs/ha.

Among clutches which hatched, fledging success (defined as a clutch fledging one or more young) was only 39%, compared with 58% in 2001. Overall in 2002, only 4% of clutches initiated resulted in fledged young.

In 2002, results from our work on Western Sandpipers at Kanaryarmiut field station were presented in a variety of fora. Abstracts of papers and presentations made in 2002, and/or those based on data collected in 2002 are presented following.



BT's Ronald Opsahl and Melanie Spies install a nest trap for the western sandpiper study conducted from the Kanaryarmiut Field Station. (BJM 6/02)



BT Melanie Spies bands a western sandpiper during the fifth year of shore-bird studies at the Kanaryarmiut Field Station. (BJM 6/02)

Seasonal and Age-related Trends in the Reproductive Output of Western Sandpipers *Calidris mauri* at Kanaryaraq, Alaska (2002 Masters thesis by Daniel R. Ruthrauff, Humboldt State University, USA)

I studied seasonal and age-related effects on reproductive output of Western Sandpipers (*Calidris mauri*) breeding at Kanaryarmiut, Alaska, in 1999 and 2000. I examined variation in date of nest initiation, clutch size, average egg volume per clutch, nest daily survival rate, fledging success, reproductive success, and parental brood attendance. Nests initiated before mean initiation date hatched at higher rates than nests initiated after mean initiation date ($P < 0.001$ in 1999; not significant in 2000) and early breeders exhibited higher reproductive success than late breeders ($P < 0.01$ in 1999; not significant in 2000). Parental brood attendance by male and female Western Sandpipers declined seasonally (males $P < 0.01$; females $P < 0.001$, years combined), but this decline was not related to fledging success, which remained constant across the seasons. Predation pressure increased seasonally in both 1999 and 2000 (not significant in 1999; $P < 0.05$ in 2000) and likely accounted for the seasonal decline in both hatching and reproductive success.

I utilized age-specific plumage characteristics to distinguish between second-year ("yearling") birds and after second-year ("adult") birds. I thus categorized breeding Western Sandpipers as yearlings (birds less than one year old, attempting their first breeding effort), new adults (birds more than one year old, attempting their first breeding effort), or old adults (birds more than one year old, attempting at least their second breeding effort). Effects of age and experience were more pronounced in females than males. In 1999, old females initiated nests on average eight days before new females and nine days before yearling females (not significant); in 2000 old adult females initiated nests an average of 10 days before new females and eight days before yearling females ($P < 0.01$). New females laid a significantly higher proportion of four-egg clutches (100%, $n=23$) in 1999 than yearling females (25%, $n=4$; $P < 0.0001$) or old females (80%, $n=10$; $P < 0.05$). Old adults and yearling females did not differ significantly in proportion of four-egg clutches. Yearling females laid significantly smaller eggs in 2000 ($P < 0.05$) than either new or old females, who laid eggs of nearly equal volume (6.86 ml \pm 0.13 SE, 7.23 ml \pm 0.07 SE and 7.21 ml \pm 0.08 SE, respectively). Finally, new females exhibited higher reproductive success than either yearlings or old females in 1999 ($P < 0.01$), whereas reproductive output of old females was higher than both yearlings and new females in 2000 ($P < 0.05$), which did not differ from each other.

Male Western Sandpipers exhibited significant variation in date of nest initiation and duration of brood attendance. In 1999, old males initiated nests six days before new males ($P < 0.05$; no yearling males detected in 1999) and five days earlier than both new and yearling males in 2000 (not significant). New males attended broods longer than old males in 2000 only ($P < 0.05$).

Older, more experienced females exhibit increased reproductive output compared to younger, less experienced birds. This is a result of special conservation interest given the low annual survival rate of female Western Sandpipers at Kanaryaraq (0.40 ± 0.06 SE) in contrast to males (0.67 ± 0.05 SE). Strong seasonal and age-related trends are noteworthy in both years of study, and additional data over a longer study duration will serve to better determine lifetime reproductive success, which will in turn aid in predicting population reproduction parameters.

(Ruthrauff and McCaffery also presented papers based primarily on Ruthrauff's thesis at the 9th Alaska Bird Conference and the 7th Western Sandpiper Workshop, in Fairbanks and Vancouver, respectively).

Use of Exclosures as Cues by Avian Predators (paper presented by Amanda C. Niehaus, Daniel R. Ruthrauff, and Brian J. McCaffery at the 9th Alaska Bird Conference, Fairbanks, March 2002)

Predator exclosures have been successfully used to protect the nests of many shorebirds, including Western Sandpipers. Although potentially disruptive to breeding birds, these structures prevent the entrance of large avian or mammalian predators, thus increasing hatching success. We evaluated exclosure efficacy at the Kanaryarmiut Field Station on the Yukon Delta National Wildlife Refuge, Alaska, in 2001. Depredation is the primary cause of nest loss at this site. We placed exclosures over 16 nests, and all other nests ($n = 40$) served as controls. We regularly monitored sandpiper behavior and nest contents, and searched for evidence of predator intrusion. Although many Western Sandpipers experienced difficulty exiting the exclosures, we did not detect signs of physical damage inflicted by egress. Exclosures were associated with decreased rates of nest failure until late in the study when Long-tailed Jaegers learned to associate exclosures with nests. Two jaegers repeatedly visited exclosures in attempts to capture adults, eggs and newly-hatched chicks. This caused severe distress to the adult sandpipers, alleviated only by removal of the exclosures. We caution the use of predator exclosures in areas where Long-tailed Jaegers are prevalent.

Spatial Variation in Shorebird Nest Success: Implications for Inference (abstract of draft manuscript prepared by Brian J. McCaffery, and submitted for review December 2002)

Studies of nesting success across a broad spectrum of avian taxa have multiplied dramatically over the last decade. Estimates of nest success have been used to evaluate a wide range of theoretical and practical issues, including the effects of habitat fragmentation, brood parasitism, and predation on nest success; source and sink population dynamics; landscape level components of habitat quality; and the costs and benefits of varying reproductive strategies. To date, however, there has been fairly little attention paid to the implications of spatial variation in nest success. In many studies, researchers select one or a few plots, and infer that plot-specific nest success values are

representative of adjacent and/or nearby areas. The spatial scale over which such inferences are made may range from the surrounding woodlot to the species' continental distribution. In lieu of application of formal sampling theory, however, such inferences are invalid.

To evaluate the implications of this issue, I compared estimates of Western Sandpiper nest success between adjacent plots (referred to as "primary" and "secondary") at the Kanaryarmiut Field Station, Yukon Delta National Wildlife Refuge. Over a 4-year period, nest success on the secondary plot varied from 5 to 260% of nest success on the primary plot. In 2 of 4 years, estimated nest success was significantly higher on the primary plot; in the other 2 years, the point estimate was higher on the secondary plot. There was no agreement between the two plots in identifying the years of highest and lowest nest success, and in fact, extreme years on one plot were inevitably associated with near-extremes in the opposite direction on the adjacent plot. Efforts to test hypotheses about the effects of cyclic rodent populations on shorebird nesting success resulted in 3 mutually exclusive conclusions depending on whether the data considered were from the primary, secondary, or combined plots, respectively. These results highlight the importance of appropriate sample design, and the limitations of inferences based on studies with only one or a few non-randomly selected plots. Just as schemes for estimating population size require statistically valid sampling design (randomization, replication, and limiting the inference to the actual sampling universe), so too do efforts to estimate demographic parameters such as nesting success.

How Intensive is Intensive Enough? Alternatives for Estimating Shorebird Nest Numbers (abstract of draft manuscript prepared by Brian J. McCaffery and submitted for review December 2002)

A double-sampling approach has recently been proposed to estimate the number of tundra-breeding shorebirds over large geographic areas. The method involves rapidly surveying a large number of randomly selected plots on single visits. A subsample of these plots are also surveyed intensively by a separate team (over a several-week period). The number of nesting pairs found on rapid surveys of these intensive plots is divided by the number found by the intensive surveyors. This index ratio is then used to expand the estimates from the entire sample of rapidly-surveyed plots.

The utility of the double-sampling approach rests on the assumption that the actual number of nests is accurately determined on the intensive plots. I tested this assumption in a study of Western Sandpipers at Kanaryarmiut Field Station, Yukon Delta National Wildlife Refuge. Because the number of nests found on a study plot by a researcher rarely equals the actual number initiated, I used Mayfield estimates of nest success to estimate the true number initiated. Effort (expressed in search-hours/ha) on my plot was more than 5 times greater than that expended on typical "intensive" plots, and I was working with a color-banded population, which greatly facilitated identifying individuals and finding nests. Despite these advantages, however, my colleagues and I still only

found, on average, 82-84% of the Western Sandpiper nests on the plot each year. These findings suggest that intensive surveying alone may be unlikely to produce accurate estimates of the numbers of nesting shorebirds on tundra study plots. At best such surveys generate an index that approaches the total number of nesting pairs to an uncertain extent. A number of model-based approaches which generate statistically valid estimates of population size must be considered if we hope to generate accurate and precise estimates of breeding shorebird population sizes.

Shorebird Population Monitoring

For the second straight year, we participated in the development of methods to estimate population sizes of tundra-breeding shorebirds. As in 2002, we cooperated with Dr. Jon Bart and Catherine Wightman (USGS) under the auspices of PRISM (Program for Regional and International Shorebird Monitoring) and the U.S. Shorebird Conservation Plan. We surveyed shorebirds in a 425 km² study area centered on northern Hazen Bay. The double-sampling methodology is described in the preceding abstract. We had a two-person crew (BT Johnson and BT Sardy) intensively survey four, 10-ha plots at Old Chevak from mid-May through mid-June; the 16-ha western sandpiper plot at Kanaryarmiut field station was treated as a fifth intensive plot. In early June, a second two-person crew (Volunteers Booms and Prather) was transported to eight different sites in the Hazen Bay area (one site/day), where they conducted a total of 50 rapid plot surveys in habitats dominated by lowland meadows. In addition, the two rapid surveyors each conducted two surveys of each of the five intensive plots. Overall shorebird density was estimated to be 398 birds/km². Estimated densities (in birds/km²) for the four most frequently detected species were: dunlin – 184.6, semipalmated sandpiper – 74.0, red-necked phalarope – 62.2, and black turnstone – 48.4.

A number of factors make implementation of this program challenging. Estimates of nesting density are habitat-specific, but many shorebird species on the delta (particularly upland-nesting species) forage regularly in the lowlands. Similarly, both locally-breeding and migratory populations of certain species overlap temporally in suitable breeding habitat. In both cases, distinguishing local breeding birds from migrants and visitors is challenging. Additional problems in 2002 included 1) some common species (including semipalmated sandpipers, black turnstones, and red phalaropes) did not nest on the intensive plots at Old Chevak, which precluded generating species-specific index ratios for those species; 2) the behavior of certain species (including dunlin and black turnstone) made it difficult to interpret their status on the intensive plots; and 3) we had both objective and subjective evidence that nest and/or pairs were missed on the intensive plots, which violates a crucial assumption of the double-sampling approach. Our concerns about this issue specifically led to the analysis described in the preceding abstract, as well as plan to address this problem empirically in 2003.

In October, WB McCaffery represented the Alaska Region at a shorebird population monitoring meeting hosted in Quebec by the Canadian Wildlife Service. Arctic PRISM

dominated the agenda, and McCaffery was selected to head a committee tasked with designing empirical field tests of the double-sampling methodology, which will be implemented at several sites in the Canadian and U.S. arctic in 2003. In December 2002, McCaffery was elected to be chair of the Alaska Shorebird Group.

WB McCaffery was a co-author with Jon Bart on a paper about shorebird monitoring presented at the Alaska Bird Conference (see abstract below).

Implementing the Program for Regional and International Shorebird Monitoring Plan (PRISM) in Alaska (paper presented by Jon Bart and Brian McCaffery at the 9th Alaska Bird Conference, Fairbanks, March 2002)

The Program for Regional and International Shorebird Monitoring (PRISM) provides a single blueprint for shorebird monitoring in North America. It has four parts - arctic and boreal breeding surveys, temperate breeding surveys, temperate non-breeding surveys, and neotropical surveys. The Alaska Shorebird Working Group is preparing a comprehensive plan for implementing PRISM in Alaska. During the next few years, the arctic and boreal breeding surveys will be emphasized and work on the non-breeding surveys will be deferred. Surveys for breeding shorebirds have been completed in the National Petroleum Reserve and have been initiated recently in several parts of western and northern Alaska. Work on methods for breeding surveys in boreal regions has just begun and should receive more emphasis starting in 2003.

Arctic Nesting Goose Studies

Current population estimates for the four goose species of special concern continue to show mixed results. Cacklers (136,100), emperors (58,750), and whitefronts (358,500) decreased while brant (136,750) increased slightly. Declines were not unexpected after heavy fox depredation severely reduced production in 2001. In addition, timing of breeding ground aerial surveys may have occurred too early to record the maximum number of returning cacklers and whitefronts.

Breeding ground aerial surveys showed decreases for all categories for all species: cackler, emperor, and whitefront pair indices decreased 14%, 9%, and 18%, respectively. Cackler, emperor, and whitefront total bird indices decreased 33%, 28%, and 20%, respectively. See below for 2002 nest estimates.

In general, chronologies of break-up, migration arrival, and nesting were considered "early." Float angles of eggs indicated average hatch dates of June 18 for emperors, June 19 for brant, June 20 for cacklers and June 22 for whitefronts. Production was good for most waterfowl species with the return of fox depredation to normal levels, an early spring with nest sites available in mid-May, no flood tides and mild weather throughout incubation and brood rearing. Drought conditions reduced pond levels and may have contributed to mortality of young waterfowl early in brood rearing.

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 0.4 x 0.8 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 84 plots were searched by crews from field camps located at Old Chevak, Tutakoke River, Hock Slough, and Manokinak River, as well as six mobile crews based at Kanaryarmiut field station. The survey estimated that 100,750 cackler, 36,100 emperor, and 93,850 whitefront nests were initiated on the 4,000 square kilometers of coastal habitat that contains about 90% of all geese on the delta. These totals represent 33% and 154% increases for cacklers and emperors, respectively and a 10% decrease for whitefronts.

Clutch sizes and nest success (%) returned to long term averages: cacklers (4.5 eggs, n=1293; 86%), emperors (5.0 eggs, n=303; 93%), and whitefronts (4.4 eggs, n=444; 98%).

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 (19,300) at Kokechik Bay, Tutakoke River, Kigigak Island, Baird Peninsula, and Baird Inlet Island were just slightly above the long-term mean (19,075 nests). This survey is integral to monitoring the flyway population and will continue in 2003.

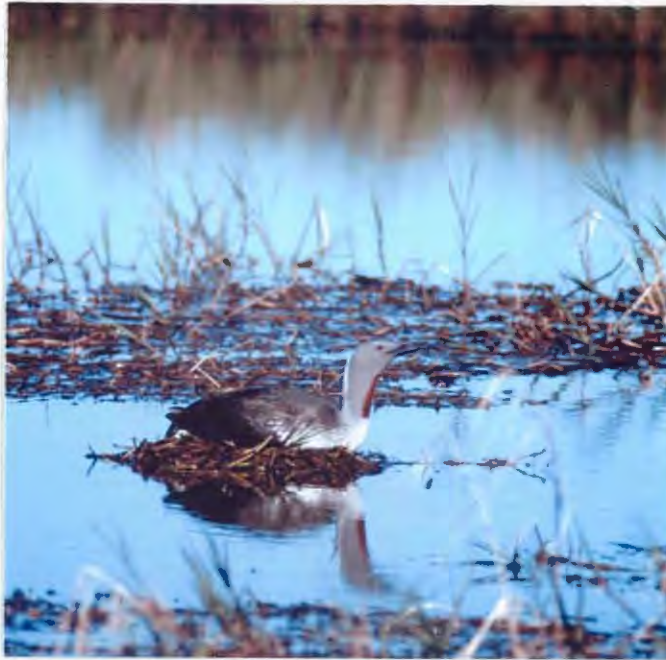
The second BRD project was the eighteenth year of a cackler, emperor, and whitefront nesting ecology study near the Kashunuk River. Nesting plots in this area were first established in 1974. The continuing work provides the best long-term nesting ecology information for these three species. Break-up and nest initiation chronologies for the study area were slightly earlier than the long term average. Nest densities of all three species were higher than long-term averages but lower than the peak numbers recorded in 2000. Clutch sizes were comparable to long-term averages with cacklers, emperors, and whitefronts laying an average of 4.6, 5.1, and 4.5 eggs, respectively. Nest success for cacklers (64%) was also higher than the long-term average. A reduced field effort prevented determining nest success for emperors and whitefronts. Plans for 2003 are under review.

The third BRD project was the twelfth year of a study of duck research on the lower Kashunuk River focusing on spectacled and common eiders, greater scaup, and long-tailed ducks. Objectives include estimating nest success, recruitment rates of marked ducklings, annual survival of adult females, duckling growth and survival during brood rearing, and lead exposure rates. Concern over declining continental scaup populations prompted initiation of a new project documenting timing of scaup reproduction. Approximately 60 females were to be collected between May 1 and June 30 to examine

nutritional and physiological attributes that influence timing of clutch formation. Examination of body composition variation, circulating levels of plasma yolk precursors, and stable isotope variation in tissues and eggs will lend insight into factors constraining timing of nesting. Further analysis of lead exposure for eiders in Alaska was initiated in an attempt to determine the source of lead detected in blood samples. Many eiders sampled in the past have had very low lead concentrations and it is suspected that the source may be naturally occurring lead in the environment and not from spent lead shotgun pellets. Ratios of stable isotopes in elements such as lead can be used to identify sources of exposure such as gasoline, natural deposits, or shotgun pellets. Blood samples were taken from spectacled eiders along the Kashunuk River and Kigigak Island and from Steller's eiders from the north slope. Isotopic signatures of available lead were also established for sediment samples from each study area and for shotgun pellets. Results from 2002 and plans for 2003 are unavailable at this time.

The fourth BRD project was the ninth year of an emperor goose nesting ecology study at Manokinak River. A total of 185 nests were located on traditional study areas and 46 of these females were banded allowing calculation of survival rates. Survival has averaged 80% (70%-90%) since the mid-1990's. Winter distribution of 40 females which received implanted radio transmitters (20 conventional and 20 satellite) during molt is being monitored. Gosling growth rates were also documented at the time of adult captures and appeared lower than in previous years. Detailed plans for 2003 are unavailable at this time, but will include additional work on gosling growth rate in relation to habitat quality.

The fifth BRD project was the third year of a project to document reproductive success, contaminant exposure, and the link between breeding populations and their non-breeding distribution for red-throated loons. Partial results indicated nest success increased from 2001, but the very dry, warm summer may have caused some chick mortality as brood rearing ponds dried up. Rainbow smelt were most frequently fed to young. Plans for 2003 are unavailable at this time.



BRD studied red-throated loons on the refuge to document reproductive success, contaminant exposure, and distribution. (JS 6/02)

Since 1984, the University of Nevada, Reno, 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 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 five years virtually all females breed every year; (3) as colony size has increased, gosling size and clutch size of females less than five years old have decreased significantly but no trend was detected in clutch size of older females or for the colony as a whole; (4) first year survival has declined from about 70% for the 1986 cohort to about 45% for cohorts in the early 1990's; (5) 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. Work continued to document

individual breeding success in relation to known wintering areas. Manipulating forage available on a traditional brood rearing site by doubling the available forage area through mowing vegetation to a suitable height also continued. Results from 2002 and plans for 2003 are unavailable at this time.

The University of Alaska, Fairbanks initiated a new project documenting survival and productivity of common eiders on the Yukon-Kuskokwim Delta. Data were gathered from study areas at Tutakoke River and Kigigak Island. Females were nest trapped and marked with colored tarsal bands to enhance recapture rates and blood samples were taken and analyzed for biochemical health parameters and exposure to disease agents. Data will be incorporated into a population model designed to compare life-history parameters among study areas and allow managers to assess geographic variation across the Yukon-Kuskokwim Delta. Results from 2002 and plans for 2003 are unavailable at this time.

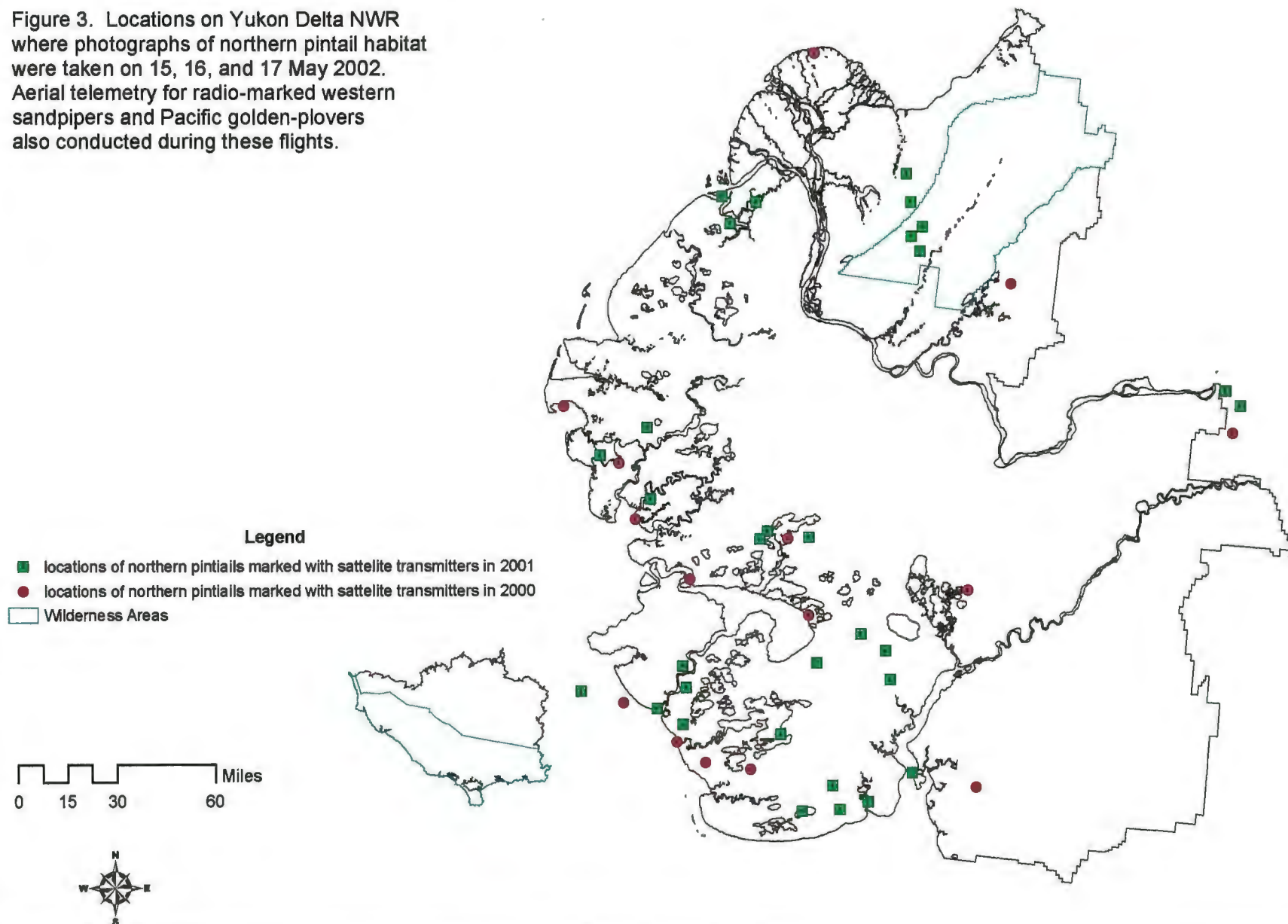


Common eiders were the focus of a new study initiated by the University of Alaska - Fairbanks to document survival and productivity on the refuge. Data were gathered from study areas at Tutakoke River and Kigigak Island. (HW 6/02)

Sub-Arctic Nesting Waterfowl Studies

In 2000, USGS - Western Ecological Research Center, Sacramento initiated a long-term project designed to use satellite telemetry to determine spring migration routes and staging areas of northern pintails wintering in California, New Mexico, and Texas (www.werc.usgs.gov/pinsat). Location of study animals on the refuge, prompted the study team to request that the refuge take aerial photographs documenting habitat used (Figure D.1). A similar percentage (33%) of marked birds utilized the refuge as are located on the refuge during the statewide breeding pair survey. No further assistance by the refuge is anticipated.

Figure 3. Locations on Yukon Delta NWR where photographs of northern pintail habitat were taken on 15, 16, and 17 May 2002. Aerial telemetry for radio-marked western sandpipers and Pacific golden-plovers also conducted during these flights.



Cape Romanzof BASH Survey

From August 12 to 21, SFWB Broerman conducted Bird Air Strike Hazard (BASH) surveys at the Cape Romanzof Long Range Radar Site Airfield. The US Air Force funded the refuge to investigate the likelihood of geese and swans colliding with incoming and outgoing air traffic during August and September. Contract support personnel working at the site have reported gulls, geese, and swans flying through, and feeding within, the airfield's Bird Exclusion Zone (BEZ), an imaginary bubble encapsulating the airfield 1,000' in all directions. This usually occurs in August and September when gulls, geese and swans are attracted to berry patches found in boulder fields and tundra terraces surrounding the airfield. During Broerman's observations neither geese nor swans were seen within the BEZ, however, gulls were seen regularly flying through the zone traveling along Nilumat Creek to and from feeding areas nearly a mile above the airfield. A report summarizing past information and this years findings, as well as making recommendations to the Air Force should be completed by April 2003.



A twin engine aircraft lands at Cape Romanzof Long Range Radar Site airfield in mid-August. The Air Force funded a study to investigate the likelihood of geese and swans colliding with incoming and outgoing air traffic from the site. (FJB 8/02)



The rock spires along Cape Romanof were havens for pairs of rough-legged hawks in 2002. (FJB 8/02)

Emperor Goose Research at Manokinak and Old Chevak

In the summer of 2002, a study of the post-fledging survival and habitat use of emperor geese was initiated on the Yukon-Kuskokwim Delta. The study was a partnership with the Yukon Delta NWR, USGS Alaska Science Center, and University of Alaska Fairbanks; results from the study were intended to be used in a master's thesis for SCEP student Bryce Lake. In late July, banding drives were conducted at the Manokinak River study site and with the help of a veterinarian, transmitters were attached to twenty juvenile emperor geese. It was noted at the time of capture that many juvenile geese were of smaller structural size and mass than previously observed. The potential effect of small size became apparent approximately three days later when Lake and Joel Schmutz tracked radio signals from the ground and retrieved about one-third of the radio-marked goslings. At that time, a decision was made that because of the small size of the goslings, it was not possible to attach more transmitters and collect unbiased data.

The banding crews from Manokinak then moved to the Old Chevak study site to assist with capturing cackling Canada geese. During these drives, emperor geese were also captured and it was noted that goslings at this study site were much larger, (about 400 grams on average) even though they were about the same age. Previous studies of gosling growth on the Yukon-Kuskokwim Delta have noted the tremendous spatial variation in growth and the importance of growth in the first year to survival and future fecundity. In the summers of 2003 and 2004, we plan to capture emperor goose goslings across a large spatial scale to assess the "health" of the juvenile emperor goose

population and whether recruitment may be limited by small size in the first year. Gosling growth is influenced primarily by environmental mechanisms and we plan on relating observed variation in growth to availability of high-quality forage and an index to competition for this forage.



SCEP student Bryce Lake initiated a study of post-fledging survival and habitat use of emperor geese in 2002. The study has to be revamped for 2003 due to the unusually small size of goslings at the study site and their inability to handle the transmitters. (BL 7/02)

National Malformed Amphibian Investigation

For the second year the refuge participated in the National Malformed Amphibian Investigation. Ponds were examined by USFWS Ecological Services field office staff accompanied by refuge staff in late May and late June. In June, wood frog tadpoles ranged from Gosner stage 39-14. This resulted in an early initiation of tadpole collection. During the week of July 4 metamorphs were collected from five of the seven ponds originally examined. A total of 280 woodfrogs were collected, none were malformed.

Three dead egg masses were found in Pond YKD02 early in the season. A drainpipe from the Women's Prematernal Home drains into the pond discharging discolored sediment. None of the egg masses from pond YKD02 survived. Contaminant Biologist Mari Reeves and BT Joseph Conner, both from USFWS Ecological Services field office in Anchorage led the collections. They were assisted by refuge staff WB McCaffery, BT's Fitzpatrick, Spies, and Johnson, and volunteer Daniel Harter.

Black Scoter studies at Aropuk Lake

This was the second year of a cooperative research project with USGS Alaska Science Center and the refuge designed to study the breeding ecology and post-nesting movements of black scoters at Aropuk Lake. Black Scoters are the least abundant scoter in North America. Count indices of scoters from the North American Waterfowl Breeding Pair Survey have declined at an average rate of 2.2% per year in strata where black scoters predominate (USFWS MBM 1999). Assuming constancy, this rate results in a 67% decline in population size over the 37-year survey period.

Jason Schamber and Josh Chapman, biologists with USGS Alaska Science Center, as well as refuge seasonal BT Chris Pekar, initiated work at the Aropuk Lake camp during the last week of May. Four female scoters were caught prior to nesting using a floating mist-net and decoys. These birds were radio-marked to aid biologists in identifying nesting habitat and ultimately to locate nests. However, as was the case in 2001, nesting was not verified for any of the early-captured females.

Nest searches were conducted from mid-June until late July. USGS biologist Paul Flint and SFWB Broerman, project leaders for research at Aropuk, assisted with nest searching as well as refuge WB Oyen, and USGS employees Ben Geiselbracht, Joe Seyfried, and Heather Wilson. Forty nests were found in 2002 compared to 35 nests in 2001, most of them again being found in shrubby dense stands of dwarf birch, spiraea, and willow, often on the sides of pingos (Fig D.2 and D.3) WB/P Anderson with the Office of Migratory Bird Management, flew a grid of transects over Aropuk and nearby lakes five times from June 4 to 20 in an effort to determine the best window of time to conduct surveys for black scoters on the Yukon-Kuskokwim Delta. Anderson also conducted flights tracking the movements of radio-marked female scoters caught on their nests prior to hatch.

In 2002 benthic invertebrate samples were collected from Aropuk Lake and satellite lake complexes used by nesting females and broods. A Ponar dredge was used to collect the samples which will be used to estimate spatial and temporal abundance of the invertebrates. This information may also show if the timing of invertebrate hatches are tied to female scoters leaving the larger bodies and moving to the smaller ponds at the onset of nesting.

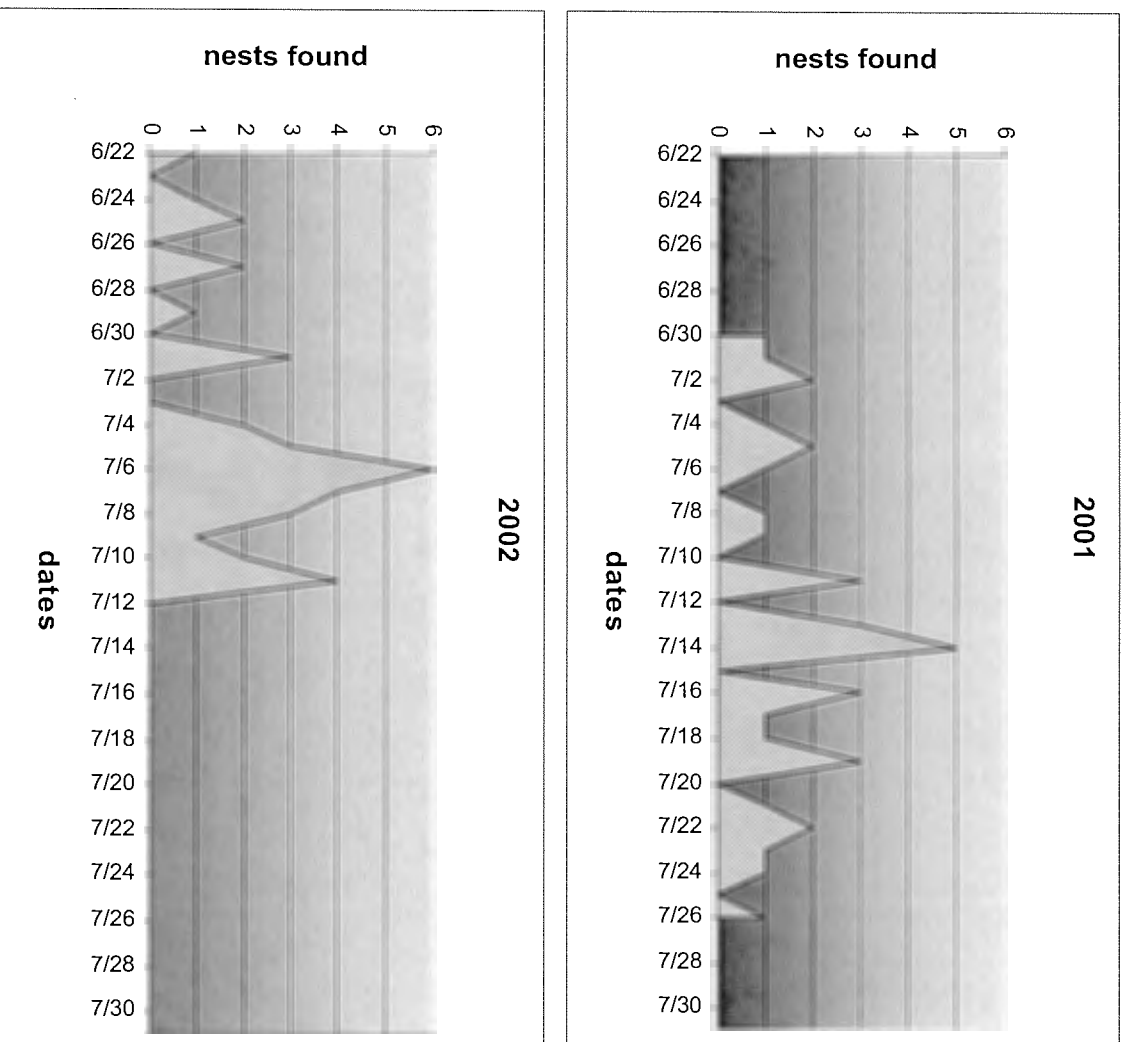
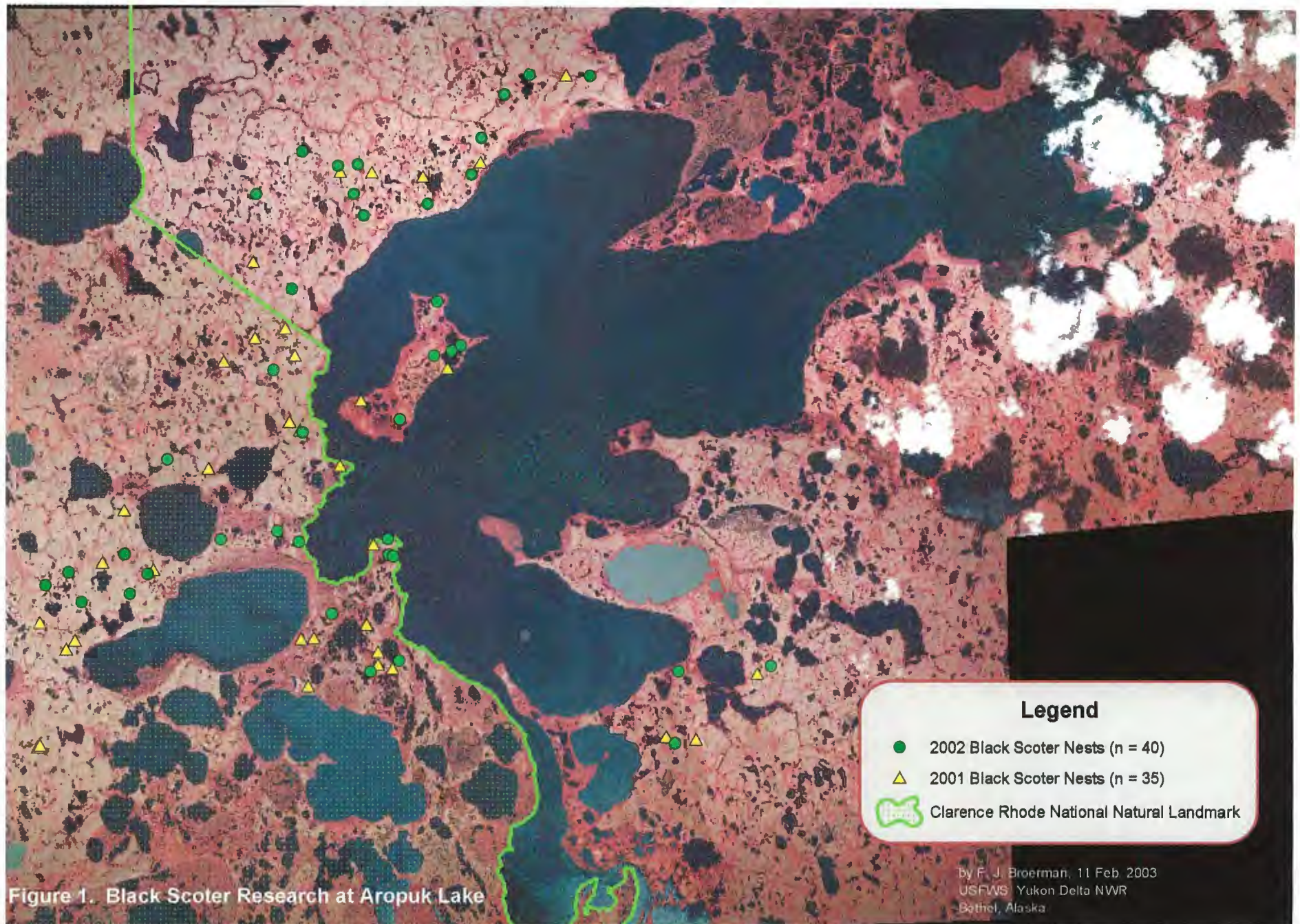


Figure D.2. Timing of finding black scoter nests at Aropuk Lake in 2001 (n = 35) and 2002 (n = 40).



Kashunak River Chum Salmon Telemetry

In recent years the dwindling stock of pacific salmon returning to the Yukon river tributaries have prompted a management plan that reduces subsistence harvest. The reduction in subsistence harvest is accomplished with allowing for harvest to occur in two 36 hour periods per week in the lower Yukon, which includes districts Y1, Y2, and the coastal district. The coastal district of the Yukon Management Area includes the villages of Scammon Bay, Hooper Bay, and Chevak along with the various tidal rivers that may or may not be linked to the Yukon.

The community of Chevak made a formal request to the U.S. Fish & Wildlife Service in early 2002 to exclude the coastal district from the subsistence schedule. Their rationale was that the coastal rivers from which they fished were terminal fisheries that included little or no Yukon salmon stocks.

This was a rational request and the Fairbanks Fish & Wildlife Field Office began a telemetry study where 30 chum salmon in the Kashunak River would be captured, tagged, and released to determine their destination. During the summer of 2002 eleven chum salmon were tagged and monitored. More tags will be deployed during the summer of 2003.

Preliminary results suggest that chum salmon of the lower Kashunuk and Aphrewn Rivers appear to mill around in the lower reaches of those coastal waterways for extended periods of time. Eight of the 11 fish were recorded moving past the remote receiving station, which was located between 15 and 20 km upstream of the tagging locations. However, most fish moved past the station multiple times over the course of several days, suggesting that they were repeatedly swimming upstream and then back downstream again.

Six tagged fish were harvested in the lower Kashunuk and Aphrewn Rivers from 2 to 30 days following tagging. Four of the six harvested fish had been recorded by the receiving station, which was located upstream of all harvest locations.

One tagged fish was recorded by receiving stations in the Yukon River proper. The fish migrated into the Bonasila River, about 500 km from the Yukon River mouth, 21 days following tagging.

Four tagged fish were not captured in the fishery and were not located in the Yukon River drainage. All four were recorded multiple times by the receiving station. However, their final destinations remain unknown. Two aerial surveys were conducted to find the tagged fish that were otherwise unaccounted for. This study will continue during the summer of 2003.

Kwethluk River Radio Telemetry Project

Between July 1 and 12, thirty-nine radio transmitters were surgically implanted in rainbow trout within the study area. In order to extend the transmitters life span, the tags were programmed to transmit a signal for 12 hours during each day (10:00 a.m. to 10:00 p.m.), then be off for the remainder of the day. This first phase of implantation involved floating approximately 80 miles of river in rubber rafts by four people (FB Dave Cannon, BT's Fitzpatrick and Hannan, and Volunteer Donna Elliot). During the trip numerous grizzly bears were observed and one visited the camp at the mouth of Crooked Creek. Sometime during the evening the bear bit one of the rafts which resulted in three - two inch tears. One day of collecting rainbow was lost while the raft was repaired.

Between July 24-27 three additional transmitters were deployed by FB Carter (from the Fairbanks FRO), and BT's Fitzpatrick and Hannan. One fish that was captured on this second trip had been implanted with a transmitter in 2001 (Tag # 49), but it apparently somehow expelled it. Other researchers have documented this phenomenon, especially with catfish that are able to absorb the transmitter into the intestine and pass it through the anus.

6. Other

In 2002 we attempted to conduct waterfowl harvest surveys in all 38 active villages in the Y-K Delta, but as always, and for various reasons, fell a few villages short of that goal. There were 31 villages that were surveyed and 34 local village contract surveyors hired. A total of \$45,800 went directly into local village economies as payment to those surveyors. Data are still being analyzed as of this writing but it is anticipated that the results will be consistent with the results from the 17 years of the surveys conducted in the past 18 years.

E. ADMINISTRATION

1. Personnel



Snow, Broerman, McCaffery, Kovach, Fitzpatrick, Sundown
Moos, Oyen, Wege, Rearden, Swaim, Albright, Jimmy, Isaac
Ivanoff, Anvil, Andrew, Hanley, Spies, Liedberg



Perry, Walters



Sipary

Kelly

Asuluk



Polty

David

Paul

Permanent

1. Michael B. Rearden Refuge Manager, GS-0485-14, EOD 6/95, PFT
2. Paul A. Liedberg Deputy Refuge Manager/Pilot, GS-0485-13, EOD 5/96, PFT
3. Kenton Moos Refuge Operations Spec., GS-0485-11, EOD 6/02/02, PFT
4. Patrick A. Snow Refuge Operations Spec., GS-0485-09, EOD 7/00, PFT
5. Fred Broerman Supervisory Wildlife Biologist, GS-0401-12, EOD 6/00, PFT
6. Michael L. Wege Wildlife Biologist, GS-0486-11, EOD 4/83, PFT
7. Brian J. McCaffery Wildlife Biologist, GS-0486-12, EOD 10/86, PFT
8. Steve Kovach Wildlife Biologist, GS-0486-11, EOD 11/96, PFT
9. Jody Oyen Wildlife Biologist, GS-0486-5, EOD 3/24/02, PFT
10. Michael Swaim Wildlife Biologist, GS-0486-7, EOD, 12/01/02, PFT
11. Dave Cannon Fisheries Biologist, GS-0482-11, EOD 7/98, Resigned 8/09/02
12. Robert Sundown Subsistence Resource Spec., GS-0401-12, EOD 5/00, PFT

13. Ignatius Andrew	Native Contact Rep., GS-1040-11, EOD 1/14/01, PFT
14. Jacob Isaac	Assistant Interpreter, GS-1040-9, EOD 2/97, PFT
15. Donna Hanley	Education Specialist, GS-1701-9, EOD 8/99, PFT
16. George Walters	Airplane Pilot, GS-2181-12, EOD 7/87, PFT
17. Bernice M. Albright	Computer Specialist, GS-2210-09, EOD 12/96, PFT
18. Phillip P. Paniyak	Refuge Clerk, GS-0303-05, EOD 1/92, LWD 3/08/02
19. Kelly Powell	Refuge Clerk, GS-0525-06, EOD 6-16-02, Resigned 9/06/02
20. Martha Perry	Refuge Clerk, GS-0303-05, EOD 2/87, PFT
21. Pat Jennings	Maintenance Worker, WG-4749-8, EOD 12/97, Resigned 2/04/02
22. Victor Anvil	Maintenance Worker, WG-4749-8, EOD 8/99, PFT
23. Henry E. Ivanoff	Maintenance Worker, WG-4749-5, EOD 8/91, INT
24. Raymond Ayogan	Maintenance Worker, WG-4749-5, EOD 5/92, INT
25. Chris Harwood	Biological Tech., GS-0404-7, EOD 3/91, PFT
26. Michael A. Jimmy	Refuge Info. Tech., GS-1001-8, EOD 11/84, PFT (Seasonal)
27. Leo Moses Sr.	Refuge Info. Tech., GS-1001-8, EOD 6/90, LWD 11/15/02
28. Joe Asuluk Sr.	Refuge Info. Tech., GS-1001-8, EOD 1/94, INT
29. James Sipary	Refuge Info. Tech., GS-1001-8, EOD 2/96, INT
30. Andrew Kelly	Refuge Info. Tech., GS-1001-8, EOD 7/98, INT
31. David Enoch	Refuge Info. Tech., GS-1001-7, EOD 1/01 INT
32. Jonathan Paul	Refuge Info. Tech., GS-1001-6, EOD 10/01 INT
33. Evan Polty Sr.	Refuge Info. Tech., GS-1001-6, EOD 1/13/02 INT

Temporary

Bryce Lake	Student Trainee (Biology), GS-0499-7 EOD 6/06/02
James M. Johnson	Biological Tech., GS-0404-7, EOD 5/05/02, LWD 7/17/02
Christopher Pekar	Biological Tech., GS-0404-6, EOD 5/28/02, LWD 8/23/02
Chadd Fitzpatrick	Biological Tech., GS-0404-6, EOD 10/1/01
Melanie Spies	Biological Tech., GS-0404-6, EOD 11/9/01
Marin Sardy	Biological Tech., GS-0404-5, EOD 5/19/02, LWD 9/20/02
Ronald Opsahl	Biological Tech., GS-0404-5, EOD 5/19/02, LWD 7/26/02
Howard Wiseman	Biological Tech., GS-0404-4, EOD 5/05/02, LWD 9/27/02
Forest Hannan	Biological Tech., GS-0404-1, EOD 6/10/02, LWD 8/05/02
Francis Lincoln	Biological Aid, GS-0404-1, EOD 6/02/02, LWD 6/13/02

Kenton Moos filled the vacant Refuge Operations Specialist (ROS) position. Kenton moved up from Minnesota where he served as an ROS for the Morris Wetlands District.

Jody Oyen was hired for a new Wildlife Biologist trainee position and will be working on sea duck projects. Jody had served at both the Kenai and Selawik Refuges in the SCEP program. She graduated from the Univeristy of Colorado in December of 2001 and joined the refuge in March.

Brian McCaffery was promoted to a GS 12 Wildlife Biologist position.

Michael Swaim filled a Wildlife Biologist position that was restructured from a vacant Biological Technician slot. Michael moved up from Washington State, where he worked as a Wildlife Biologist for Mid-Columbia River Complex. His main focus will be with GIS responsibilities.

Dave Cannon resigned his Fisheries Biologist position to take a similar position with the Kuskokwim Native Association (KNA) in Aniak. His position with KNA is a new one funded through the OSM Partners program.

Kelly Powell, briefly filled the Administrative Technician position. She later decided to pursue other interests and resigned.

Henry Ivanoff and Raymond Ayogan's positions as Biological Technicians were reclassified as Maintenance Workers and they were converted from GS-5's to WG-5's.

Evan Polty, from Pilot Station, was hired into the vacant RIT position at the beginning of the year.

One of the two Refuge Clerk positions was reclassified to an Accounting Technician at the GS-6 level while the other was upgraded to a GS-5.

We continued to recruit for a permanent full time Refuge Officer. A selection was made and the position offered and accepted, but the applicant declined the position before reporting for duty. A third advertisement and selection were made late in the year and we hope to finally have the position filled by early in 2003.

The vacant Maintenance Worker position has not yet been filled, and it's necessity is being evaluated. Refuge maintenance needs have been met this year by increasing the amount of hours worked by MW's Henry Ivanoff and Ray Ayogan.

2. Youth Programs

The Lower Kuskowkim School District (LKSD) Work Experience Program under the leadership of Ross Boring, Career Community Development Specialist, matches refuge staff with a high school student who expresses an interest in working at the refuge. This year, Sonya Weston, from Mekoryuk, Alaska, spent a week with ES Donna Hanley, learning how the refuge conducts and plans outreach events. Sonya also joined Pilot George Walters and RIT Jonathan Paul for a couple days learning about the refuge's expediter position and helping to arrange deliveries of supplies to field camps. Jeffery Curtis from Toksook Bay, Alaska, spent a week with WB Steve Kovach assisting with data entry of caribou research and validating refuge historical data entries. Jeffery also accompanied Steve and George on two caribou telemetry tracking flights.

3. Other Manpower Programs

The SCEP (Student Career Experience Program) program has been used by the region and this refuge for several years. Bryce Lake was the sole SCEPs student at Yukon Delta in 2002.

Bryce coordinated a study of the post-fledging survival and habitat use of emperor geese on the Yukon-Kuskokwim Delta. The study was a partnership with the Yukon Delta NWR, Alaska Science Center, and University of Alaska Fairbanks; results from the study are intended to be used as Bryce's master's thesis.

The Student Trainee Employment Program (STEP) allows the Fish & Wildlife Service to hire students that show an interest in a Service career, allowing them to gain valuable experience. Francis Lincoln, a high school student from Toksook Bay worked with one of the boat crews for the goose/eider nest plot survey in June.

4. Volunteer Programs

This year there were a total of 13 volunteers working in one of four areas; in field camp, for International Migratory Bird Day Celebration, during National Wildlife Refuge Week, and for the refuge visitor center. Benny Ordenthal assisted FB Dave Cannon with the rainbow trout radio telemetry tracking research project. John Prather and Travis Boons assisted WB Brian McCaffery in conducting shorebird surveys at Old Chevak. For International Migratory Bird Day in May, Andrea Swingley, Education Specialist for the Alaska Bird Observatory presented a slide show at the refuge on "Masters of Migration and Minus 40 degrees". Andrea also volunteered to lead a guided bird walk for an eager public earlier that morning.

The wildlife training of visitor center volunteers expanded greatly this year by adding a two hour orientation training, biology talks at monthly meetings, and visits to a refuge weir. The training included a new 20 minute interpretive script written to offer visitors a detailed tour of the history of the refuge, the mission of refuges, conservation issues prevalent on this refuge, and cool facts about resident wildlife.

Beginning in September, a staff member from the refuge presented a half hour program on their area of work at the monthly volunteer staff meetings. BT Jody Oyen gave a slide show on her field camp study of spectacled eiders. RIT Michael Jimmy talked about the Information and Education programs he conducts in the villages. In October, FB Tim Roettiger (Kenai FAO), led five of our visitor center volunteers on an educational field trip to the Kwethluk weir. While there they met the weir staff and discussed what work they do, and the importance of the weir and the data they collect.

Throughout the year, seven volunteers staffed the visitor center conducting environmental education, interpretation and outreach programs for the public, offering

short interpretive museum tours and hosting "Wildlife at the Movies" on Saturdays from 1-4pm. Four volunteers helped staff Alaska Natural History Association (ANHA) sales tables in October and November. Ellen and John Gladys both reached 100 hours of volunteer service. Heather Johnson, beginning her third year, is our longest serving volunteer and has completed over 200 hours of volunteer work. They each received a certificate of appreciation and awards.

All of the above mentioned volunteers served 875 total hours compared to a total of 1,899 volunteer hours served last year. The number of volunteers' hours worked last year was much higher because six volunteers worked the summer in field camps whereas this year only three volunteers worked in the camps. The total number of volunteers working at the refuge was also greater last year than this year. Eighteen volunteers worked last year compared to thirteen volunteers who worked this year.

5. Funding

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

Table E1. Funding for the Yukon Delta NWR, FY-98 thru FY-02

<u>Activity Code</u>	<u>FY-98</u>	<u>FY-99</u>	<u>FY-00</u>	<u>FY-01</u>	<u>FY-02</u>
1943 Army National Guard				25K	25K
1230/31 (Mig Birds)	40K	70K	135K	120K	111K
1260 (Refuge Ops)	2,340K	2,369K	2,243K	2,565K	2,819K
1937 (Subsistence Fisheries)			75K	272K	272K
1971 (NPS)	19K	17K	17K	25K	10K
1113 (End. Species)		15K			
Total	2,399K	2,471K	2,650K	3,007K	3,237K

Funding to operate the refuge came from a number of different sources. Reimbursable funds were provided from two different sources; the National Parks Service provided 10K to conduct a project on black scoters in support of the designated National Natural Lands Site, and the Army National Guard provided 25K for steel shot clinics and information and outreach efforts regarding the goose management plan in coastal villages.

Two Challenge Cost Share agreements were funded, one to cooperate with the World Wildlife Fund to sponsor a science camp in the village of Mekoryuk on Nunivak Island (9K), and the other with Audubon to develop outreach materials in an effort to bring attention to the ATV and snowmachine trailing problems (10K).

Three thousand dollars was received in an Equipment Rental Funds program. The funds were used for equipment needed to replace the headquarters well pump in May.

No new RONS or MMS projects were approved this fiscal year.

6. Safety

Fisheries Biologist Dave Cannon held boat safety classes for seasonal and permanent employees. After Dave's resignation, efforts were made to certify SRS Sundown as a watercraft safety instructor but course openings have been limited and to date we have no watercraft instructor on staff.

Paul Liedberg and Kenton Moos attended a week long Collateral Duty Safety Officer Course in Anchorage in November.

Occupational Safety & Health Manager Dick Stiefken visited us in August to perform safety inspections. Sights inspected included refuge facilities located in Bethel, Old Chevak, Paimute, and Kanaryarmiut.



Safety Manager Dick Stiefken (center) was joined by Chief, Program Coordination, Fred Nolke (right) to inspect, among other things, our human waste incinerator at the Kanaryarmiut field station in August. MW Victor Anvil provides support. Facility Coordinator Anne Dohmann was also on the trip. (PAL 8/02)

Bear and Firearms Safety Instructors Steve Kovach and Patrick Snow conducted bear and firearms safety training for 10 refuge staff, four volunteers, five USDA Natural Resource Conservation Service employees, one Kenai FRO employee, and two Lower Kuskokwim School District (cooperator) employees during the spring and summer of 2002.

Additionally, Kovach traveled to Kotzebue in June 2002 to conduct bear and firearms safety training for nine Selawik NWR staff members, two Selawik NWR volunteers, four National Park Service employees, and one Bureau of Land Management employee.

7. Technical Assistance

The Nuniwarmiut Reindeer and Seafood Products organization on Nunivak Island requested that a member of the refuge serve on their reindeer advisory committee. WB Steve Kovach was appointed to the committee which met once in Bethel during the year. The committee also includes representatives from BIA and NRCS.

F. HABITAT MANAGEMENT

1. General

Yukon Delta NWR encompasses approximately 19.2 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 extensive tidal wetlands are scarcely above sea level and are frequently inundated by Bering Sea tides.

The coastal plain 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.

The forces of nature were even more evident than normal this year when the Kisaralik River, which at least in recent years had been prone to overflow its banks during high water and spill into the Kasigluk River, made a major new channel that could be permanent. All summer long, and even during the low water periods, most of the water from about 20 miles above the mouth the Kisaralik drained over to the Kasigluk. The

Hoffman sport fishing camp located a bit below the new cutoff reported a major change in fishing activity on the Kisaralik - most notable being the much increased catch of northern pike. The first rafters down the Kisaralik in July had an experience they will not soon forget. Assuming the new cutoff was the main Kisaralik channel, they spent nearly 24 hours hacking their way through about two miles of brush and snags before popping out on the Kasigluk. It will be interesting to see what happens to the river next year.



A new channel developed during the year when the Kisaralik River overflowed its banks and flowed cross-country to the Kasigluk River. This photo shows the new channel with the Kisaralik in the lower right. (RS 8/02)

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 was done in 2001, Nuniwarmiut Reindeer and Seafood Products (NRSP) was contracted (\$7,000) to conduct a ground count of the reindeer and muskox herd on Nunivak Island. This effort located 4,318 reindeer and 553 muskox. This compares with

a count in 2001 of 4,251 reindeer and 595 muskox. The management plan calls for a pre-calving herd of 2,000 reindeer. Significant progress was made during the year to bring the slaughter facility back up to code so meat can be inspected and shipped out of state. A total of 888 animals were slaughtered during the 2001/2002 season. Jobe Weston was hired as the NRSP manager in 2001 and under his leadership we are hopeful that further “gains” can be made in reducing the size of the herd.



Jobe Weston, Manager of Nuniwarmiut Reindeer and Seafood Products (NRSP) on Nunivak Island reviews special use permit provisions with DRM Liedberg. Jobe has helped forge a positive relationship between the refuge and NRSP. (PS 2/02)

9. Fire Management

Year 2002 was the 19th 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.

In December an initial meeting was held with Regional FMO Larry Vanderlinden to review fire suppression levels on the refuge and discuss possible changes. At the same meeting the AVCP Forestry-Fire Specialist was briefed on our initial thoughts for significant reductions in the suppression levels assigned to refuge lands. Fire history on the refuge has been minor compared to the drier and warmer refuges that are located further upriver. This warrants a reduced level of suppression. However, with nearly 6,000,000 acres of private inholdings in the Full suppression category interspersed throughout the refuge, the initial Full and Modified levels assigned to refuge lands have never been seriously evaluated. This meeting began that process.

Fire suppression responsibilities on the refuge have been delegated to the Alaska Fire Service (AFS). 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.

The fire activity on the Yukon Delta Refuge was relatively high in 2002. A total of 3 fires were reported on the refuge that burned a total of 20,804 acres.

Fire Number 7546 was located on the Nageethluk River, 40 miles northeast of St. Marys in a modified suppression area. The fire was discovered on June 3rd. The Alaska Fire Service deployed eight smoke jumpers to the scene, and it was declared out on June 4th. The fire totaled 625 acres.

Fire Number 7517 was reported on June 18th, 59 miles NW of Bethel in a modified suppression area. The fire was monitored by the Alaska Fire Service and declared out on the 21st of July with an estimated size of 20,047 acres. A small crew was put on the fire for a few days to protect an allotment but it was otherwise unmanned.

Fire Number 7542 started on August 28th when a local resident reported a fire in a full suppression area five miles east of Chevak. Eight smoke jumpers were deployed to the area. The fire was declared out on September 5th; it totaled 132 acres. Unlike the other two fires on the refuge in 2002, which were caused naturally, this was the result of a camp fire.



Wildfire 7542 which burned 132 acres was contained by eight smokejumpers (and a solid perimeter of lakes and wetlands) after it was started by campers near the village of Chevak in August. (KM 8/03)

12. Wilderness and Special Areas

Two wilderness areas occur on the refuge, the Andreafsky Wilderness which contains approximately 1,300,000 acres, and the Nunivak Wildernesses containing approximately 600,000 acres. Both were established by ANILCA in 1980. Both are remote and receive little public use.

In 2000, the Andreafsky Wilderness and vast expanses of the refuge's coastal meadows were designated as a hemispheric reserve in the Western Hemisphere Shorebird Reserve Network (WHSRN). This is a tribute to the importance of the habitat, and to shore and water birds visiting the refuge each year numbering in the millions. Many shorebirds come to breed on refuge tundra, shorelines, and mountaintops. By August, they flock to coastal, lacustrine, and riparian mud-flats to build fat reserves for long migrations.

The Nunivak Wilderness encompasses the southern half of Nunivak Island. Volcanic in origin, the combination of eelgrass beds, cliffs, hills, low isolated mountains, buttes, tundra, and numerous shallow lakes and ponds provide habitat for nesting seabird colonies, migrating waterfowl, and a large variety of other migratory birds that nest on the island. The area is also well known for its herd of muskox, introduced from Greenland in 1935, and a large herd of reindeer, introduced in 1920. The reindeer are owned by the traditional council of Mekoryuk (the only village on the island) and graze on the refuge under a permit.

The Andreafsky River and all its headwaters, including its East Fork, were designated as a Wild and Scenic 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. There is one large game guide, Eric Williamson, who is permitted to operate out of the Andreafsky Wilderness area.

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. 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 130,000 birds since 1981. The 2002 population for emperor geese - 58,750 - was similar to the average of 59,500 since 1983. This species has not responded well to the local goose management plan, but is managing a slow increase of 2-5% annually. Cackling Canada and Pacific greater white-fronted geese numbered about 400,000 and 500,000, respectively, 30 years ago. The 2002 estimates for cacklers and whitefronts are 136,100 and 358,500, respectively. Undoubtedly, these four species have been a significant factor in shaping the coastal ecosystem.

Though there has been a reduction of geese from historical levels, the refuge still supports large numbers of ducks. The 2002 breeding pair survey indicated 1.4 million ducks on the refuge in early June. Principal species were northern pintail, greater scaup, and wigeon. Green-winged teal, mallards, northern shovelers, and scoters 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 2002 estimate was about 2,800 breeding pairs. Sea ducks in general have been declining throughout the continent; long-tailed duck and black scoter have been added to the refuge's list of species of concern.

2. Endangered and/or Threatened Species

Eskimo curlews formerly staged in both spring and fall on the tundra near St. Michael, but they have not been detected there since the 19th century. Small numbers of threatened Steller's sea lions haul out on the rocks at Cape Romanzof and on Nunivak Island. Several thousand spectacled eiders nest on the refuge, as do (at least occasionally) tiny numbers of Steller's eiders (i.e., probably < 10 pairs). Steller's eiders breeding in Alaska constitute only a small fraction of the Pacific-wintering population of Steller's eiders, most of which breeds in Russia. The waters adjacent to the refuge are extremely important to a large fraction of this Pacific population. Tens of thousands stage each spring on Kuskokwim Shoals 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 on Kuskokwim Shoals and along the shoreline of Nunivak Island. Prior to 2000, we did not know whether or not the flocks migrating and/or moulting along the refuge's coast included any individuals from the threatened Alaska-breeding population of Steller's eiders. In summer 2000, cooperators from Northern Alaska Ecological Services (NAES-FWS) and the North Slope Borough (NSB) attached satellite transmitters to four Steller's eiders at Barrow, the most well-known and predictable breeding location on Alaska's arctic coastal plain. All three that migrated south of the Seward Peninsula stopped on the Kuskokwim Shoals, and two apparently molted there. These detections were the first to explicitly link the threatened breeding population with the birds molting in the shallow waters just off the refuge coastline.

In 2001, NAES and NSB again implanted satellite transmitters in Steller's eiders at Barrow, five in males and five in females. Among the 10 birds, six occurred (and apparently molted) in the refuge's coastal waters – five at Kuskokwim Shoals and one near Cape Mendenhall on Nunivak Island. In early September, 2001, WB McCaffery and DRM Liedberg flew to Kuskokwim Shoals to estimate the number of Steller's eiders in the vicinity of the satellite locations. They found over 5,000 apparently molting birds; 95% of these were along the shoreline of a single barrier island (Kwigluk Island) or foraging over the adjacent eel grass bed. They did not locate additional eel grass beds associated with any of the other shoals or barrier islands surveyed.

Overall, there are probably at most only a few thousand pairs of Steller's eiders nesting in Alaska, with the vast majority of those on the arctic coastal plain. The combination of satellite telemetry data and the refuge's aerial survey results suggest that a significant fraction of the threatened (i.e., Alaska-breeding) population of Steller's eiders molts in the coastal waters immediately adjacent to the refuge.

In 2002, WB McCaffery co-authored "Historical and present breeding season distribution of Steller's Eiders in Alaska" (Western Birds 33:99-120) with colleagues from Alaska Department of Fish and Game, Alaska Biological Research Incorporated, and the University of California, Berkeley.

3. Waterfowl

Duck banding was again conducted in 2002 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 2002 totals.

On May 30, BT Harwood and SFWB Broerman conducted an aerial survey to document annual numbers and locations of harlequin ducks and other riparian birds along pre-established river segments in the Kilbuck Mountains. This was the ninth consecutive year for the survey. From an all time high of 374 harlequins detected in 2000, the 309 (including 125 pairs) detected this year was the lowest in five years. Survey conditions were satisfactory, ducks were well-dispersed, and snow/ice melt was markedly advanced compared to recent years.

On August 30, 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. The survey area includes 99 km of streams within the Kisaralik watershed which have been surveyed annually during late brood-rearing since 1995. Thirty-two, 25, 11, 11, 17, 23, 20, and 35 harlequin duck broods were detected in this area in the years 1995-2002, respectively. These groups included 172, 104, 50, 43, 75, 83, 94, and 150 birds (i.e., young and hens) during the same eight years, respectively.

WB McCaffery and BT Harwood collaborated on a poster, presented by SFWB Broerman, for the North American Sea Duck Joint Venture Conference in Victoria, British Columbia, on November 6. The poster summarized the refuge's nine years of Harlequin Duck data, and was entitled "Status of Harlequin Ducks in the Kilbuck Mountains, Alaska." The abstract for the poster is as follows:

There are few breeding population trend data for Harlequin Ducks in interior Alaska. Since 1994, we have conducted helicopter surveys of breeding Harlequin Ducks in the Kilbuck Mountains in southwest Alaska. In 1994, we completed a comprehensive spring inventory along 19 streams totaling 546 km. We detected 403 Harlequin Ducks on 16 of 19 streams, or 0.74 ducks/km surveyed. Limited ground truthing suggests that we may have detected only about 50% of the harlequin ducks using the surveyed streams. Each spring since 1995, we have surveyed a 181-km (33%) subset of the streams surveyed in 1994 (i.e., 73 km along the Kisaralik River and 108 km along 4 nearby streams). Since 1995, we have also conducted a fall brood survey along these same streams to estimate annual productivity. From 1994-2002, the spring population in the 181-km study area increased at an annual rate of 5%. Between 1994 and 2000, the annual rate of population growth was 8%, followed by declines in 2001 and 2002. The factors contributing to these changes are unknown. In our study area, spring population size did not predict annual production, nor did production predict changes in population size 1, 2, or 3 years later. These data suggest that variation in adult survival away from the breeding grounds may have the strongest effect on breeding population growth rates. A

few dozen parties of recreational rafters float the Kisaralik River every year, while little or no rafting occurred along the other 4 streams. Observed densities along the Kisaralik River, however, have exceeded the mean density along the other 4 streams in every year of the study. In addition, the overall population growth in the study area from 1994-2002 is strictly a function of increasing numbers along the Kisaralik; total numbers along the unrafted streams have shown no net change over the same interval. Our data suggest that current levels of recreational activity are not adversely affecting the local Harlequin Ducks breeding population.

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 25 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. 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

Shorebird Aerial Telemetry Flights

For the second year the refuge participated in a cooperative effort with Point Reyes Bird Observatory, Prince William Sound Science Center and the USGS San Francisco Bay Estuary Field Station to track the spring migration of radio-tagged shorebirds. In April of 2002, 59 western sandpipers and 29 long-billed dowitchers were radio-marked at Bahía Santa María, Sinoloa, Mexico. Frequencies of Pacific golden-plovers radio-marked on their wintering grounds in Hawaii by Dr. Oscar W. Johnson at Montana State University were also included on telemetry flights. This year's flights were done in conjunction with photographing habitats where northern pintails marked with satellite transmitters were detected on the refuge in 2001.

Flights for shorebird telemetry and northern pintail photos were conducted on May 15, 16, and 17. Three radio-tagged western sandpipers were detected on May 15.

An additional flight to track Pacific golden-plovers was conducted on June 26, 2002. Pilot Walters and SFWB Broerman headed west from Bethel toward Aropuk Lake then to Kanaryarmiut Field Camp, west over Hazen Bay, then east along the north shore of Baird Inlet, then south nearly to Dall Lake and back to Bethel without detecting any plovers.

Bar-tailed Godwit monitoring near Tern Mountain

In the first week of September, 1999 and 2001, field crews from Yukon Delta NWR and the Alaska Science Center (ASC) assessed the proportion of juveniles in flocks of bar-tailed godwits staging along the refuge's outer coast. In both years, the percentage of juveniles was <3%. Because chronic production at such low levels is probably inadequate to maintain the population, we continued field work on this project in 2002 with 3 specific questions in mind: 1) was the proportion of juveniles measured in 1999 and 2001 typical? 2) is there spatial segregation between adults and juveniles on the staging grounds? and 3) is there temporal segregation between adults and juveniles on the staging ground? To address these questions, the refuge and ASC fielded a pair of two-person crews to 1) measure the proportion of juveniles in 2002, 2) determine these age ratios at two sites separated by 150 km (Tern Mountain and the Tutakoke River mouth), and 3) determine age ratios over a four-week period from mid-August to mid-September. A secondary objective was to search for flagged godwits to increase our understanding about the non-breeding season destinations of the delta's bar-tailed godwits.

BT Sardy and Daniel Ruthrauff (ASC) were at the Tutakoke River from August 17-25, while BT Fitzpatrick and BT Spies were at Tern Mountain from August 18 to September 14; Sardy joined them at Tern Mountain in late August. Maximum single day counts at Tutakoke and Tern Mountain were ~2,000 and ~4,000, respectively. Among 11 flocks sampled at Tutakoke, the overall percentage of juveniles was 2.03; among 53 flocks at Tern Mountain, the percentage was 0.64. Pooling data among sites, the percentage of juvenile godwits in 2002 was 0.83. This value was not atypical relative to the ones in 1999 (2.83) and 2001 (0.00). Although the point estimate for the percentage of juveniles was three times higher at the Tutakoke River, both estimates were extremely low, and they were not significantly different. Finally, there was no relationship between date and the percent of juveniles in flocks between mid-August and mid-September. Because the answer to all three questions was no, our initial concerns based on the preliminary data in 1999 and 2001 have been confirmed. Field efforts in 2003 may be directed toward developing a more geographically comprehensive and statistically robust sampling protocol. At the same time, we are encouraging colleagues in Australia and New Zealand (where the staging godwits spend the non-breeding season) to conduct similar work in the Southern Hemisphere to determine if our findings in Alaska are corroborated on the non-breeding grounds.

Flagged godwits were found at both sites. At Tutakoke, there were 44 sightings of flagged birds, comprising at least 21 individuals, including ≥ 13 from southeast Australia (orange flags), ≥ 4 from northeast Australia, and ≥ 4 from New Zealand. Among these latter four birds was the first Alaskan "recovery" of a godwit banded on the South Island of New Zealand. At Tern Mountain, there were 31 observations of flagged birds, comprising at least 12 individuals, including ≥ 8 from southeast Australia, a possible from northeast Australia (but observation too distant to confirm), ≥ 1 from New Zealand, and two apparently flagged during spring migration, one from Japan and one from China.

Publications

WB McCaffery was a co-author on the Birds of North America (BNA) species account for Wandering Tattlers (2002) along with Robert E. Gill of the Alaska Science Center and Pavel Tomkovich of Moscow State University. The three authors also collaborated on the BNA account for rock sandpipers (submitted 2002, to be published 2003), and McCaffery and Gill were among four authors on the bristle-thighed curlew BNA account (also submitted 2002, to be published 2003).

6. Raptors

Nineteen 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 breeding populations of breeding golden eagles in North America. For the twelfth consecutive year, the refuge conducted a helicopter survey for cliff-nesting raptors in the Kisaralik watershed (to include the Kisaralik River and Quicksilver Creek). Along approximately 100 km of river, where 16 active cliff nests were found in 2001 (10 golden eagle, six gyrfalcon), WB McCaffery located only five active cliff nests (i.e., laying pairs) on May 3-4, including four golden eagle nests and one gyrfalcon nest, within 1.6 km of the river (study area = 320 km²). No rough-legged hawks nested in the study area in 2002.

Given this level of breeding activity (the lowest since our surveys began in 1991), the low productivity was not unexpected. Since 1998, productivity of this golden eagle population has fluctuated dramatically, generating the five most extreme years of the 12 year study. In 1998 and 2000, 17 and 21 young, respectively fledged in the study area. In both 1999 and 2001, however, only four young fledged in each year. This year was the worst ever for golden eagle productivity with only three young being fledged from a total of 23 historically occupied territories. Overall in 2001, nesting pairs, successful pairs, total fledglings, fledglings/nesting pair, and fledglings/successful pair were all below the 12-year mean.

For the third straight year, SWB Broerman and WB McCaffery completed a survey of nesting raptors in the Ingakslugwat Hills, a volcanic region which serves as an oasis of cliff-nesting habitat in the center of the delta. On May 13, they located 16 occupied raptor territories (defined as an active nest, an observed pair, or at least one adult plus evidence that a nest had been worked on this year), including six rough-legged hawk territories, three golden eagle territories, and seven gyrfalcon territories.

BT Harwood presented a poster entitled "Riparian Raptors of the Lower Yukon and Kuskokwim River Watersheds" at the Alaska Bird Conference in Fairbanks on March 6. The poster summarized raptor data from four years of surveys on the two rivers. The poster abstract is as follows:

Since 1998, Yukon Delta National Wildlife Refuge (YDNWR) personnel have conducted Breeding Bird Surveys (BBS) along sloughs and tributaries of the lower Yukon and Kuskokwim rivers. Although the project was designed primarily to monitor population trends in passerines, we have also documented 15 species of diurnal and nocturnal raptors, 8 as confirmed breeders and 2 as probable breeders. In the lower Yukon watershed in 2000 alone, we discovered 38 active nests, plus another 19 suggested by behavioral evidence. Highlights since 1998 include: (1) breeding range extension of Red-tailed "Harlan's" Hawk, (2) discovery of the only known subpopulation of tree-nesting Rough-legged Hawks in the state, (3) local breeding of Peregrine Falcons (and seeming predation therein) at a Bank Swallow colony, (4) local, clustered nesting of Ospreys on the Talbiksok River, (5) widespread breeding of Great Horned Owls beyond the spruce forest, to within 30km of Bering Sea, and (6) Northern Goshawk nesting in tall willows, <50km from Bering Sea. While the compressed survey time window (10-30 June) and brief visits to BBS stop locations (3 min/stop) have precluded exhaustive exploration and documentation of breeding raptors in the study areas, the surveys have illuminated the richness of riparian corridors on YDNWR in terms of these taxa.

BT Harwood (lead author), WB McCaffery, SFWB Broerman, and DRM Liedberg submitted a manuscript entitled, "A Local Concentration of Snowy Owls on the Yukon-Kuskokwim Delta in Summer 2000," to the *Journal of Raptor Research* in September. The summary for the paper, which is currently in review, is as follows:

The largest reported summer concentration of Snowy Owls (Nyctea scandiaca) in nearly 40 years on the Yukon-Kuskokwim Delta was documented south of Nelson Island in 2000. Abundance estimates from five aerial surveys ranged from 79 - 229 individuals in a 2545 km² study area. The presence of several juvenile owls suggested probable local breeding.

7. Other Migratory Birds

WB McCaffery represented the refuge at the North Pacific Migratory Bird Conference at Middlebury College, Vermont, September 9-13, 2002. This gathering of Russian and American ornithologists and managers reviewed accomplishments in international bird conservation over the past decade, and developed proposals and a framework for cooperative efforts in the next decade.

In 1998, the refuge initiated a widescale landbird monitoring program of the Lower Yukon and Lower Kuskokwim rivers. The purpose of the project was three-fold: (1) to develop a refuge-specific monitoring program; (2) to assist other land management units in monitoring "Species of Concern" for the Western Alaska Bioregion (now, WALU BCR [i.e., Western Alaska Lowlands/Uplands Bird Conservation Region]), and; (3) to remedy the lack of ornithological data in the study areas. Eighteen Yukon and 12 Kuskokwim breeding bird survey routes were established. Five of the Yukon routes have since been dropped (in 2000) to ensure that all routes can be completed, even in summers

with poor weather. The Yukon and Kuskokwim BBS routes are run in even- and odd-numbered years, respectively.

Able assisted by ROS Snow and RIT Sipary, BT Harwood again conducted breeding bird surveys of 13 sloughs and tributaries of the Lower Yukon River, between Paimiut and Emmonak from June 6 - 27. They completed all surveys which included 650 stops distributed over >325 river-miles. Including official surveys and incidental observations, 92 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 250 miles between Paimiut and Emmonak). Comparisons of species abundance and distribution presented here are restricted to detections made during official survey periods.

The most abundant species (based on individuals detected per stop) on the survey was northern waterthrush (2.6 individuals/stop). Northern waterthrush was also the most widespread species based on detection frequency (i.e., percentage of stops on which detected), being detected on 92% of all stops. Abundance indices for "Species of Concern" were also analyzed. The eight species for the Western Alaskan Bioregion (as determined at the 1999 Alaskan Boreal Partners in Flight Working Group meeting) include: gyrfalcon, gray-cheeked thrush, varied thrush, blackpoll warbler, golden-crowned sparrow, McKay's bunting, rusty blackbird, and hoary redpoll. It appears from detection frequencies/rates that this survey, in conjunction with the Kuskokwim BBS, can help to monitor three to four of the species (i.e., gray-cheeked thrush, varied thrush, blackpoll warbler, and probably rusty blackbird). Gyrfalcon, golden-crowned sparrow, and McKay's bunting were not detected, while no attempt was made to distinguish hoary redpoll from its congener, common redpoll, either visually or audibly.

Publications

WB McCaffery was a co-author on the Birds of North America (BNA) species account for bluethroats (2002) along with Michael J. Guzy from the University of Wisconsin-Madison. He and his wife also presented a paper at the Alaska Bird Conference in Fairbanks (see following abstract).

Double-brooding passerines in western Alaska (paper presented by Brian J. McCaffery and Christine V. McCaffery at the 9th Alaska Bird Conference, Fairbanks, March 2002)

At temperate latitudes, many passerines attempt to produce multiple broods within a single breeding season. The prevalence of such behavior at higher latitudes, however, is poorly documented. At Cape Romanzof, Alaska, we individually color-banded, and confirmed double-brooding in, 3 taxa. Double-brooding was documented once in both Fox Sparrows and redpolls. Second clutches in these species were initiated ≤ 8 and 6 days, respectively, after their first broods fledged. In Golden-crowned Sparrows, 5 of 7 pairs renested, including 4 that had fledged young from their first nest; 3 of these 4

fledged young from their second nests. Second clutch initiations in this species ranged from ≤ 3 -5 days after first broods fledged. Among re-nesting pairs, males provided most post-fledging parental care for first broods, but some females continued to provision first broods as late as the first day of second clutch initiation. Although a mean of 2.83 young fledged per nest attempt, re-nesting (to include double-brooding) resulted in 4.86 young fledged per nesting female. The incidence of re-nesting at Cape Romanzof in a year characterized by delayed snow melt and late nest initiation suggests double-brooding may be a regular tactic among some subarctic passerines. Efforts to model passerine population dynamics and habitat quality must recognize this type of variation; even at high latitudes, nest success alone is probably an insufficient metric of reproductive success for some species.

8. Game Animals

Moose

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.

Two census units have been identified on the refuge (one along the Yukon River, divided into three areas; one along the Kuskokwim River and Kilbuck Mountains, divide into two areas). The refuge, in cooperation with ADF&G, attempts to conduct one census each winter (Kuskokwim River/Kilbuck Mountains in even numbered years). 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, 1997, and 2001 prevented surveys from being conducted those years.

In 2002 we managed to complete the census for the entire Yukon River census unit and the Kuskokwim River area portion of the Kuskokwim/Kilbuck census unit before losing out to deteriorating weather. ADF&G provided funding for one contract A-1B Husky; the refuge provided funding for one contract PA-18 Supercub and two service A-1B Husky's (one from this refuge and one from Alaska Peninsula/Becharof NWR).

The census effort began on February 21st in the upper segment of the Yukon River census unit. Poor weather hampered flying for several days and then relented. The census effort ended on March 7th. The Yukon census unit encompassed 4,318 mi²; 70.4 hours of flight

time was required to cover the 1,214 mi² actually sampled. The Kuskokwim River area encompassed 907 mi² and required 19.9 hours to cover the 384.5 mi² actually sampled. In the Yukon River unit 1,677 moose were observed; the population was estimated at 3,476 moose (Table G.1). One hundred eight moose were observed in the Kuskokwim River area resulting in an estimated population of 117 moose (Table G.1).

Table G.1. Moose census results for Yukon Delta NWR, 21 February - 7 March 2002.

Area	Observed	Estimated Population	90% CI	Average Density ¹
Yukon River				
Paimiut	1,069	2,383	2,060 - 2,705	1.5
Andreafsky	257	419	340 - 498	0.3
Lowest	351	674	550 - 798	0.6
Kuskokwim/Kilbuck				
Kuskokwim	108	117	99 - 135	0.1

¹ number of moose/mi²

These results indicate that moose in the Yukon River unit are continuing to expand in number. The greatest increases occurred in the Lowest area. In fact, the estimated population and average density are nearly at the upper limit estimated for the this area two years ago; obviously, the carrying capacity estimate needs to be reviewed. For the Kuskokwim River area, the census results show virtually no change from the 2000 census (e.g., estimated 84 moose with a 90% CI of 67 - 105). Distribution of moose in the Kuskokwim River area was largely unchanged from that recorded during the 2000 census.

Caribou

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 last 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 Mulchatna Caribou Herd (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 15 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 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 was 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 supported the hypothesis of a distinct, resident herd, significant increases in numbers and radio telemetry observations have documented annual mixing with the MCH since 1995. It now appears that the KCH has been completely assimilated by the MCH. Survey efforts over the last four years have failed to locate what could be considered calving grounds in the Kilbuck Mountains. Beginning in 2002 all caribou in southwest Alaska were managed as a single entity. Recent analysis of all available data for caribou in southwest Alaska provide arguments that management by herds, as traditionally defined by calving area, may in fact be an inappropriate approach to caribou management.

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 U.S. Fish and Wildlife Service 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. Each year dead whales wash up on the coastline of the refuge which provide caron for arctic foxes and other wildlife.

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. 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.

11. Fisheries Resources

Including the Bering Sea, refuge waters provide habitat for at least 40 species of fishes. The Yukon and Kuskokwim rivers, which flow through the refuge, support regionally and internationally significant salmon fisheries. Salmon originating from refuge streams contribute substantially to the commercial or subsistence harvests of chinook, chum, coho and sockeye salmon in Kuskokwim Bay, Norton Sound, the lower Yukon and Kuskokwim rivers. Yukon-Kuskokwim origin salmon also contribute to the commercial harvests (harvested incidentally in the sockeye fishery) in the Area M and False Pass fisheries of the Alaska Peninsula and bycatch from the North Pacific groundfish fisheries; unfortunately, the extent of contribution is presently unknown and has been a highly controversial management concern. Other important freshwater resident species include several species of whitefish, sheefish, Alaska blackfish, burbot, northern pike, Dolly Varden and grayling. Nearshore ocean habitats harbor Pacific herring, halibut, tomcod and starry flounder.

Over the past decade, southwestern Alaska experienced several severe economic and social hardships as a consequence of unusually poor salmon runs; unfortunately, this year was no different. It's believed that significant atmospheric and oceanic changes, such as warmer water temperatures (up to 10°F), lighter winds, reduced currents, lower levels of nutrient upwelling, and algal blooms in the North Pacific Ocean and Bering Sea during 1997 and 1998, had profound effects on the entire marine ecosystem. This resulted in a reduced food base for developing juvenile and maturing adult salmon. Besides the 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. Considering that many of the salmon species spend three to five years in the ocean and the time it takes for stocks to rebuild, it'll be many years before we can hope for near "normal" returns. These conditions demonstrate how complicated ecosystems can be, and that far-off environmental influences can have significant implications 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. Escapement is the term used for the number of fish returning each season to spawn future generations. Successful management requires accurate and timely knowledge about run timing and strength, commercial and subsistence harvest levels, and escapement levels. Within these drainages are numerous projects operated individually

by federal and state agencies or private organizations, or through cooperative efforts. Unfortunately, despite the complexity and size 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.

Perpetuating healthy salmon runs are 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. However, the following results do not bode well for future returns of salmon into refuge streams.

Yukon River Drainage - East Fork Andreafsky River Salmon Escapement Project

The East Fork of the Andreafsky River weir was operated again by the Kenai Fisheries Resource Office (FRO) in 2002. However, the office did go through a name change and is now called the Kenai Fish & Wildlife Field Office. The weir facilitates monitoring of refuge spawning salmon stocks and other resident species. Scale samples, pattern analysis, age/sex/length, run timing and abundance data, all data are also collected from fish caught at the weir. All data are shared with ADF&G who uses the information for managing the commercial and subsistence chinook and summer chum salmon fisheries in the Yukon River. This information is also used in the Yukon River Joint Technical Committee U.S./Canada Pacific Salmon Treaty negotiations.

This summer the weir operated from June 19 to September 14. For summer chum salmon, 2002 escapement at the Andreafsky weir fell below average. The cumulative count of summer chum totaled 44,194. While escapement was below average, it should be noted that escapement during 2002 was higher than 1999, 2000, and 2001. The range of escapement data between 1994 and 2000 is 22,918 to 200,981.

In 2003 this project will be turned over to the Fairbanks Fish and Wildlife Field Office so that all Yukon River projects are coordinated by one station.

Kuskokwim River Tributary Salmon Escapement Projects

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 primarily directed at chum and coho salmon, while chinook salmon are the principal target of subsistence users. Substantial numbers of chinook and sockeye salmon however are taken incidentally by the commercial fishermen. Throughout the

Kuskokwim River drainage, the combined annual commercial and subsistence harvests have been as high as 1.5 million chum, 100,000+ chinook, and 900,000+ coho. Considering these high exploitation rates, there is very little information available regarding fish populations and their status in the lower Kuskokwim River, in particular on refuge waters. 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 Aniak and McGrath. These relatively few projects are considered indexes, and are intended to be indicative of what populations are doing throughout the drainage.

Kwethluk River Weir

The Kwethluk weir was one of two salmon monitoring projects administered by the Kenai Fish & Wildlife Field Office on the refuge in the Kuskokwim drainage. These projects are used to assess run abundance, run timing, and age and sex composition of the returning salmon. This project was funded by federal subsistence dollars which came about due to the Federal Government acquiring responsibility for fisheries subsistence management on federal waters in 1999. This was the third year that the weir was operated in cooperation with the Native Village of Kwethluk. The target date for installation is mid June, just prior to when the king and chum salmon begin entering the tributaries (king and chum salmon runs peak about the second week of July). The weir was operated between June 28 and September 13 and closed after enumerating the later returning coho salmon whose numbers peak during the last half of August.

The 2002 season was considered an average to above average year for commercial and subsistence harvests, with over half of the escapement projects throughout the entire drainage reaching escapement goals. For the second season the subsistence fishery was reduced from seven days a week to four days a week. However, the schedule was lifted on June 28 when adequate escapement was forecasted and a commercial season was opened. It's believed that these management decisions contributed to the better than expected escapement for chum and king salmon in the entire drainage. There was a limited commercial fishing season for coho salmon. A total of 113,199 coho were harvested, well below the 10 year average of 501,018.

Table G.2. Fish passage at the Kwethluk River weir.

Year	Chinook	Chum	Sockeye	Pink	Coho
1992	9,675	30,596	1,316	45,952	45,605
2000	3,547	11,691	1,049	1,407*	25,610
2001	129(p)	353(p)	67(p)	102(p)	19,196(p)
2002	8,390	34,678	272	1,415	23,244

(p) Partial Count

*The spacing of the pickets on the weir in 2000 were a little further apart than what was in place in 1992, this allowed many of the pink salmon to squirt through without being counted. However, since 2000 was an even numbered year (pink runs are strong), and if it was close to being a “normal” sized run, more pinks should have used the counting chute. This low return is cause for alarm, not only for pinks but for the chinook, chum and coho because of the marine derived nutrients which pink salmon provide to the entire ecosystem.



Coho smolt remain in the river for a full year before migrating out to the ocean. The extended period of time spent in the river by these fish requires an abundant supply of nutrients for survival. A significant amount of these nutrients come from decomposing salmon carcasses. (RS 8/03)

Tuluksak River Weir

A weir administered by the Kenai Fish & Wildlife Field Office had been used in the Tuluksak River between 1991-1994, however, due to the local perception that weirs killed fish, the Village of Tuluksak insisted that it be removed. After negotiations with the village in 2000, approval was given to the refuge to reinstall the weir. Funding for the weir was obtained through the Office of Subsistence Management (OSM). The Kenai FRO fabricated and operated the weir in conjunction with the Native Village of Tuluksak. During 2002 the weir was in place on June 12th and removed September 10th.

Table G.3. Fish passage at the Tuluksak River weir.

Year	Chinook	Chum	Sockeye	Pink	Coho
1991	697	7,675	34	392	4,651
1992	1,083	11,183	129	2,470	7,501
1993	2,218	13,804	88	210	8,328
1994	2,917	15,724	82	3,488	7,953
2001(p)	777(p)	17,599(p)	131(p)	45(p)	10,430(p)
2002	1,341	9,958	82	27	11,487

(p) Partial Count



In an attempt to increase the flow of water through the trap on the Tuluksak River weir during a low-water period, temporary wings were placed upriver of the trap. The effort yielded some success. (TR 7/03)

Whitefish Lake Outlet Weir

For years, local residents of the Aniak area complained that whitefish numbers in Whitefish Lake have been declining, and saying that the decline was due to downriver fishermen catching too many fish who sell them commercially. Whitefish Lake is an important subsistence fishery, and the number of fishers, amount of harvest, and fish populations are unknown.

Three species of whitefishes of the subfamily Coregoninae inhabit Whitefish Lake, humpback *Coregonus pidschian*, broad *C. nasus*, and least cisco *C. sardinella*. Of the three species, humpback whitefish were most common, followed by least cisco then broad whitefish.

This project which began in 2001 continued in 2002 with enumeration of various species of whitefish as well as other scientific samples. The weir became operational on June 16, 2002 and operated through September 28, 2002. A total of 59,004 fish were counted through the pickets. Of these 32,003 were humpback whitefish, 26,194 least cisco, and 147 broad whitefish. Other fish counted included 198 northern pike, 24 long-nosed suckers, 17 coho salmon, one chum salmon, and one sockeye salmon.

Floy tags were placed on 5,470 humpbacks, 1,872 least cisco, and 31 broad whitefish. Lengths, sex, stage of maturity, scales and otoliths were taken from many of the lake's subsistence caught fishes. During the season there were tags recovered at the weir. They included nine humpbacks from the 2001 (89 tagged). Tagged fish were recovered in various places such as Tuluksak, Red Devil, Kalskag, and Aniak. The range of age for each species were as follows and were determined by otolith and scale pattern analysis; 4-9 years for broad, 7-21 years for humpback.

Kwethluk River Radio Telemetry Project

The locations and movements of 49 rainbow trout were monitored within the Kwethluk River via 22 aerial flights and one winter (February 6-8) ground tracking survey. In October of 2001 a fixed receiver was placed at the base of Three Step Mountain to record fish movements past this point. This site was located at the lower end of the study, and downstream of any of the tagged fish. Neither the aerial surveys nor the fixed receiver detected any tagged fish moving downstream into the slower deeper water to suspected overwintering areas. The fixed receiver was removed in late March and then reinstalled at the base of Elbow Mountain on May 15 in hopes of detecting upstream movement of tagged fish to potential spawning areas. The fixed receiver was then removed from the Elbow Mountain location on July 11. No upstream or downstream movements of fish were detected by the receiver.

Preliminary data analysis show no substantial movement of fish within the study area. The furthest distance that a tagged fish moved during 2001 was approximately seven

miles. As mentioned in the Investigation Plan, rainbow trout from other telemetry studies in Southwest Alaska have moved as far as 48 miles. However, most relatively large movements were associated with river systems containing large lakes which provided overwintering habitat. In the spring of 2002 (between May 11-28), only two of the study fish moved up into Crooked Creek and are thought to have spawned there.

16. Marking and Banding

The USGS-BRD banded 429 cackling Canada geese near Old Chevak in July as part of their demographic study. Refuge personnel banded 260 cacklers at a site on the Aknerkochik River 55 km southeast of Chevak.

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 August 10-24. Waterfowl concentration areas were baited with whole corn and birds were captured using clover-leaf, swim-in traps. A total of 935 northern pintails, 104 green-winged teal, and 5 mallards were banded by refuge staff. One, one, two, one, one, two, and four pintails banded at Kgun Lake in 1995, 1996, 1997, 1998, 1999, 2000, and 2001, respectively, were recaptured in 2002. Two of these 12 birds were banded as AHY males, six as AHY females, one as a HY male, and three as HY females. The only other recapture was a pintail banded in Alberta in 1996 as a HY female.

Table G.4. Total numbers, age, and sex of waterfowl leg and/or neck-banded under station permit on Yukon Delta NWR, 2002.

Species	Age and Sex					Total
	AHY-M*	AHY-F	HY-M	HY-F	Unk.	
Cackling Canada geese	133	127	0	0	0	260
Northern pintail	228	240	209	258	0	935
Green-winged teal	36	14	23	31	0	104
Mallard	3	1	0	1	0	5

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

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 2002 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 school programs during the year, discussing the Goose Management Plan and other refuge issues with students. While in the villages, they presented programs to an estimated 2,100 community school and council members.

Waterfowl (Goose) Calendar Contest

Since the first calendar was published in 1985, the calendar contest has helped facilitate the refuge outreach and educational effort. This year the calendar has a new name. The Goose Calendar (GC) is now formally called the Waterfowl Calendar. The calendar has been credited with successfully focusing on conservation, education and management efforts to reverse the decline four species of geese. The focus now is on all waterfowl particularly the two threatened species of sea ducks - the Steller's and spectacled eiders.

The number of schools participating in 2002 calendar contest was up significantly from 21 in 2001 to 25 in 2002. However, the number of students participating was down slightly from 810 combined entries in 2001 to 785 combined entries in 2002. Of the seven refuges and their schools that enter the contest, the Yukon Delta Refuge typically has the most entries and subsequently the most winners. This year turned out to be a banner year for refuge winners. Both of the grand prize poster and literature winning entries were from villages associated with this refuge. Three other refuge regional entries won at the state level; a second place winner in grades K-2 poster, first place winner in grade 9-12 poster, and a first place winner in grade 6-8 literature. The two Grand Prize winners were Gia Seo, grade 3-5 from Bethel for her literature entry, and Zach Kameroff, grade 9-12 from Emmonak for his poster entry.

The judges for the regional judging here in Bethel were Nita Rearden from LKSD, Bing Santamore from the Association of Village Council Presidents (AVCP), Johnny Nick, a local Native artist, Sharon Takumjenak from the City of Bethel, and Martha Glore from the University of Alaska Fairbanks (UAF). Contributors for the 2002 calendar were Ducks Unlimited, Incorporated, National Fish and Wildlife Foundation, National Audubon of Alaska, the Association of Village Council Presidents, and Alaska Rural Systemic Initiative.

Approximately 7,500 calendars were distributed to school children, village councils, local businesses, and community members throughout the delta.

2. Outdoor Classrooms--Students

The refuge participated in the Bethel Regional High School Career Days in October. WB Jody Oyen spent one and one-half days speaking to local and village high school students about her job as a wildlife biologist and careers within the Fish and Wildlife Service. Jody also spoke about refuge fish weirs, waterfowl projects and moose and bear research. DRM Paul Liedberg spoke to the Lower Kuskokwim School District junior class students about FWS careers and job opportunities.

In October, WB Brian McCaffery gave a 45 minute talk to 36 students at Mikelnquut Elitnaviat Elementary School on "The Wonders of Birds".

Again this year, ES Donna Hanley guided two bird walks for "kids only" ages five to eleven during International Migratory Bird Day (IMBD) celebration in May.

Also in May, as part of the Audubon Bird Academy hosted by the refuge, 60 fifth and sixth grade students participated in two full days of both indoor and outdoor activities learning about birds and birds species found on the refuge.

Steel shot clinics were held in Newtok and Chefnak in August and September with a total of 36 participants. SRS Robert Sundown was the main instructor with RIT James Sipary, AI Jacob Isaac and NCR Louie Andrew assisting.

Throughout the year RIT Michael Jimmy hosted a number of school groups in the visitor center and offered several 15-30 minute information and education programs. An estimated 508 school children attended, up from last year's total of 450 .

WWF Challenge Cost Share Grant (CCS)

This year three partners - World Wildlife Fund (WWF), Cuvrillrit Ilikluteng, and the refuge - successfully completed a CCS that enhanced community stewardship in the refuge and surrounding areas by involving and training young people from Mekoryuk in scientific and environmental projects. Through this program a team of specialists including SFWB Fred Broerman and WWF Education Specialist Luise Wolflein worked with a village based educator, a village elder, a group of eight students for several days teaching them data collection methods, journaling techniques, mapping skills, and core ecological concepts. With supervision and guidance from the participating adult staff, students used the data they collected and prepared an exhibit to share their findings with their community. The student's data will also serve as baseline information for monitoring long term change on the island.



SWB Fred Broerman assisted the World Wildlife Fund and Cuvrillrit Ilikluteng with hosting a science camp for students from Mekoryuk. Funding for the refuge portion of this initiative came from the Challenge Cost Share program. (FB 6/02)

3. Outdoor Classrooms--Teachers

Back by popular demand again this year, the refuge hosted several "Wildlife in the Classroom" workshops for local and village school administrators and teachers. The workshops, organized and taught by ES Donna Hanley, consisted of two days of training in activities pulled from both previously developed wildlife curriculum and newly developed curriculum. The newer curriculum reflects conservation and resource issues related to the Yukon Delta NWR covering topics such as cow moose, lead shot, off road vehicles, and salmon. In January, 25 Lower Yukon School District (LYSD) principals and administrators attended a two day workshop. Education Specialist Laurel Devaney from Fairbanks Fish and Wildlife Field Office assisted with the salmon in the classroom presentations.

In April, ES Donna Hanley traveled to Alakanuk and Mountain Village to offer the workshops to LYSD administrative staff and bilingual teachers. Similar workshops were also conducted in March, April, and August to all five school districts within the refuge. The LKSD, LYSD, Kuspuk, Yupiit and Kashunamiut (Chevak) school district curriculum developers, administrative staff and teachers participated. RIT's Michael Jimmy, Leo Moses, and Evan Polty spoke to participants describing their jobs and explained their I & E program. In addition, a Kilbuk school teacher and one of the visitor center volunteers, Amelia Savinova, spoke to the LKSD and LYSD administrators on how she has

successfully integrated wildlife curriculum into her classroom. In 2002 over 60 school district administrators attended these workshops. As planned, these administrators are teaching their teachers the refuge curriculum and asking them to teach it to their students. The refuge related wildlife curriculum is being incorporated as part of the mainstream curriculum of the village classrooms, disseminating the curriculum into not only science classes but also in reading and math classes.

In May, the refuge hosted our first Audubon Bird Academy co-sponsored by Audubon of Alaska. Instructors for the teachers were Bucky Dennerlein from Audubon and ES Donna Hanley. Fourteen local and village teachers attended a weekend of training while earning one hour college course credit. The course consisted of four main parts: overview of the refuge, it's history, current refuge related bird research and conservation issues, as well as bird ecology as it relates to the bird species found on the refuge.

6. Interpretive Exhibits/Demonstrations

The refuge visitor center is known as a location in Bethel for learning about refuge big game, birds, fish, plants and wildlife habitat, as well as Yup'ik culture. According to our guest register we had over 1,670 visitors. This is more than double of the 500 visitors we recorded in 2000 and 300 more than recorded in 2001. The steady increase is most likely due to: 1) improved record keeping, 2) being open on Saturdays, 3) volunteers offering more interpretive talks during the year, 4) the presentations of RIT Michael Jimmy, and 5) hosting of LKSD Open House. Eighty per cent of the visitors have local addresses with the remainder coming from Anchorage and the lower 48. During 2002 several interpretive programs were offered that were either planned for the public or spontaneously presented by the visitor center volunteers. A popular program that attracts larger numbers of visitors each year is the "Tundra Plant Walk and Talk" which includes a 30 minute slide show of tundra plants pointing out each plants nutritional/medicinal values and a guided tour of the plants outside the office. This program was offered by visitor center volunteers Ellen Gladys and Amelia Savinova in both the spring and fall. The four Saturday talks drew an enthusiastic total attendance of over 120 local residents and visitors.



The refuge got a head start on publicizing the Refuge Centennial by taking part in the Fourth of July parade in Bethel. (DH 4/02)

7. Other Interpretive Programs

Refuge Information Technicians Program

The major public relations activity in 2002 continued to be the information and education efforts associated with the Y-K Delta Goose Management Plan and the four goose species and the two ducks of concern - the spectacled and Steller's eiders. The Refuge Information Technicians (RIT) conducted school programs during the year, discussing the Plan and other refuge issues with students. They presented programs to 2100 community school and council members.

Assistant Interpreter Jacob Isaac and RIT James Sipary attended the Steel Shot Instructors training course in Anchorage during the last week of August and are certified as instructors.

The first week of December, the RIT's attended the first ever RIT annual meeting held in conjunction with the Outreach Conference in Anchorage. The main theme of the conference was to provide the employee the tools and skills necessary to use outreach as an effective resource management tool. This may become an annual event.

Guided Bird Walks

Using IMBD as a cornerstone event, we extended the celebration and awareness of migratory birds arriving in Bethel by offering guided bird walks on the weekends throughout the month of May and June. Bird walks were led by ES Donna Hanley, and assisted by volunteer Christine McCaffery, WB Brian McCaffery, and SFWB Fred Broerman. The average attendance per bird walk was 10 and the average number of species sighted was 27.



Bird walks were sponsored by the refuge again during May and early June. These walks have become very popular and garnered enough of a following to start an Audubon chapter in Bethel. (DH 5/02)

8. Hunting

Moose Check Station

After sixteen years of operating the moose hunter check station near Paimuit on the Yukon River, the ADF&G and the refuge ceased manning the station this year. Recent years have seen a decrease in hunters bringing harvested moose to the check station. ROS Kenton Moos did assist Phil Perry (ADF&G) with moose hunter checks on the Kuskokwim River below Kalskag for three days in late September.

Two registered big game guides - Ed Shavings and Fred Don - have traditionally taken out hunters in need of those services on Nunivak Island. However, in the past several years two transporters working on the island - Abe David and Charlie Spud - have taken

an increasing 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 negligible, while that which may occur on Nelson Island is unknown.

The reported harvest of caribou and moose is unreliable at best. Harvest tags are required for all caribou and moose hunts in game management units which are encompassed by the refuge borders, although many harvested animals go unreported. Caribou, most likely from the Western Arctic Caribou Herd occasionally enter the refuge through the Nulato Hills in the north, but only a small number are available for harvest. In recent years the majority of caribou which are available for harvest on the refuge are members of the Mulchatna Caribou Herd. This herd has increased its migration into the eastern portion of the refuge during the fall in recent years.

The past couple years have seen an influx of the Mulchatna Caribou Herd into Game Management Unit 18 in late August and early September; however, few caribou have been seen this fall. We think this may be a result of lack of snow and unseasonably warm weather but are not sure why the caribou have not shown up and are not sure where the herd is located.

Transporter and Guide Activity

Big game guides reported taking the following animals as part of their operations on the refuge in 2002.

	Clients	Days Hunted	Species Taken
Ed Shavings Sr., Nunivak Island Guide Service	10	11	10 muskox
Fred Don Sr., Nunivak Outfitters	11	12	11 muskox
Bob Adams, Adams Guide Service	-	-	-
Eruk Williamson, Eruk's Wilderness Floats	-	-	-

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

Abe David, Nunivak Island Experiences	12	21	12 muskox
Charlie Spud, Spud's Transporting and Tendering	7	9	7 muskox
Steve Williams, Ptarmigan Air	35	70	1 wolf
			44 caribou

9. Fishing

With an estimated 500,000 lakes and ponds, and the two largest river systems in the state running through the refuge, sport, commercial, 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 among the less used fishing waters (i.e., the Kwethluk, Kasigluk, and Kisaralik Rivers). Rainbow trout, Dolly Varden, grayling, pike, and five species of salmon are sought by sport fishers. Burbot, Alaska blackfish, herring, sheefish (inconnu), and sticklebacks are all harvested at various levels for subsistence. During the winter months, ice fishing for pike and whitefish occurs on many of the region's lakes and rivers to fulfill subsistence needs.

Subsistence Fishing

The population of the Yukon-Kuskokwim Delta is among the largest of any similar Native/aboriginal occupied region in Alaska. It's estimated that over 50 percent of all of the state's rural subsistence fishing activities occur within the Yukon and Kuskokwim River drainages, much of which are located within the refuge's boundary. Fish play an important part in the subsistence cash economy. According to an Alaska Department of Fish & Game (subsistence division) study, fish can account for 70-85 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 substantial quantities of several whitefish species, northern pike, sheefish, Alaska blackfish, burbot, rainbow smelt and Pacific herring are also harvested. As evidenced by the following discussion, the majority of management effort and most available subsistence information pertains to salmon while very little is 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. There is a desire by the state and refuge to conduct studies for these species, but the reality is that salmon will always overshadow the so called less significant species.

For the third year in a row, salmon subsistence fishing restrictions were imposed on the Kuskokwim River to conserve chinook and chum salmon. Going into the 2002 season, both the state and federal managers agreed to implement a subsistence schedule that allowed salmon fishing for four consecutive days per week. This schedule was lifted on June 28 when in-season indicators suggested that escapement and subsistence needs would be met. Subsistence harvest in the entire Kuskokwim River drainage for chinook salmon alone generally ranges between 85,000 and 90,000 fish, most of which (90%) are taken from the lower section of river within the refuge's boundary. Actual 2002 harvest numbers become available in late spring of 2003.

The schedule for the lower Yukon going into the season was two 36-hour periods per week. Numbers of salmon harvested in 2002 are not yet available.

Commercial Fishing

The commercial harvest of salmon originating from refuge rivers is of economic and nutritional importance to local residents of the Y-K Delta. Commercial salmon fisheries within the refuge are concentrated in the mainstem rivers, and along the western coastline and Nunivak Island for Pacific herring and halibut. 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 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. In both river systems, the majority of commercial effort (approximately 75% in the Yukon and 90% in the Kuskokwim) occurs within their lower sections which lie within the refuge's external boundary.

Due to the recent poor returns of chums and kings in the Kuskokwim River, the economic significance of coho salmon has steadily grown. Although the coho's importance continues to escalate, 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. As noted in Section G.11, there is concern with this year's low escapement of approximately 23,244 coho into the Kwethluk River, and last year's return of only 19,196.

The commercial coho catches in 2001 and 2002 were 192,998 and 83,463, respectively, well below the ten year average of 500,000.

There is a long existing directed commercial fishery for king and summer chum salmon on the Lower Yukon within the boundaries of the refuge. The commercial catch for salmon in fishing district Y1 was 11,581 king salmon and 6,507 summer chum. In district Y2 the commercial catch was 11,468 king salmon and 4,065 chum salmon.

Pacific herring are harvested in four commercial districts along the refuge coast: Cape Avinof, Cape Romanzof, Nelson and Nunivak Islands, all of which are in the State's Arctic-Yukon-Kuskokwim (AYK) Region and within the refuge. The average price paid to fishers for herring with 10% roe content was \$100-150 per ton, compared to \$200 per ton in 2000 and \$200-\$500 per ton in 1999. The total harvests in 2002 for the following areas were Cape Avinof with 79 tons, Nelson Island with 950 tons, Nunivak Island with 176 tons, and Cape Romanzof with 100 tons.

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 (inconnu) 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 Andreadsky. Regional and national publications have recently featured articles which promote fishing and floating some of these waters. Proactive management will be necessary to protect resident fish populations and fulfill management obligations.

There are several local outfitters operating mainly on the Kwethluk and Kisaralik rivers. They include Pa Pa Bear Adventures, an outfitter that co-owns Ptarmigan Air Service that flies clients to the headwaters of Kuskokwim tributaries. Also operating on Kuskokwim River tributaries is Kuskokwim Wilderness Adventures which guide clients on the Kwethluk and Kisaralik rivers. On the Northern fringe of the refuge several guides operate out of the Aniak to guide on the Aniak River. They include Alaska Dream Lodge, Morning Peace, Aniak Air Guides, Aniak River Lodge, and Rough & Ready Guiding Service.

10. Trapping

Furbearer trapping continues to be a supplemental source of income for a number of local residents. Trappers in the region have suffered diminished income from the depressed fur prices in recent years. Trappers focus their efforts on beaver, otter, mink, fox, and muskrat. Other species such as wolf, wolverine, marten, and lynx are also highly sought. Trapping success during the past five years continues to be well below historical average harvest, mainly due to depressed fur prices.

Only five species of furbearer are required to be sealed by the State of Alaska. Many of the furbearers, especially beaver and land otter, are crafted into hats, mittens, etc. and used or sold in the local area. Harvest information provided to ADF&G based on sealing requirements are most likely under-representative of the actual harvested population.

11. Wildlife Observation

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. Snowmachines are used heavily, both for recreational and subsistence uses. 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, damages the surface vegetation, leaving ruts and many obvious trails. The regulations state, in essence, that snow machines are allowed as long as there is adequate snow cover to prevent resource damage. Snow machine 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 snow machines 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 19,000,000 acres of refuge land, the regulation is difficult at best to enforce. Our practice has been to focus on enforcement of the gross misuse of the machines. This year we are initiating an information and education campaign aimed at highlighting the habitat destruction the machines cause.

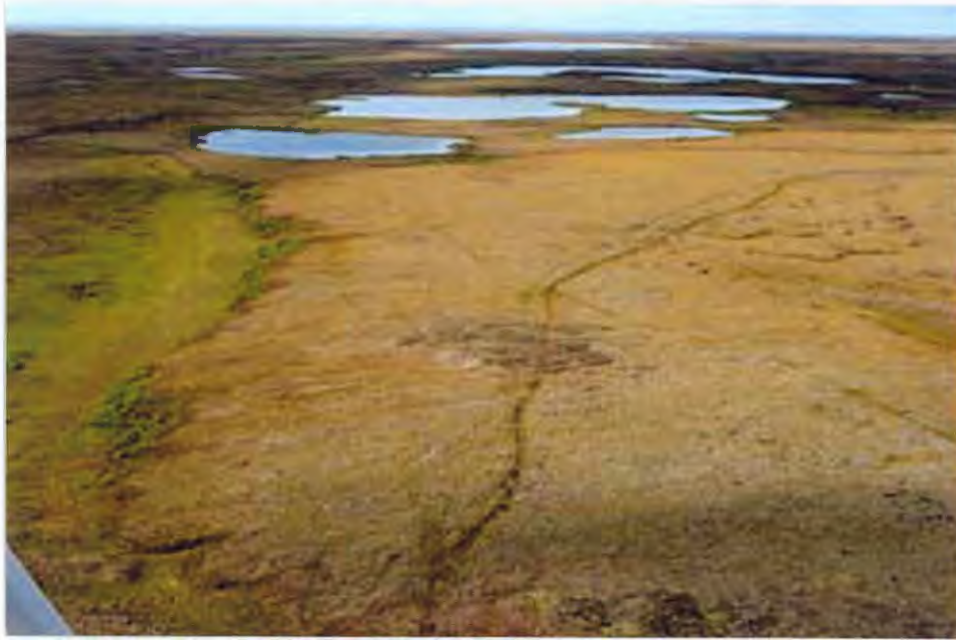
ATV/ORV Poster

The refuge is developing, with Alaska Department of Transportation and Public Facilities (ADOT) funding, an educational ATV and snow machine poster. The poster will serve as primary mitigation for wetland impacts expected from the upcoming relocation of the Alakanuk Airport in the Yukon River Delta. It will be approximately 8 1/2" X 11", printed in full color and translated in Yup'ik and Chup'ik. The poster production is part of a larger education program on the same topic currently being developed by the refuge. The poster was originally scheduled to be completed last year. Funding was released at the end of this year so completion is now scheduled for FY 03.

ATV's/ORV's and the Tundra Challenge Cost Share (CCS) Grant

Beginning this year and continuing next year three partners- Audubon of Alaska, The Nature Conservancy of Alaska and the YDNWR - have planned and begun implementing a project to raise public awareness of the environmental impact of riding all terrain vehicles (ATV's) and snow machines over tundra and wetlands. It is intended that the publication will discourage ATV and snow machine traffic through sensitive habitats, such as high-density waterfowl nesting areas in the refuge. The group has compiled information and educational materials on the impacts of ATV and snow machine traffic on tundra and wetlands and designed a short comic book that summarizes and illustrates concerns about ATV and snow machine traffic. George Smart, a Hooper Bay resident and Native artist is completing the pencil sketches of the comic book. Yet to be

completed are the translation of the comic book into Yup'ik by Native linguists Sophie and Oscar Alexie.



Trails made by traveling with snowmachines when there is little or no snow cover are becoming more and more common throughout the Y-K Delta. Most of the worst trails are on village corporation lands but it is only a matter of time before the same occurs on the refuge. (RS 6/02)

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 year once again proved to be a very busy year for law enforcement (LE). The number of officers on staff varied throughout the year due to transfers and other personnel actions. ROS Peltola transferred to Selawik NWR in early January. SRS Sundown completed his FLETC training on March 18th and attended ROBS in early May.

ROS Moos arrived in mid June bringing the number of officers to three on staff including DRM Liedberg. A selection for our full time officer position was made for the second time; however, after initially accepting the position, the individual later turned it down. This position was readvertised and will hopefully be filled early next year. The new Refuge Officer position is funded by the subsistence fisheries program.

Spring waterfowl LE patrols were conducted for the second year by DRM Liedberg in the village of Kongiganak. Two Notices of Violation (NOV's) were issued for possession of lead shot. Jimmy Andrew was hired again to serve as a guide and interpreter for the assignment. A house and snowmachine were rented from village residents. This effort has proven to be a significant success in relations with the south coast villages not to mention the increased compliance of hunters from this area. Patrols were also conducted along the coast by Sundown and Liedberg in an effort to contact hunters returning to their village from hunting walrus, seals, and eiders.

Other spring waterfowl LE efforts included Special Agent Wade from Nome conducting patrols from Bethel to the Baird Inlet by airplane. An observation of interest was the heavy hunting pressure placed on black scoters by hunters west of the tundra villages.



Refuge Officers contacted hunters on the coast when they returned with their boats from hunting walrus, seal, and eiders. (RS 4/02)



We assume the imaginative owner of this boat was really into black scoter hunting.
(RS 6/02)



Waterfowl hunters in June peel back the vegetative layer of the tundra and store their birds where the cool ground can preserve them. (MW 6/02)

This marked the second year of fishing regulations which limited the subsistence fishing for the Yukon and Kuskokwim rivers. Patrols were conducted on both rivers to ensure compliance with scheduled closures.

Enforcement patrols were conducted on the Yukon River from June 12th thru the 28th from the mouth of the river to the refuge boundary near Holy Cross. DRM Liedberg conducted the patrol activity with assistance from Jay Peterson, Deputy Manager at Lacreek NWR in South Dakota and Tom Koerner, Deputy Manager at Rainwater Basin in Nebraska. Contacts were made with an estimated 70% of active fish camps located along the river. No NOV's were issued and the LE presence was accepted very well by the local residents. Two special agents worked the river during this time period as well. This was the first LE effort conducted by refuge officers by boat on the Yukon River for subsistence fishing.

Enforcement activities for the Kuskokwim River were conducted from June 9th thru the 24th. Patrols were conducted by aircraft and boat by SRS Sundown, DRM Liedberg, and DRM Jay Peterson. A total of six nets were seized. Two cases remain unresolved pending identification of the net owners, three citations were issued and paid (nets returned), and one case was excused for a legitimate medical excuse. Overall, it was felt that the significant effort to provide information prior to the start of the fishing season assisted with compliance. With 90% of the subsistence caught salmon on the Kuskokwim River taken within the refuge boundaries, it was critical that enforcement efforts be effective and we feel that the goal was achieved.

Obviously, subsistence users voiced several concerns with the scheduled closures. One of the major concerns voiced by subsistence fishermen was that sport fishermen were not restricted by these closures. This was especially evident near Aniak because of the heavy sport fishing activities on the Aniak River.

In June of 2001, two individuals from Atmauthluak were caught on Baird Inlet Island with emperor geese, lead shot, and over 200 goose eggs. Six NOV's were issued in January 2002 totaling \$13,100. In a telephonic trial on March 15 they were each sentenced to a \$750 fine and 120 hours of community service. The community service was spent assisting with refuge maintenance projects, obtaining an orientation on refuge programs and the background for regulations, and conducting meetings in their village about what they did and why it was wrong.

SRS Robert Sundown and ROS Kenton Moos conducted a large portion of the patrols and investigations during the rest of the year. SRS Sundown's experience growing up on the Y-K Delta and speaking Yup'ik has made him a valuable addition to the LE staff. Patrols were conducted on the Kisaralik and Kwethluk rivers and several visits were made to villages with commercial flights. Some citations issued include: 12 citations were issued for trespass in a closed area (BIA site), four citations issued to construction workers in Chevak for hunting migratory waterfowl without State or Federal duck stamps, and a littering case on Kisaralik River was turned over to State Troopers.

As a result of a contact made in Chevak, three individuals are currently under investigation for the sale of raw walrus tusks to a non-Native.

In August DRM Liedberg and SRS Sundown flew down to Tuntutuliak to assist State Trooper Matt Dobson with issuing citations for illegal harvest of moose. Upon arrival, an estimated 70 residents of the village denied access to the officers. All three officers returned to Bethel with no further incident. The case was later resolved through communications between the village council and the State Troopers. Three citations were issued for illegal harvest of moose but it was widely rumored that 11 moose had been taken in the area during the several months leading to this investigation.

Lastly, approval for a legal spring subsistence waterfowl harvest in 2003 became a reality during the year and final regulations are expected in early in the year.

18. Cooperating Associations

The refuge, in partnership with Alaska Natural History Association (ANHA), operates a small sales outlet in the visitor center. Gross sales for the calendar year 2002 were over \$17,000. This is a substantial increase in gross sales since calendar year 1999. See the table below:

Calendar Year	Gross Sales
1999	\$3,000
2000	\$7,300
2001	\$15,000
2002	\$17,200

The sales increase over the last three years is primarily due to four changes: 1) the knowledgeable and courteous presence of RIT Michael Jimmy at the front desk, 2) the additional display tables of product in the visitor center, 3) the upgrade of the bookstore to slat wall fixtures which maximizes and beautifies the display space, and 4) the increased presence of product displays at community events. Given the limited size of the refuge store, and looking at the total sales this year, we have probably reached a plateau in sales for this branch. To expand gross sales further would probably require taking the bookstore on the road and/or have an additional sales site elsewhere in Bethel.

I. EQUIPMENT AND FACILITIES

3. Major Maintenance

Vinyl siding was put on residences Q-2 and Q-6. Four more refuge houses are scheduled to be sided in 2003, which will complete the project of siding all refuge residences.

Other maintenance performed included replacement of storm doors on all houses as well as installation of new carpeting in Q-5 and Q-7.

The Yukon Delta headquarters underwent several renovations. New carpet was installed in the entire office building with the exception of the visitor center, and new modular furniture was installed on the upper level. The well pump that services the office, bunkhouse and two residences failed in May and had to be replaced. No significant problems were encountered in the job.

Several storage vans were placed at the old site and a gravel pad laid out for boat storage. The storage units, boats, weir materials, and other equipment were reorganize and stacked for a more tidy and safe environment. Fertilizer and grass seed were laid down at the old headquarters site and around the edge of the parking lot of refuge office.



The well pump that provides water for the headquarters complex in Bethel failed in May and had to be replaced. At least the sewer system still worked! (PAL 5/02)

Two major maintenance projects took place at the Kanaryarmiut field camp in August. A new floating dock was put in place to facilitate the heavy use of float planes and extend the existing dock into slightly deeper water. New vinyl framed windows with screens that actually keep out mosquitoes were installed in the main building.

4. Equipment Utilization and Replacement

The Dodge flatbed stake-truck was auctioned through GSA and replaced with a new Ford flatbed truck.

We received a new 20' Alweld boat & EZ Loader trailer from Kenai Fisheries to replace the refuge's 22' Alweld that they were able to inflict 20 years of wear and tear on during the previous summer. We purchased a 90hp outboard boat motor to install on the 20' boat.

The dual 45hp four stroke Honda outboard boat motors were taken off of the 22' Silver Streak and replaced with the 100hp two stroke Evenrude which had purchased several years ago and not put into use. Having one engine on the Silver Streak rather than two made the steering easier and handling better.

An 18' Lund and EZ Loader trailer were purchased for performing law enforcement duties west of Bethel. One of the 45hp Honda outboard motors taken off of the Silver Streak was installed on the Lund, while the other 45hp Honda was placed in storage as a backup unit.

Three Polaris Indy 550 snowmobiles were purchased to support refuge law enforcement efforts and the RIT program. The snowmobiles will be kept in Bethel unless needed elsewhere. Funds were allocated to purchase an additional Suburban. Once added, the refuge fleet will be 10 strong.

5. Communication Systems

The project to replace existing radio equipment with a digital system continued during the year. Five hand held Racal's were purchased in addition to the four purchased in 2001. Fifteen more are planned for purchased in 2003. Two additional Iridium satellite phones were purchased.

8. Other

The old BIA school buildings in the village of Nightmute were removed during the summer. These buildings and approximately four acres of land that went with them became part of the refuge when BIA no longer needed the facilities and relinquished them to the nearest Federal landholder. Engineering and CGS negotiated a contract with Phukon Inc. for approximately \$600,000 to remove the asbestos, contaminated soil, the

remaining three buildings, and the associated fuel tanks and other structures. Two of the buildings had been burned down by arsonists in 2000 and 2001. Needless to say, it was a great relief to have this site cleaned.

J. OTHER ITEMS

3. Items of Interest

For years the quilting group in Bethel has used the refuge conference room on a weekly basis for their projects. In appreciation for use of the room, they presented a wildlife theme quilt to the refuge in the spring. The quilt hangs in a prominent place in the refuge headquarters.



Refuge Manager Mike Rearden accepts the quilt donated by the Bethel Quilters representatives in appreciation for using the refuge conference room for their projects. (DH 5/02)

Anchorage Daily News reporter Joel Gay spent several days in Bethel covering fisheries issues in July. The refuge flew he and a Fish and Game representative to Birch Crossing near Aniak where he documented a mark-recapture project for salmon being conducted by Fish and Game with funding from a number of sources, including the Office of Subsistence Management. Joel's article shed light on the cooperative working relationship between all the parties involved with fisheries management on the Kuskokwim River.



Anchorage Daily news reporter Joel Gay interviews Carol Kerkvliet, the ADF&G project leader for the salmon mark-recapture project near Aniak. (PAL 7/02)

From July 21 through 25, the refuge sponsored a float trip on the Kwethluk River for several fisheries specialists to view habitat conditions and discuss salmon management issues on the river. Joining the group was Eric Knudsen, Alaska Science Center, Joe Margraf, Unit Leader for the Alaska Cooperative Fish and Wildlife Research Unit at UAF, and Jeff Cederholm, Washington Department of Fisheries and Wildlife. Others on the trip included RM Rearden, DRM Liedberg, FB Cannon, and RM Aaron Archibeque from the Togiak NWR. It is believed that salmon returns on the Kwethluk River are very low relative to historic runs and the trip was an effort to discuss current management practices and the opportunities for long-term studies of the river's potential.



Eric Knudsen (BRD) and Jeff Cederholm (Washington Department of Fisheries and Wildlife), discuss nutrient recycling and carrying capacity issues with FB Dave Cannon during a float trip on the Kwethluk River in July. (MBR 7/02)

4. Credits

The biological staff of SWB Broerman, WB's Wege, McCaffery, Kovach, and Oyen, and BT Harwood wrote Sections D.5, F.1-7, G.1-10 and 14-17. SRS Sundown wrote Sections G.11 and H.9. ROS Snow wrote sections E.1, 3, 5, and 6, F.9, and Section I. ES Hanley wrote sections E.4, H.1-7, 11-16, and 18. ROS Moos authored Section B, E.7, and H.7, 10, and 17. RM Rearden wrote the Feedback section. DRM Liedberg wrote Sections C, D. 2-4, and 6, Section J., and compiled, edited (along with Broerman), and finalized the report.

K. FEEDBACK

Thirty years ago the stereotypical refuge manager showed up for work with a pair of binoculars slung around his neck and a daily plan that included counting something worth counting. He (yep, they were mostly "he's") could give a detailed description of every nook and cranny of the wild place they were charged with managing—and even what was going on with the critters. A typical manager today spends an inordinate amount of time hunched over a computer keyboard and can give a detailed description of every element of the budget and report that he/she (yep, we have she's now—one of the

actual improvements to the system) was charged with producing—and even what is happening to it economically, and politically. I sometimes shake my head at what we have become.

The focus of us as managers has changed for sure..but the foundation for which we need to make our decisions has not. It is easy to get lost in the maze of reports, budgets, responses to ridiculous inquiries, politics and the resultant internal confusion but we must never forget: We still need a strong biological foundation for every decision we make that involves wildlife or habitat. That is still the bottom line. That hasn't changed since the days of binoculars and field work—but sometimes that bottom line gets hazy in the fog of bureaucracy.

Fortunately, as of late, we have focused on our refuge biologists and the role they play in managing our systems. That is a good thing and we need to keep that focus. The removal of our key research biologists and their transplantation from one agency to another (and to another) threatened our biological credibility several years ago. Fortunately, our refuge biologists took up the slack and continued to do good science. Now it is our job, as managers to use that good science to make good decisions that will ensure the viability of our lands and wildlife.

In order to know enough to do that though, we need to sometimes turn our computers off, let the battery go dead on the cell phone, ignore the deadlines and ever-present immediate demands and take a stroll on the land we are privileged to manage. Go count some ducks, remove some noxious weeds or get your feet stuck in the aromatic mud of a riverbank.

If we don't do that our whole life will revolve around the electronic version of refuge management, which is really not management at all.