

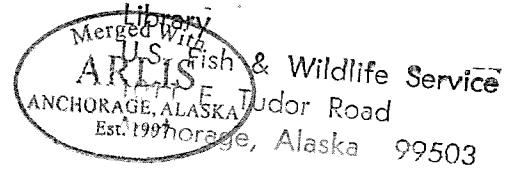
TOGIAC NATIONAL WILDLIFE REFUGE

Dillingham, Alaska



ANNUAL NARRATIVE REPORT

Calendar Year 1988



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

REVIEW AND APPROVALS

TOGIAC NATIONAL WILDLIFE REFUGE

Dillingham, Alaska

ANNUAL NARRATIVE REPORT

Calendar Year 1988

Dave Fisher

Refuge Manager

3-8-89

Date

E. H. Hennrich

Acting

Associate Manager,
Refuges and Wildlife Review

4-4-89

Date

John P. Rogers

Regional Office Approval

4/20/89

Date



TABLE OF CONTENTS

	PAGE
<u>INTRODUCTION</u>	i-v
A. <u>HIGHLIGHTS</u>	1
B. <u>CLIMATIC CONDITIONS</u>	2
C. <u>LAND ACQUISITION</u>	
1. Fee Title . . . . .	.5
2. Easements . . . . .	.5
3. Other . . . . .	.5
D. <u>PLANNING</u>	
1. Master Plan . . . . .	.7
2. Management Plan . . . . .	.7
3. Public Participation . . . . .	.10
4. Compliance with Environmental and Cultural Resource Mandates NTR	
5. Research and Investigations	10
6. Other	Nothing to Report
E. <u>ADMINISTRATION</u>	
1. Personnel	61
2. Youth Programs	62
3. Other Manpower Programs	Nothing to Report
4. Volunteer Program	63
5. Funding	66
6. Safety	66
7. Technical Assistance	Nothing to Report
8. Other (Special Use Permits)	67

F. HABITAT MANAGEMENT

1.	General	69
2.	Wetlands	70
3.	Forests . . . . .	.Nothing to Report
4.	Croplands . . . . .	.Nothing to Report
5.	Grasslands . . . . .	.Nothing to Report
6.	Other Habitats	70
7.	Grazing . . . . .	.Nothing to Report
8.	Haying . . . . .	.Nothing to Report
9.	Fire Management	70
10.	Pest Control . . . . .	.Nothing to Report
11.	Water Rights	71
12.	Wilderness and Special Areas	71
13.	WPA Easement Monitoring . . . . .	.Nothing to Report

G. WILDLIFE

1.	Wildlife Diversity	74
2.	Endangered and/or Threatened Species	74
3.	Waterfowl	75
4.	Marsh and Water Birds	80
5.	Shorebirds, Gulls, Terns, and Allied Species	81
6.	Raptors	82
7.	Other Migratory Birds	84
8.	Game Mammals	85
9.	Marine Mammals	87
10.	Other Resident Wildlife	92
11.	Fisheries Resources	93
12.	Wildlife Propagation and Stocking	104
13.	Surplus Animal Disposal . . . . .	.Nothing to Report
14.	Scientific Collections	104
15.	Animal Control . . . . .	.Nothing to Report
16.	Marking and Banding	104
17.	Disease Prevention and Control . . . . .	.Nothing to Report

H. PUBLIC USE

1.	General	107
2.	Outdoor Classrooms - Students	109
3.	Outdoor Classrooms - Teachers . . . . .	.Nothing to Report
4.	Interpretive Foot Trails . . . . .	.Nothing to Report
5.	Interpretive Tour Routes . . . . .	.Nothing to Report
6.	Interpretive Exhibits/Demonstrations	111
7.	Other Interpretive Programs	112
8.	Hunting	112
9.	Fishing	113

H. PUBLIC USE CONTINUED

10.	Trapping . . . . .	.116
11.	Wildlife Observation . . . . .	.117
12.	Other Wildlife Oriented Recreation . . . . .	.117
13.	Camping . . . . .	.117
14.	Picnicking . . . . .	.Nothing to Report
15.	Off-Road Vehicling . . . . .	.117
16.	Other Non-Wildlife Oriented Recreation . . . . .	.118
17.	Law Enforcement . . . . .	.118
18.	Cooperation Associations . . . . .	.Nothing to Report
19.	Concessions . . . . .	.Nothing to Report

I. EQUIPMENT AND FACILITIES

1.	New Construction . . . . .	.122
2.	Rehabilitation . . . . .	.123
3.	Major Maintenance . . . . .	.123
4.	Equipment Utilization and Replacement . . . . .	.124
5.	Communications Systems . . . . .	.125
6.	Computer Systems . . . . .	.126
7.	Energy Conservation . . . . .	.126
8.	Other . . . . .	.Nothing to Report

J. OTHER ITEMS

1.	Cooperative Programs . . . . .	.127
2.	Other Economic Uses . . . . .	.Nothing to Report
3.	Items of Interest . . . . .	.127
4.	Credits . . . . .	.130

K. FEEDBACK

INTRODUCTION

Located in southwestern Alaska, between Kuskokwim Bay on the west and Bristol Bay on the south and east, Togiak National Wildlife Refuge is approximately 400 miles southwest of Anchorage. The refuge is bordered on the north by the Yukon Delta National Wildlife Refuge, and on the east by Wood-Tikchik State Park.

Togiak National Wildlife Refuge absorbed the former Cape Newenham National Wildlife Refuge, and now comprises 4,011,000 acres. The designated wilderness area lies in the northern half of the refuge and contains 2,270,000 acres. Eighty percent of the refuge is located in the Ahklun Mountains, where large expanses of tundra uplands are cut by several broad glacial valleys opening on to a coastal plain. Like the majority of refuges in Alaska, Togiak Refuge is roadless.

Archaeological evidence indicates that the Cape Newenham/Togiak region of southwestern Alaska has been continuously occupied by aboriginal people for at least 2,000 years. One site, at Security Cove near Cape Newenham, shows evidence of possible human occupancy dating 4,000 to 5,000 years ago.

Aboriginal people within this area were of two different groups. Kuskwogmiut Eskimos occupied the area from Chagvan Bay north to the Kuskokwim River. The Togiagamiut Eskimos lived in the area south of Chagvan Bay east to Togiak Bay. The people in the Nanvak and Osviak Bay areas were known as Chingigmiut, or Cape People, and were considered a branch of the Togiagamiut.

At the time of the 1880 census, over 2,300 Eskimos lived within what is now Togiak National Wildlife Refuge. Elliott (1866) stated that the Togiak River was remarkable with respect to the density of the people along its banks. At that time, 1,926 people lived in seven villages along the river from Togiak Lake to Togiak Bay. This population reflected the great abundance of the fish and wildlife these people relied upon as their sole source of food and clothing.

The Togiagamiuts, unlike most coastal Eskimos, did not entirely depend upon the fish and wildlife resources of the sea for their subsistence. Sea mammals were hunted, but more effort was expended in pursuit of the moose, caribou, and brown bear found in the interior mountains and valleys. From their winter villages along the rivers near the coast, hunters and their families traveled into the interior where they spent several months in the spring and fall, berry picking and hunting. In mid-summer they would return to their villages to harvest salmon. The food they gathered would hopefully tide them over the coldest months of winter, when the frigid weather conditions would prohibit any hunting and/or fishing activity.

The Kuskwogmiut, who occupied the area west and north of the Togiagamiut, were more dependent on the resources of the sea for their subsistence. They spent little time, if any, hunting land mammals of the interior. The people living in the vicinity of Cape Newenham, for example, obtained their meat, blubber, and oil from seals, beluga whales, and walrus. The latter was especially prized for its ivory, which was used in the manufacture of tools, or as an article of trade. Seabirds were abundant, furnishing people with meat, eggs, and clothing. Salmon and trout were also important items in their diet.

Captain James Cook was probably the first white man to see this area. Entering Bristol Bay on July 9, 1778, he continued westward, reaching Cape Newenham on July 16, 1778. Somewhere north of Cape Newenham, possibly in the area of Goodnews Bay, Captain Cook was visited by a group of Eskimos in kayaks. He was of the opinion that these people had not had any previous contact with whites, because there was no tobacco nor any foreign articles in their possession.

Russian explorers reached Bristol Bay in the 1790's, but the first contact they had with the Togiagamiut didn't occur until around 1818, when a party of Russian American Company traders established a fort on the Nushagak River. It was from this post that trade was established with the Togiagamiut. The area was rich in furs, and the post was soon handling over 4,000 pelts annually. A great variety of animals were taken, including brown and black bears, wolves, wolverines, beaver, martin, mink, marmots, muskrats, river otters, ground squirrels, lynx, seals, and red and arctic foxes.

Of the various industries created in the area during the 1800's, only the salmon fishery retains its original importance. In 1885, Alaska Packing Company of Astoria established the "Scandinavian" cannery on the west side of Nushagak Bay. With a capacity of 2,000 cases per day, it operated until the end of World War II. Bristol Bay Canning Company, then called the Bradford Cannery, went into production a few miles from the Scandinavian in 1886, at a site later to become known as Dillingham. By 1897, the fishing industry had invested \$867,000 in the Bay. By 1908, the number of canneries operating at Nushagak numbered ten.

Interest in gold mining and trapping declined during World War I, and reindeer herding practically became extinct by the mid-1940's. This was due to the near total extermination of reindeer by a series of hard winters. Most of the gold mines closed at the outbreak of World War II; however, platinum mining began in 1926, and continued until 1975.

This discovery, at Fox Gulch near the present village of

Platinum, produced what was probably Alaska's last big stampede. Miners from all over Alaska and the "Lower 48", came to the mining camps along the tributaries of the Salmon River, which was heralded as the "Dawson of 1937". The platinum stampede was unlike any of the Klondike era: airplanes brought stampedeers into Platinum several times a week; few resorted to dog sleds or the long overland treks which were characteristic of "The Trail of '98". Also, power drills and tractors replaced single jacks and horsedrawn wagons. Since 1926, more than 640,000 ounces of this precious metal have been mined from the platinum placers in the Goodnews Bay district.

By 1934, one company, the Goodnews Bay Mining Company, had nearly acquired all of the claims in existence. After changing ownership several years ago, Hanson Enterprises, as it is now known, worked a dredge continuously until 1975. Since then the dredge has only operated intermittently. Hanson Enterprises is the only company in the United States that primarily produces platinum, and most of the platinum claims it owns are located on lands selected by native villages.

Trapping also continues, with fur prices dictating the degree of effort spent in running trap lines. Historical and archaeological features of the refuge primarily consist of former Eskimo villages. Prior to 1969, the area that became Togiak National Wildlife Refuge was part of the public domain, under the jurisdiction of the Bureau of Land Management. On January 20, 1969, the Secretary of the Interior issued Public Land Order 4583, withdrawing 265,000 acres of that area and designated it the Cape Newenham National Wildlife Refuge. With this order, the Fish and Wildlife Service assumed its first refuge management responsibilities in the area: to protect and preserve the "outstanding wilderness values" of Cape Newenham.

The majority of lands that were to become Togiak National Wildlife Refuge, were withdrawn in 1971, under Section 17(d)(2) of the Alaska Native Claims Settlement Act. The withdrawals covered all forms of appropriation under the public land laws, including selection under the Alaska Statehood Act and the mining and mineral leasing laws. The Settlement Act directed the Secretary of the Interior to study all (d)(2) "national interest land" withdrawals as possible additions to the National Wildlife Refuge, Park, Wilderness, and Wild and Scenic River Systems.

The Secretary withdrew additional parts of what was to become Togiak National Wildlife Refuge, under Section 17(d)(1), of the Settlement Act. All of these "public interest lands", were also withdrawn from all forms of appropriation under the public land laws, with the exception of metalliferous locations.

Congress failed to take action before the five-year deadline expired for the (d)(2) lands being considered for additions in

the National Park, Refuge, Forest, and Wild and Scenic River Systems. So, on November 16, 1978, the Secretary of the Interior invoked his emergency withdrawal powers, under Section 204(e) of the Federal Land Policy Management Act to protect these lands, and withdrew nearly 110 million acres of land throughout Alaska. Most of the present Togiak Refuge was covered by this Order, including the (d)(1) and (d)(2) lands, and lands available to the Natives but not yet selected.

Fifteen months later, on February 11, 1980, the Secretary issued Public Land Order 5703, under section 204(c) of the Federal Land Policy Management Act, establishing the Togiak National Wildlife Refuge. This order withdrew all lands subject to existing rights for up to 20 years, from all forms of appropriation under the public land laws. As a refuge, Togiak became subject to all of the laws and policies of the Fish and Wildlife Service, used to govern the administration of the National Wildlife Refuge System.

The Alaska Native Claims Settlement Act of 1971 chose a route vastly different from previous solutions to aboriginal land claims. Departing from Lower 48 precedents of reservations and government-subsidized industries, the compromise bill empowered Alaska's Natives with cash and land conveyances. It further provided that corporations would administer this division of wealth.

The settlement act abolished aboriginal title to lands in exchange for 40 million acres and compensation totaling almost \$1 billion, creating perhaps the largest single transfer of wealth from government to a group of indigenous peoples. Thirteen regional and 220 village corporations were created. Final payments were disbursed from the Alaska Native Fund in 1981, and after a slow start and further legal wrangling the majority of land entitlement have been conveyed. Probably the greatest benefit of the settlement act was forcing native people to become deeply involved in the economy, in the mainstream of the state and the nation.

In December 1980, Congress enacted the Alaska National Interest Lands Conservation Act. This act, among other things, rescinded Public Land Order 5703, and designated all of the withdrawn land as a refuge. In addition, the Act made Cape Newenham National Wildlife Refuge a unit of Togiak National Wildlife Refuge. The first refuge manager subsequently reported for duty in October, 1981.





The Lands Act is the primary statute affecting the planning and management of the refuge. The Act established Togiak as a national wildlife refuge; identified its purposes; and required it to be administered subject to existing rights, in accordance with the laws governing the Refuge System.

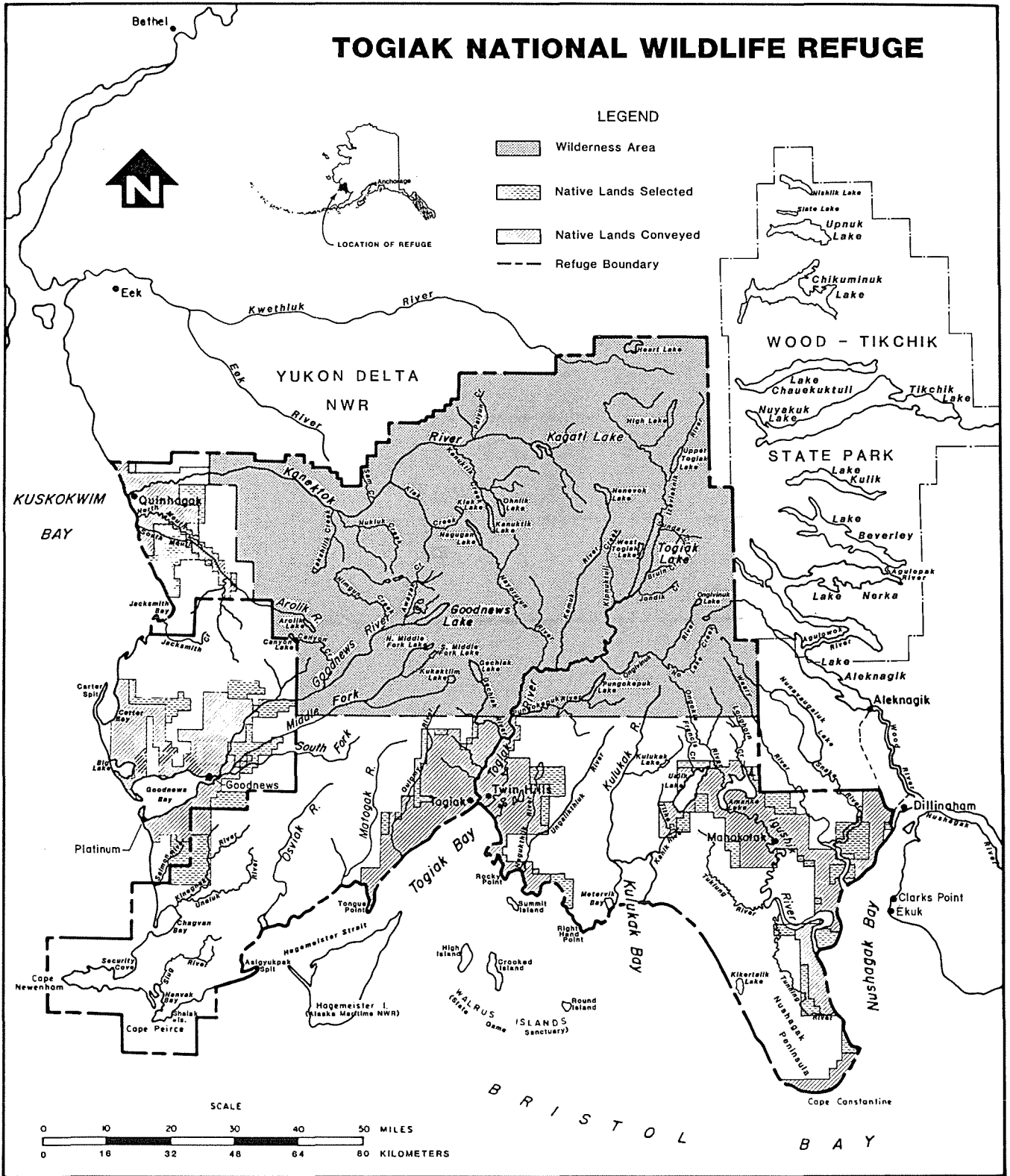
Section 303(6)(B), of the Lands Act, stated four purposes of the refuge. The Fish and Wildlife Service has set additional goals for the refuge. All of the following goals and purposes form the major guidance for managing the refuge. They are also the criteria for developing and evaluating management alternatives for the refuge. These purposes are:

1. To conserve fish and wildlife populations and habitats in their natural diversity, in order to:
 - * preserve a natural diversity and abundance of fauna and flora on refuge lands;
 - * conserve salmon populations and their habitat;
 - * conserve marine bird populations and their habitat;
 - * conserve marine mammal populations and their habitat;
 - * conserve and restore to historic levels large mammal populations;
 - * preserve, restore, and enhance in their natural ecosystems (when practicable), all species of animals and plants that are endangered or threatened with becoming endangered.
2. Fulfill international treaty obligations of the United States with respect to fish and wildlife and their habitat:
 - * to perpetuate the migratory bird resource.
3. To provide in a manner consistent with the purposes set forth in (1) and (2), the opportunity for continued subsistence use by local residents.
4. To ensure to the maximum extent practicable, and in a manner consistent with the purposes set forth in (1), water quality and water quantity within the refuge.
5. To assure preservation and availability of wild and scenic waterways, lakes, historic and archaeological sites, trails, and other cultural features, geological and paleontological areas, and other scientific and educational values.
6. To provide an understanding and appreciation of fish and wildlife ecology and man's role in his environment, and to provide refuge visitors with high quality, safe, wholesome, and enjoyable recreational experiences, oriented toward wildlife to the extent that these activities are compatible with the purpose for which the refuge was established.

TOGIAK NATIONAL WILDLIFE REFUGE

LEGEND

-  Wilderness Area
-  Native Lands Selected
-  Native Lands Conveyed
-  Refuge Boundary



A. HIGHLIGHTS

In a cooperative effort with the Alaska Department of Fish and Game and three village corporations, 148 caribou were transplanted from the Northern Alaska Peninsula herd to the Nushagak Peninsula, Togiak National Wildlife Refuge.

Construction was completed on a much needed bunkhouse and storage building. We officially moved into these facilities on May 9, 1988.

Ms. Carol Johnson joined the staff as refuge secretary on February 22, 1988. Carol replaced Kim Custis who moved with her family back to Oregon.

For the first time since the Marine Mammal Protection Act was passed in 1972, two Natives were convicted of wasting walrus meat.

Work continued on the public use management plan. By the end of the year a workbook had been completed and ready for public meetings in January of 1989.

Three refuge information technicians were hired to help with the Kanektok and Togiak River subsistence studies and the public use management plan.

Refuge personnel banded 707 geese on the Nushagak Peninsula. A first for this station.

Work continued on the fisheries management plan. Several drafts were given to the State to review prior to public release.

B. CLIMATIC CONDITIONS

The refuge is located in a climatic transition zone. The primary influence is maritime; however, the arctic climate of interior Alaska also affects the refuge and the Bristol Bay coastal region. Temperatures range from an average minimum of 8.0 degrees F. in December, to an average maximum of 64.0 degrees F. in July. The frost-free period is approximately 120 days; ponds and smaller lakes usually freeze in October and thaw in May.

Prevailing winds are from the north and northeast during October through March, and from the south and west during April through September. The wind blows almost continuously along the coast, frequently reaching gale force velocities in the Cape Newenham area. Recorded temperatures in Dillingham, Alaska, have ranged from -53 degrees F, to +92 degrees F, with an average of 25 inches of rain and 73.5 inches of snow. Cape Newenham, by comparison, has recorded minimum temperatures of -28 degrees F; maximum temperatures of 75 degrees F; and an average of 37 inches of rain and 81 inches of snow.

Fall is the wettest season in this area, while the least precipitation occurs in the spring. The varied topography on the refuge creates microclimates which affect local temperatures, types of precipitation, and wind conditions.

January-March

The high of 37 degrees F. occurred on two days in January and one day in March. The low of -22 degrees F. occurred during February, (Table 1). The average temperature for the quarter was 20.9 degrees; higher than the long term average (18.3). There were 53 days of precipitation. Snowfall (31.0") for the quarter was recorded on March 15.

TABLE 1
1988 Climatic Conditions

Month	Temperature (F)			No. Days	Precipitation	
	Maximum	Minimum	Mean		Rain (in.)	Snow(in.)
JAN	37	-4	21.5	16	.56	10.0
FEB	36	-22	20.4	18	1.51	24.0
MAR	37	1	13.3	19	3.37	31.0
APR	40	-5	28.3	16	.73	6.0
MAY	56	31	42.2	21	1.73	0
JUN	58.8	43.4	51.1	13	5.16	0
JUL	63.7	49.3	56.5	13	1.08	0
AUG	65	39	52.0	19	3.10	0
SEP	61	29	45.0	16	2.75	0
OCT	48	4	37.0	13	1.87	2.5
NOV	38	-11	14.0	19	4.39	42.0
DEC	37	-14	11.1	26	3.45	16.1
Annual	48.1	11.7	32.7	209	29.70	131.6

April - June

The average temperature for this quarter (51.3 degrees F.) was above the long term average of 41.4 degrees F. A low of -5 degrees F., was registered in April, and the high of 58 degrees F. was recorded in June. These readings were extreme when compared with the long term average temperature range for the quarter of 23.2 degrees F. to 60.7 degrees F. From 50 days of precipitation there were 7.6 inches of rain recorded during this quarter, and 6.0 inches of snow; both slightly above the long term average of 4.56 inches of rain and 5.7 inches of snow.

July - September

This quarter the average temperature of 51.3 degrees F. was similar to the long term average of 52.1 degrees F. The average temperature for the month of July was 56 degrees F. A low of 29 degrees F., recorded in September, was below the long term average for the quarter of 39.3 degrees F. There were 48 days of precipitation this quarter resulting in a very minimal 6.8 inches of rain.

October - December

It is fairly common knowledge in this area that freeze-up begins by October 20.

Overall, this quarter average temperature of 26.6 degrees F. was

slightly above the long term average of 24.4 degrees F. The high of 48 degrees F. was recorded in October, and the low of -14 degrees F. occurred in December.

Precipitation was recorded on 58 days this quarter, with an above average rainfall (9.21") and snowfall (60.6"). The first snowfall occurred on October 10, much earlier than previous years. This snow has stayed with us all winter.

There were 209 days of precipitation during 1988. Snowfall for the year (131.6 inches) was well above the 73.5 inch long term average. Rainfall (29.7 inches) was also well above the long term average of (25.08 inches).

C. LAND ACQUISITION

1. Fee Title

Construction of a bunkhouse and storage building was completed at the administrative site. Land for the administrative site was purchased from private parties in 1986 and totals 4.24 acres.

2. Easements

An easement was granted to the City of Dillingham for the construction of a walkway along the highway side of the administrative site. The walkway will be graveled and should be completed in 1989.

3. Other

There were no major land status changes during 1988. Table 2 shows the current land status as of the end of the year.

TABLE 2
Land Status of Togiak National Wildlife Refuge
as of December, 1988

Ownership	Acres	Percent of Refuge
FEDERAL	4,011,000	85%
NATIVE VILLAGE CORP/GROUP:		
* Selections	151,000	3%
* Conveyances	480,000	10%
REGIONAL CORPORATIONS:		
* 14(h)(1) Selections	12,000	<1%
* 14(h)(1) Conveyances	0	0
* 14(h)(8) Selections	5,000	<1%
* 14(h)(8) Conveyances	0	
NATIVE ALLOTMENTS:		
* Applications	11,000	<1%
* Conveyances	33,000	<1%
PRIVATE PARTIES:		
* Selections	0	0
* Conveyances	600	<1%
TOTALS:	4,704,000	100%

Of the 4,704,000 acres of land within the refuge boundary, approximately 4,011,000 acres (85%) of the area is under federal jurisdiction. About 513,000 acres (10%) of the lands within the refuge boundary have been patented or conveyed to eight native village corporations; Clark's Point, Ekuk, Dillingham, Manokotak, Platinum, Quinhagak, Togiak and Twin Hills; individual natives, private parties, and one native group (Olsonville). About 150,000 acres in the refuge have been selected, but are still under federal jurisdiction; some of these lands may or may not be interim conveyed.

D. PLANNING

1. Master Plan

The Record of Decision for the Final Comprehensive Conservation Plan/Environmental Impact Statement and Wilderness Review for the Togiak National Wildlife Refuge was signed by the Regional Director on February 12, 1987

Implementation of recommendations contained in the Comprehensive Conservation Plan/Environmental Impact Statement remained the focus of several refuge programs during 1988.

2. Management Plan

Several recommendations in the Togiak Comprehensive Conservation Plan call for the development of specific step down management plans. These plans will describe specific actions that will be taken to implement the general management directions outlined in the Comprehensive Conservation Plan.

The preparation of a fisheries management plan and a public use management plan continued during 1988. These two plans were identified in the Comprehensive Conservation Plan as a high priority, and will be necessary to develop meaningful resource programs on the refuge. The fisheries management plan is scheduled for completion during 1988, while a public use management plan will be completed in 1990.

FISHERY MANAGEMENT PLAN

The refuge fishery management plan was completed during the year and forwarded to the regional office (Fisheries Resources Division) for review. The Department of Fish and Game also reviewed the plan and made a list of concerns. All comments and concerns that the Department had were addressed and the revised plan was sent back to them for a final review. Because of the noncontroversial nature of the plan, an environmental assessment was not needed. The regional office however has planned to have the plan go through public review which will start in 1989 with a mailing of a synopsis to all interested parties and a 60 day comment period.

PUBLIC USE MANAGEMENT PLAN

Between 1981 and 1984, refuge personnel noticed an accelerating trend in sport fishing on the refuge; recreational use during that period is estimated to have increased from about 3,000 use days a year to more than 12,000 use days a year. As a result of this rapid change, refuge personnel became increasingly concerned over potential impacts to established subsistence activities, sport fishing opportunities and wilderness values.

In 1984 the Fish and Wildlife Service per recommendations from the refuge manager, placed a moratorium on the issuance of any new permits to conduct commercial sport fish guiding activities in the refuge. The moratorium was to remain in place until the issues and concerns could be addressed through a planning process. With the approval of the Togiak Comprehensive Plan in 1987, the decision was made to prepare a public use management plan for the refuge. In preparing this plan, the Service would increase efforts to collect public use data on refuge rivers and provide opportunities for the public to determine how refuge rivers should be managed.

Between January and April 1987, workshops were held throughout the refuge to identify specific issues and concerns relating to public use. The following major issues were identified:

- *Increasing conflicts between recreational and subsistence users.
- *Increasing conflicts between motorized and non-motorized recreation use.
- *Increasing impacts to wilderness values (naturalness, solitude).
- *Loss of high quality sport fishing opportunities.
- *Increasing litter and trespass on private lands.
- *Lack of consistent management objectives between various land managers and landowners.

During the past year several complex legal questions that relate to the planning effort have been addressed, mostly relating to management jurisdictions. As a result it has become clear that successful management of refuge resources and programs will depend on agreement of management objectives.

Land ownership patterns and management authorities within the refuge are complicated. The state of Alaska owns the lands under

many of the rivers in the refuge and all tidal areas adjacent to the refuge. The Submerged Lands Act of 1953, the Alaska Statehood Act of 1958, and the state constitution established state ownership of shorelands (the beds of navigable rivers), tidelands (lands subject to tidal influence) and submerged lands (lands seaward to three miles from shore). Shorelands, tidelands and submerged lands adjacent to or within Native Corporation lands are also in state ownership and subject to state management.

The watercolumn is the actual water that is in a lake or river. State ownership of the watercolumn is established in the Acts identified above and the state constitution. The Service also has certain authorities to manage watercolumns within the refuge.

The Service and the State have agreed to work cooperatively to ensure that existing and future activities occurring on these lands and waters are compatible with the purposes for which the refuge was established, and the purposes for which the state was given ownership of tidelands, submerged lands, shorelands and watercolumns.

The plan will identify how different sections of the rivers in the refuge should be managed. The preparation of the plan will be guided by several major goals. Based on public comment, these goals may change or be modified:

- *Provide for continued opportunities for subsistence and recreational use of refuge resources.
- *Provide a range of high quality recreational opportunities, including wilderness areas that emphasize naturalness, solitude and primitive recreation, and areas that may not have wilderness qualities as a key feature of the recreational experience.
- *Maintain wild fishery stocks in their naturally occurring species diversity, abundance and age class composition.
- *Ensure public access to navigable or public waters on the refuge.

Specific guidelines for accomplishing these goals will then be developed through the planning process. Developing these will take extensive discussion of the types of management tools available to each agency. In some cases, the U.S. Fish and Wildlife Service, Department of Natural Resources or the Department of Fish and Game may lack authority to meet a management goal without changes in legislation or regulations.

3. Public Participation

Several refuge projects have required extensive public involvement this year. In conjunction with the preparation of the public use management plan, a refuge brochure was prepared and distributed to recreation users. The purpose of the brochure was to address problems related to trespass, conflicts with subsistence users, and general etiquette when recreating within the refuge. A planning update was also prepared to introduce the process for completion of the public use management plan and describe the issues, the planning schedule, and management responsibilities. The public involvement effort that will accompany the preparation of the public use management plan was developed utilizing the process of "Systematic Development of Informed Consent".

A public involvement schedule for the final refuge fisheries management plan was developed by the regional office and will be completed next year prior to plan approval.

Substantial public involvement has been incorporated into the refuge biological programs. Village meetings, media releases, and utilizing refuge information technicians to explain programs have all resulted in more widely accepted and successful management programs. This has been particularly evident during the caribou reintroduction project last winter and the moose telemetry project that is planned for February - March 1989. In conjunction with these projects, public involvement efforts focused on rural residents in the villages of Manokotak, Togiak, Twin Hills, Aleknagik, and Dillingham. Fisheries projects have been explained to people in the villages of Quinhagak and Togiak.

5. Research and Investigations

PUBLIC USE SURVEY CAMPS

Monitoring public use on the refuge is difficult due to the remoteness and to the variety of access types visitors use on the refuge. The primary visitor activity is sport fishing which is concentrated on the Kanektok, Togiak and Goodnews Rivers. Guided and unguided visitors access the refuge by aircraft, motorboat and river raft.

Begun in 1984, with a pilot study at Kagati Lake, we have found staffing a camp at the headwaters of a major river a very feasible means of acquiring public use information. Volunteers staff the lake camps and are provided with a 10'x12' weatherport cook tent, 8'x10' weatherport sleeping tent, HF single side band radio, inflatable boat and outboard motor.

The primary goal is to contact all visitors landing at the lake to determine the following: guided or unguided; name of guide(s); name of air taxi; number of people in each party; length and purpose of each trip; and the number of use days; (Table 3). Volunteers also informed visitors about the refuge, wilderness ethics, private land status, and demonstrated proper catch and release fishing techniques.

In 1988 Kagati and Goodnews Lakes field camps were each staffed by two refuge volunteers. Togiak Lake visitor information was gathered by our volunteer working with the Alaska Department of Fish and Game salmon counting tower project at the outlet of Togiak Lake.

The Kanektok River receives the most float use. In 1988, 288 clients and 123 unguided visitors floated the Kanektok River (3067 use days). In addition, the guides themselves contribute another 118 people and 1140 use days. Since 1984, interviewed guided float use on the Kanektok has increased. Guided float use has accounted for between 70% and 81% of the total use days on the Kanektok River.

The Togiak River system has in the past ranked out as the refuge's second most popular float river. In 1987 the Togiak fell to number three. Float use continues to decline and in 1988 our volunteers interviewed 70 visitors and guides for 576 use days. Guided use accounted for 44% of the float use.

Float use on the Goodnews River had remained relatively steady in past years, but increased by 300 use days in 1988. Volunteers interviewed 145 clients, guides and unguided visitors for 1206 use days combined. Guided use accounted for 19% of the total float use in 1988, down from 41% in 1987.

Overall float use on the three major rivers of the refuge has increased steadily from 1985 to 1988. Guided float use on the refuge in 1988 was down by 323 use days from 1987 figures while unguided use was up 917 use days. Guided use accounted for 57% of the refuge float effort in 1988 (Table 3).

TABLE 3
 Documented Float Use at Kagati, Togiak and
 Goodnews Lakes. 1986 - 1988.

	KAGATI LAKE			TOGIAC LAKE			GOODNEWS LAKE			TOTAL		
	1986	1987	1988	1986	1987	1988	1986	1987	1988	1986	1987	1988
<u>GUIDED</u>												
NO PARTIES	36	43	32	8	9	3	1	7	6	45	59	41
NO CLIENTS	209	247	228	28	33	12	3	26	22	240	306	262
NO GUIDES	114	126	118	14	14	7	1	11	6	129	151	131
TRIP LENGTH	9.0	8.0	8.3	9.4	7.4	7.8	15.0	9.9	8.0	9.1	8.1	8.2
CLIENT USE DAYS	1,877	1,977	1,887	264	243	93	45	258	176	2,186	2,478	2,156
GUIDE USE DAYS	1,045	1,029	1,140	121	100	51	15	111	48	1,181	1,240	1,239
TOTAL USE DAYS	2,922	3,006	3,027	385	343	144	60	369	224	3,367	3,718	3,395
<u>UNGUIDED</u>												
NO PARTIES	36	22	29	19	14	12	19	22	30	74	58	71
NO PEOPLE	164	92	123	75	62	51	63	67	117	302	221	291
TRIP LENGTH	9.4	7.8	9.6	8.2	7.6	8.5	9.2	7.9	8.4	9.2	7.6	8.9
NO USE DAYS	1,548	713	1,180	620	438	432	601	526	982	2,769	1,677	2,594
<u>TOTAL</u>												
NO PARTIES	72	65	61	27	23	15	20	29	36	119	117	112
NO PEOPLE	487	465	469	117	109	70	67	104	145	671	678	684
NO USE DAYS	4,470	3,719	4,207	1,005	781	576	661	895	1,206	6,136	5,395	5,989
% USE DAYS GUIDE	65%	81%	72%	38%	44%	25%	9%	41%	19%	55%	69%	57%

(From Togiak NWR Public Use Survey Camps, supplemented by air taxi trip reports in 1987 and 1988).

SEABIRD COLONY CENSUSING AT CAPE PEIRCE

This study was a continuation of the work contracted to LGL-Ecological Research Associates in Anchorage, in 1984. Their study, Population Estimates, Productivity, and Food Habits of Nesting Seabirds at Cape Peirce and the Pribilof Islands, indicated there may have been a significant decline for most species of seabirds, specifically, the black-legged kittiwakes.

Volunteer Donna O'Daniel was assigned the task of continuing the population estimates and productivity portions of the 1984 LGL study. The Cape Peirce colonies have been intermittently surveyed since 1976. This historical data, coupled with standardized observation points, (each marked with a steel rod), and photographs of individual areas of each colony to be surveyed, provides us with the means to assess the status of and fluctuations in seabird populations and productivity.

Nesting phenology of the seabirds at Cape Peirce was slightly earlier in 1988 than in 1987. The nest building activity for black-legged kittiwakes, common murres, and pelagic cormorants was underway when volunteers arrived June 16.

Kittiwake, murre, and cormorant eggs were present upon arrival. Egg-laying began approximately June 6 for kittiwakes, June 17 for murre, and mid-May for cormorants. These dates were derived from known incubation periods of the eggs and dates of first hatchings. The first kittiwake chick was seen July 4, the first murre chick July 17, and cormorant chicks were already present upon arrival.



Nesting Kittiwakes at Cape Peirce. FP 6/88

The reproductive success (chicks fledged/nest with eggs) was 40% for kittiwakes, and the productivity (chicks fledged/nest attempt) as 0.16. These values are both higher than those of 1987, (Table 4).

Reproductive success (chicks fledged/murres in incubating posture) was 58% for murre, which is also higher than 1987. Productivity could not be calculated due to the presence of both breeding and non-breeding adults present on the study plots. Since most of the cormorant nests had chicks by the time observers arrived at the Cape, reproductive success and productivity could not be determined. The first cormorant fledgling was observed July 28.

The total population of kittiwakes, on established study plots, was approximately 1/3 higher than the population of 1987. The murre and cormorant population was slightly higher in 1988 than

1987, (Table 5). As in previous years, red foxes and common ravens preyed upon seabird eggs and chicks. However, the raven population was half that of 1987, and it is presumed that predation from this source was less than last year.

TABLE 4

Productivity Parameters and Results of Black-Legged Kittiwakes
and Pelagic Cormorants at Cape Peirce, 1987 and 1988

	Kittiwakes		Cormorants	
	<u>1987</u>	<u>1988</u>	<u>1987</u>	<u>1988</u>
Nest attempts	22.1	128	44	40
Nest with eggs	51%	42%	70%	87.5%
Hatching success	0.32-0.64	0.49	0.67-0.73	0.98
Fledging success	0	0.25	.40	.71
Reproductive success	0	0.15	1.55-1.71	1.63
Productivity	0	0.06	1.09-1.20	1.43

Hatching Success = eggs hatched per eggs laid

Fledging Success = chicks fledged per eggs hatched

Reproductive Success = chicks fledged per nests with
eggs

Productivity = chicks fledged per nest attempt

TABLE 5

Cape Peirce, 1987-1988
Mainland Population Estimates for Seabird Species

SPECIES	1987	1988
Black-legged kittiwake	2,440	4,020
Common murre	5,000	5,735
Pelagic cormorant	200	140

RECOLONIZATION OF THE CAPE PEIRCE TERRESTRIAL HAUL OUT BY
PACIFIC WALRUS

Walrus have recently begun to recolonize previously abandoned haul-out grounds along the Alaskan coast. Every year since 1978 walrus have been reported hauled out in the Cape Peirce/Security Cove region. By 1981 Cape Peirce was re-established as a major haul out site. Its importance rivals the Round Island Game Sanctuary, which was set aside to provide a protected resting place for walrus. Unfortunately, the Cape Peirce haul-out site does not enjoy the same level of protection from disturbance by planes, boats, and visitors that the Round Island sanctuary does under State of Alaska stewardship. Haul out activity increased rapidly with a record 12,000 animals in 1985. Since then, a decrease in activity has occurred with only 6,300 animals in 1987 and a peak of 6,900 animals on July 17th, 1988.

From June 16th to October 12th, the social behavior and herd number of walruses utilizing Cape Peirce were monitored and recorded. Specific objectives were to collect data on population size, distribution, and record any tagged animals. Four of Round Island's 1984 tagged animals were sighted at least once during the summer. Of Sue Hill's 1987 transmitter tagged walruses, frequencies 165.800, 165.810 and 165.850 were recorded on 24 different occasions once monitoring with the Telonics receiver began August 1.

Data was collected daily from each haul out beach using the same location for each count. Counts were conducted in the afternoon. Other data collected included weather, tide, disturbances and sightings of marine and other mammals in the area.



Walrus continue to use the sand dunes at Maggy Beach.
GS 8/88

Information collected at the Cape Peirce haul-out grounds during the past three years is characterized by a synchronous population fluctuation during the summer haul-out period. The correlation between the peak periods at Cape Peirce and those observed at Round Island suggest a movement pattern between the two areas, as well as a conservative population estimate of 15,000 animals utilizing the north Bristol Bay area.

A new haul-out site was established during the 1987 season, when approximately 700 animals were observed hauled out on a stretch of beach on the northwest side of Cape Newenham. This site was not a previously documented haul-out location; however, it was used extensively during the 1987 season and reported as being used on a regular basis during the 1988 summer. The report of 1988 use was given to refuge volunteers stationed at Cape Peirce by the maintenance personnel stationed at Cape Newenham Air Force Base.

A brief addition to the censusing was the attempted use of time lapse photography. An 8mm movie camera, with an XL601 interalometer was placed on a vantage point to record the movements on one of the main haul out beaches. The camera was set to take a frame every 15 minutes continuously. Unfortunately, repeated battery failures were experienced and only a few days worth of data were collected.

TOGIAK RIVER SALMON SMOLT ENUMERATION

The refuge worked cooperatively with the Alaska Department of Fish and Game Commercial Fisheries Division to establish a data base on the number of smolting sockeye from Togiak Lake. The adult spawning escapement goal is currently set at 150,000. Escapements have exceeded this during the past several years. For this reason it is important to determine the optimum escapement level. By looking at smolting salmon it is possible to better understand the spawning recruitment relationship and to establish a new escapement goal if needed. The gathered data base will aid in return forecast and increase biological knowledge of sockeye salmon in the Togiak system. The smolt sonar operated from June 6 through June 30, 1988. This was the first smolt sonar on the Togiak River.

Volunteers Matt Hubers, Allyn O'Neil, and Sue Safford installed and operated the project under the guidance of Wes Bucher, Alaska Department of Fish and Game Area Biologist.

The equipment used to count the out-migrating salmon consisted of one Bendix Smolt Sonar and two arrays with twenty transducers each. One array was placed off of the left-hand bank (facing upstream) and was termed inshore array and the second array was placed further out and termed offshore array. The width of the river was measured and counts for the area not covered by the arrays were interpolated.

Smolt outmigrate from the lake at the surface and are mainly propelled by the water current downstream. The sonar was usually set 2/10 of a foot beneath the surface during the day and 1/10 of a foot during the night to optimize smolt counts. The current velocity was taken daily and used to set the firing rate of the counter transducers.

The smolting salmon samples were taken with a fyke net. The sample goal was set at 120 a day. Ten scales were taken from each fish along with weight and a total length measurement. The scales were mounted on microscope slides and weight/length data recorded.

The data gathered from the samples showed that the mean length of smolting age I fish was 76mm with a mean weight of 4.4 gr. Age II fish had a mean length of 93mm with a mean weight of 8.1 gr. The actual raw counts of smolting salmon for both arrays was 29,087. This figure was then used to calculate a total out migration of 2,661,366 sockeye smolt.

This total outmigration estimate is thought to be low for this

first year of operation for several reasons. The first reason being that the smolt outmigration had begun before the project was operational and some fish had been missed. A second and perhaps the major source of error was that two arrays were not sufficient to cover a large enough area of the river needed to get an accurate count and led to more interpolation than desired. The data collected this year also indicates that the counts would have been higher if both arrays had been placed further from the left shore where the river velocity was higher. The conclusions that can be drawn from this years data are that the use of sonar for the enumeration of smolting sockeye on the Togiak River is technically feasible. It was found that more work is needed to determine migrational timing. Additional data should also be collected on the productivity of the lake to determine when the system might receive an overescapement of adult sockeye. It was recommended that the sonar should be installed at least two weeks earlier and that three arrays should be employed to adequately cover the river and that the arrays might be placed where the river velocities are higher to optimize counting.

The data gathered is very important for the establishment of a data base that will increase the knowledge of smolting sockeye salmon in the Togiak fishery on the refuge. It is hoped that this cooperative project will be continued annually to establish a reliable data base which will better define salmon escapement goals into Togiak Lake.

TOGIAK RIVER SALMON ENUMERATION TOWER COOPERATIVE PROJECT

This cooperative effort began in 1987 when Alaska Department of Fish and Game managers proposed to cut funding from the project in the wake of budget limitations. The Togiak system management and escapement goals are a concern of refuge fisheries resource management.



Sockeye salmon are the primary species enumerated at the tower site. LU 7/88

The sockeye salmon fishery is a very important resource for the village of Togiak and nearby communities, subsistence fishery, the commercial fishery, and as a food source for refuge wildlife. For this reason the counting tower near the outlet of the lake has been in operation since 1959. The counting tower provides the Alaska Department of Fish and Game with in-season counts to manage the commercial fishery and it ensures that the escapement goal of 150,000 sockeye is reached. The counting tower also provides a continuous data base on biological data such as sex ratios, fish age, and growth. Maintaining a consistent data base is vital in forecasting runs which help in formulating management strategies prior to the season.

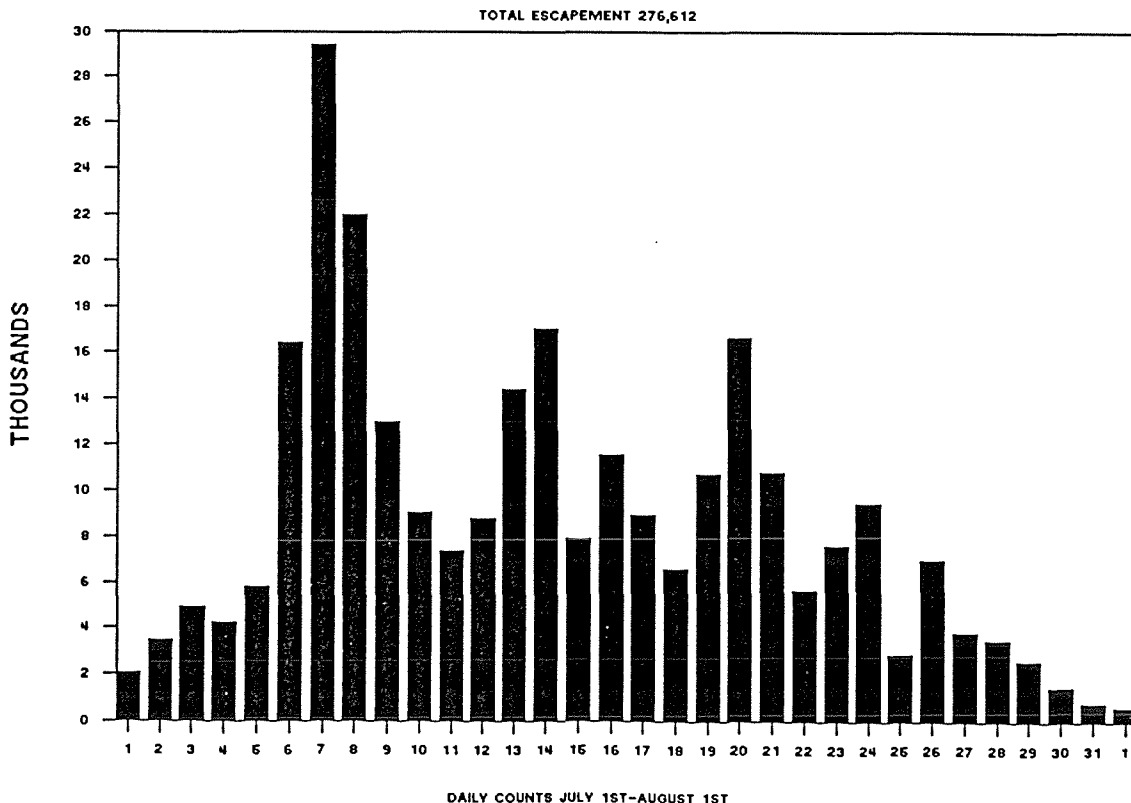
In 1987 the refuge staffed the tower with personnel and the Alaska Department of Fish and Game provided equipment and supervision. For the 1988 field season the tower was staffed by three Alaska Department of Fish and Game employees and assisted by refuge volunteer Matthew Hubers. Counting began on July 1st and terminated on August 1st. The counts were made from two 25 foot towers. Polarized glasses were used to cut out the glare from the sun and to improve visibility. Hand tally counters and timers were used for accuracy and consistency. Night counts were done by using car headlights powered by twelve volt batteries. White wire panels placed on the river bottom in past years were not installed because the composition of the substrate and water clarity levels were such that fish could be counted without

difficulties. This also alleviated the problem of fish spooking out and around the panels. The counts were started on the hour for the left bank tower and ended on the half hour for the right bank tower. Ten minute counts were made for each side and multiplied by a factor of 6 to achieve an hourly count.

To obtain sex ratios, age and length data during the run, approximately 2500 sockeye were sampled using a 10 foot x 100 foot beach seine. One scale was taken from each fish and mounted on a gum card. A measuring cradle was used to determine mid-eye to fork length. Length and sex were recorded on standard age, weight, and length forms. The adipose fin of the sampled fish was clipped so that recaptures could be recognized.

The data shows that counts often peaked at 6-7 day intervals correlating strongly with commercial fishery openings. The highest daily count of 29,400 fish occurred on July 7 representing nearly 11% of the total escapement (figure 1). The escapement goal of 150,000 was reached on July 14. The total escapement was estimated at 276,612. The actual escapement however was probably higher. The reasons for this being that, by the time the tower started operation, an unknown number had already passed and sonar enumeration down river showed after the tower project ended that fish continued to come in.

FIGURE 1
1988 TOGIAK RIVER SOCKEYE ESCAPEMENT



Side-Scan Sonar Estimation of Salmon Escapements Into Togiak River

During 1988 the King Salmon Fishery Assistance Office completed year two of a three year side-scan sonar salmon enumeration study on the Togiak River. This is a cooperative study involving the refuge and the Alaska Department of Fish and Game. The objectives of the study include: 1) provide in-season escapement estimates for chinook, coho, and sockeye salmon. 2) reduce the present time lag (about 10-14 days) between sockeye salmon escapement estimation and the commercial fishery. The focus of the 1987 field season was site selection, calibration and experimentation of equipment.

The study was conducted from June 17 through October 4, 1988. Side-scan sonar counters were operational from June 25 through September 30, 1988. The remainder of the time was spent investigating potential alternative sites and sampling methods.

A field camp and the counters were set up at the site (river kilometer 30) identified during 1987. The field crew consisted of a staff biologist, two biological aids, and two to three volunteers. The counters were modified to increase their pulse rate adjustment to account for the slow fish swimming speeds observed during 1987. Counting towers (5.5m) were used to verify the efficiency of the counters and to collect species composition data, when water clarity allowed. Gill nets and beach seines were used to collect species composition, length, and age data. A laptop computer was used to develop and test field data entry and preliminary analysis techniques.

Daily species escapement were determined using the sonar total counts proportioned by the species composition of daily samples. Species proportionment is one of the crucial components to the success of side-scan sonar enumeration. Daily sampling schedules, using beach seine and drift net sets to determine species composition, involved intense effort by the crew.

Daily escapement estimates were relayed to Alaska Department of Fish and Game in Dillingham. Preliminary 1988 escapement estimates at the sonar site are: 527,000 sockeye, 217,000 chum, 3,000 chinook, and 69,000 coho salmon. Further analysis of these data will be needed to develop a 1988 pink salmon escapement estimate.

Chinook salmon present the greatest problem for estimating escapement. Chinook numbers are small in comparison to sockeye and chum salmon, and observations indicate that some portion of the chinook migrate beyond the counting range attainable with a single counter on each bank during spring and early summer river flows. If available, additional counters will be used to extend counting ranges and test for offshore migrations during 1989. If

offshore migrations are evident, gill nets will be used to identify the offshore targets.

During coho migrations daily fish passage is often low (<3,000 fish per bank). Low fish passage makes accurate calibration of the sonar counters difficult or impossible. If available, a chart recorder will be modified for use in conjunction with the counters during 1989. A chart recorder provides a permanent hard copy of targets passing the counters and can be operated for several hours to provide data for accurate calibration.

Kanektok River Rainbow Trout Sportfishing Investigations

Information for this project is not available at this time. The King Salmon Fishery Assistance Office completed work on the river in 1987. A draft report has been completed and is currently under review by fishery resource personnel in the regional office. We hope to have a final report early in 1989!

Togiak River Creel Census Project

A creel census project was run on the Togiak River during 1988 between July 7 and September 15. Volunteer Matt Hubers staffed the creel clerk position early in the season. Volunteer Laura Umbright was assigned to assist Hubers with the project from August 10th to September 15th. The river was divided into five sublocations and three time periods. The sublocations were chosen so the creel clerk could travel through the area in approximately one hour counting the anglers for an instantaneous count. These sublocation delineations also were set up to break at the wilderness boundary, with two sublocations below and three areas above. The time periods were set up to approximate the chinook and coho salmon run timing.

Chinook salmon were caught by interviewed sportfishermen between July 7 and 30. Coho salmon were checked in the creel between July 30 and September 13 while pink salmon were angled between July 8 and September 9.

Anglers expended 18,806 hours fishing during 1988, almost 2,000 angler hours more than were expended in 1987. Primary areas and times fished included sublocation two in time periods one and three (table 6). Sublocation one was fished heavier during 1988 than in 1987 almost doubling in effort. Sublocation two stayed approximately the same as in 1987. Sublocation four doubled in effort for the third time period over that of 1987 in response to guide camps being set up in that area of the river and fairly consistent coho fishing.

TABLE 6.
Summary of Sport Fishing Effort (in Angler Hours) by period and location
Togiak River, Alaska 1988.

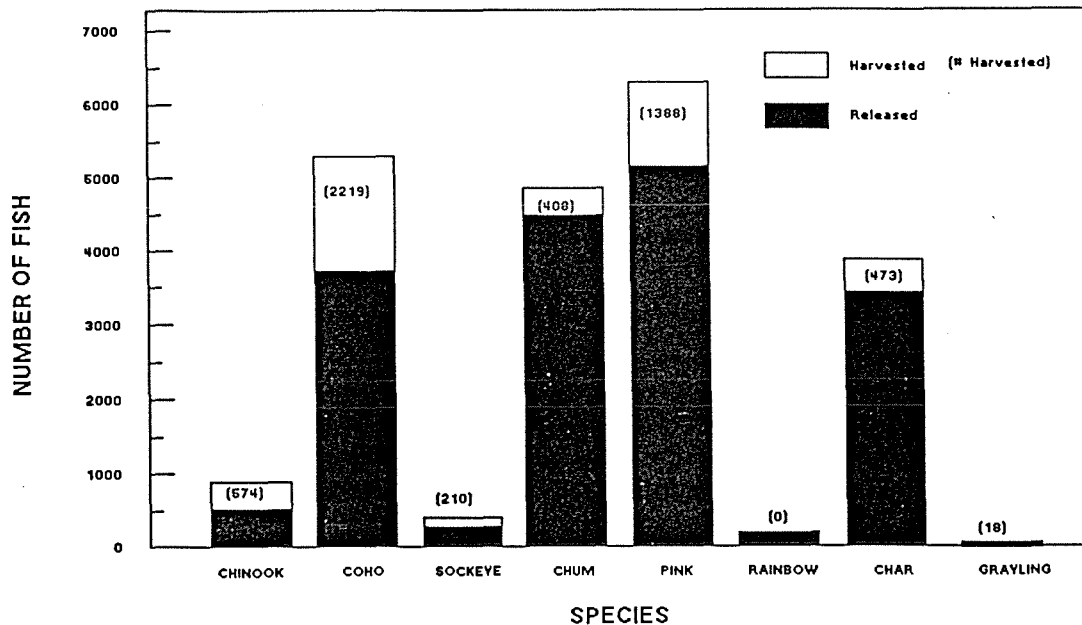
		SUBLOCATION						
		001	002	003	004	005		
DATES	RIVER MILE	0-7	7-16	16-28	28-37	37-53	TOTAL	95% CI
PERIOD 1 (JUL 7 - JUL 31)	EFFORT	2,122	3,534	1,591	682	443	8,372	5,832 --1,091
PERIOD 2 (AUG 1 - AUG 15)	EFFORT	688	919	784	0	660	3,051	2,187 -- 391
PERIOD 3 (AUG 16 - SEPT 15)	EFFORT	1,838	2,692	1,245	1,364	244	7,383	5,759 -9,007
TOTAL EFFORT		4,648	7,145	3,620	2,046	1,347	18,806	15,670 -21,942

Pink salmon were the most prevalent fish caught in the river with 6,299 fish caught and 1,388 harvested (figure 2). The abundance of pinks on an even year run made this an exceptionally good year for pink salmon fishing. Coho salmon were next in abundance with 5,332 fish caught and 2,219 fish harvested or a 42% harvest rate. Chums and char also made up a large portion of the harvest with 4,847 and 3,848 fish caught respectively. Only 865 king salmon were caught, however 574 were harvested for a 66% harvest rate. Other species made up a relatively small portion of the catch, for example only 192 rainbow trout were caught and none were reported harvested.

Char abundance was down considerably this year from last when over 12,000 were caught. This year anglers only caught 3,848 or about a third of the previous years catch.

Figure 2

Sportfish Catch and Harvest in Togiak River, Alaska 1988.



Inventory and Baseline Data Collection on Togiak National Wildlife Lakes

This was the third and final year of a study begun in 1986. The overall objectives of the project were to:

- *Map depth contours of major lakes.
- *Map shoreline substrate denoting important spawning areas for salmon, lake trout, pike, whitefish, and other species.
- *Collect water quality data.
- *Determine fish species and abundance.
- *Collect plankton samples from refuge lakes to establish preliminary information on production.

A pilot to this project was completed in June 1984 when 21 refuge lakes were surveyed for physical and chemical water profiles. Temperature, pH, conductivity, and dissolved oxygen profiles were measured using a Hydrolab 4041 water quality meter and a probe with a fifty meter cable. Secchi disc visibility was also measured.

In 1986 most of the scheduled objectives were completed. The three larger headwater lakes (Kagati, Togiak and Goodnews) were surveyed for water profiles periodically throughout the ice free season. A sonar graph recorder was used to map the depth contours of these lakes. Plankton samples were collected at random intervals. Sockeye salmon spawning concentration areas and substrate types were mapped for Togiak Lake.

In 1987 a two-person crew was dedicated to accomplishing lake surveys. Six lakes (West Togiak, Upper Togiak, High, Hart, Ongivinuck, and Nenevok) were sampled for water profiles, mapping, plankton, and spawning substrate. Measurements of species composition, inlet and outlet of stream discharge, chemical parameters of alkalinity, acidity, hardness and carbon dioxide concentrations were collected. Fish samples were analyzed for age, weight, length and stomach contents. Experimental mesh gill nets, minnow traps and sport fishing were all employed to collect fish samples. Plankton sample collection also continued at Kagati and Togiak Lakes.



Volunteers Safford and O'Neil conducting sonar graphing at Pungokepuk Lake. MJL 8/88

In 1988 a two-person crew was assigned to surveying eight additional lakes. These were the Arolik, Canyon, Gechiak, Kanuktik, Kulukak, Nagugun, Ohnlik and Pungokepuk Lakes. Sampling procedures were similar to the 1987 survey. A brief summary of the lakes sampled in 1988 is given (Table 7).

Completed analysis of collected data is unavailable at this time.

TABLE 7
Maximum Depth, Conductivity, Sampling Effort Hours and Catch by
Species, for Lakes Surveyed During 1988

LAKE	DEPTH		NET		ANGLING												
	MAX	COND	HOURS	HOURS	AC	RBT	LT	WF	GR	NP	RS	KS	SS	PS	CS	SCUL	STIK
Kuskokwim Bay																	
Goodnews R. System																	
Canyon	145'	38	26.25	14.0	23		4				14	X	X	1			X
Kanektok R. System																	
Kanuktik	126'	NM	42.15	3.0	8		8										
Ohulik	140'	NM	13.75	11.2	2		24				X		X				
Arolik R. System																	
Arolik	178'	40	24.80	0.0			6	1									
Bristol Bay																	
Kulukak R. System																	
Kulukak			46.83	2.0	27		19			45	X	X					X
Togiak R. System																	
Gechiak	72'	31	69.42	4.2	25	1				1	1	X					X
Nagugun	190'	NM	26.75	2.5	43		4					X					X
Pungokepuk	54'	49	130.00	61.8	24		29	23	44	33				1			X

COND. = Conductivity in microsiemens.

NM = Not measured.

Fish Species Abbreviations: (AC) Arctic char, (RBT) rainbow trout, (LT) lake trout, (WF) whitefish, (GR) grayling, (NP) northern pike, (RS) red (sockeye) salmon, (KS) king salmon, (SS) silver salmon, (PS) pink salmon, (CS) chum salmon, (SCUL) sculpin, (STIK) stickleback.

Kagati Lake Sockeye Salmon Escapement Survey

Refuge volunteer Rob Doyle and Refuge Information Technicians Wilbur Bavilla and Charles Evans collected age, weight and length data from 300 sockeye salmon in Kagati Lake during August and September 1988. All samples were taken from dead sockeye found on the beaches of the lake over a three week period. This was the second sample of sockeye taken from the lake. All scale samples were sent to the Alaska Department of Fish and Game, Commercial Fisheries office in Bethel.

Aerial Spawning Escapement Surveys

During 1988 Fisheries Biologist Harper conducted aerial spawning surveys of the rivers in the Bristol Bay section of the refuge. Surveys for chinook, sockeye and chum salmon were flown on August 1st and 10th. During the survey very few king salmon were observed in the Osviak, Matogak, and Quigmy rivers. The Negukthlik and Ungalikthluk rivers were the only rivers with any significant numbers of spawning chinook. The Togiak River was surveyed by the Department of Fish and Game.

Surveys for coho salmon and Dolly Varden/char were flown October 4, 5 and 6 for Bristol Bay drainages and October 25th for the Goodnews River. The survey on October 25th was too late for much information on coho salmon on the Goodnews, however good data was obtained for char.

Information at this time points to the gradual decline in the chinook salmon stocks in the rivers of the southern refuge coast. Most of the impact to these fisheries is from the by catch that occurs during the large sockeye salmon fisheries and possibly high seas interception. New and innovative methods of controlling this catch while still allowing for the harvest of the larger runs of sockeye need to be devised to prevent further loss of this resource.

Ungalikthluk/Negukthlik River Rainbow Trout Study

The Negukthlik and Ungalikthluk Rivers sustained heavy fishing pressure in 1984 and 1985, especially when idle herring fishermen were waiting for commercial fishing openings. There were reports of numerous overlimits and the netting of rainbow trout. The state sport fish biologist closed the river to sport fishing in the spring of 1986 and 1987 to protect spawning rainbow trout. Sport fishing on the river during the remainder of the year has increased over the past few years to over 500 use days in 1987. In 1986 fewer fish were observed than were expected during an aerial survey of spawning fish. The possible loss of older spawning aged fish has the refuge concerned.

Since there is little data on the populations of rainbow trout of this river a preliminary study proposal was submitted to the regional office. Objectives of the study are:

1. Determine the life history characteristics of the Negukthlik/Ungalikthluk River rainbow trout populations.
2. Determine critical spawning and overwintering habitat areas.

3. Determine the feasibility of monitoring rainbow trout populations on the Negukthlik and Ungalikthluk Rivers by using aerial survey techniques.

This study was approved for funding in 1989 by the regional office. The study should start (depending upon weather), sometime in the spring of 1989 and continue into 1990.

SOUTHWESTERN ALASKA RAINBOW TROUT INVESTIGATIONS - GOODNEWS AND AROLIK RIVERS

The King Salmon Fishery Assistance Office at the request of the refuge initiated a study to determine the population structure of rainbow trout in the Goodnews and Arolik Rivers.

The initial field season of a proposed three-year investigation of Goodnews and Arolik River rainbow trout was conducted from June 20 through September 21, 1988. Sampling was limited to the Goodnews River because the Service was unable to complete a lease agreement prior to the field season for a camp on the Arolik River with Qanirtuug, Inc., Quinhagak, Alaska the landowner.

The four person crew consisted of a biological technician and three volunteers. The crew began the year by sampling the upper North Fork from a camp located at Goodnews Lake. As water levels steadily receded, camp was progressively moved downstream. Three camps sites were utilized to sample fish from as much of the watershed as possible.

A total of 238 rainbow trout were captured during 1988. Seventy-two percent of the captured rainbow trout were collected from the North Fork, 15% from the Middle Fork and 13% from the South Fork. The trout were sampled for age, weight and length data. Scale samples were collected from all captured fish and a subsample of 124 fish were sacrificed for otolith collection.

The otolith aged fish ranged from 2-11 years of age, from 134-615 mm in fork length (Figure 3) and from 0.25-2.55 kg in weight. The scale collection is presently being read. Comparison of the Relative Stock Density of the 1985 and 1988 sampled fish indicated a shift from a predominance of fish in the Memorable category to the Quality category (Figure 4). This is based on a 92 fish sample captured in 1985 by the Alaska Department of Fish and Game, and may not indicate a true change in population structure because of sample size and sampling gear biases. The percentage of 1988 fish in each category more closely resembles the 1987 Kanektok River sample (442 fish).

Twelve float parties totaling fifty-four float anglers were interviewed in 1988, and they reported a total rainbow trout catch of 117 fish. The overall seasonal catch rate for this group is estimated to be 2.2 rainbow trout-per-angler-day. This is similar to the catch rate of unguided float anglers on the Kanektok River in 1986 and 1987 (2.2 and 2.4 rainbow trout-per-angler-day, respectively). Catch rates for motor boat anglers have not been estimated at this time.

GOODNEWS LAKE TOWER PROJECT

A commercial fishery has occurred annually in Goodnews Bay since 1968. Salmon escapement into the Goodnews River has been assessed by aerial surveys and starting in 1981 bolstered by a counting tower established on the Middle Fork. Aerial surveys of the river system have been carried out rather sporadically and were missed completely last year during the coho season. The primary objective of this project was to determine the feasibility of counting salmon at Goodnews Lake and to provide an estimate of the salmon escapement into the lake. The collection of data at Goodnews Lake is tied to the public use camp. The project would not be conducted if the public use camp were not in operation.



Volunteers Hopkins and Edgar counting salmon
at Goodnews Lake Tower.

KH 8/88

The Goodnews Lake salmon counting tower operated from July 8th through August 3rd, and from August 21st through September 11th, 1988. An estimated 81,359 sockeye, 32 chum, 3,737 pink, and 4,624 coho salmon migrated past the counting tower during the 1988 operational period. These data are expanded to cover 24 hour days, based upon a limited (8-9 hours) amount of daily observations. Since the observations were not made for entire 24 hour periods estimates could be adjusted down or increased.

JET BOAT STUDY

Through out the scoping process for the fishery management plan one issue that kept surfacing was that of jet boats and their impacts on the fisheries on the rivers. Numerous people in villages, the refuge staff and others felt that there might be an impact to the spawning grounds and to the small fish found in the river. A study proposal for research into the impact of jet motors was submitted to the regional office. The study was tentatively approved with major revisions for possible funding in 1990. Other agencies interested in the project include the National Park Service and the Sport Fish Division of the Alaska Department of Fish and Game. A jointly funded project may be possible in the near future.

SUBSISTENCE FISHERY TOGAIK RIVER

During several meetings in the village of Togiak the people expressed their concern over the lack of char and the decrease in the size of the fish in the river. The refuge recieved a letter from Togiak Natives Limited that the village was concerned about the char population and would like the refuge to possibly start some studies into the status of the population. To better understand the subsistence fishery on the Togiak River and to gather information on the char population the refuge initiated a subsistence study on the Togiak River during the fall of 1988. With the use of Refuge Information Technician, Wilbur Bavilla, subsistence information was gathered from Togiak village residents. Some progress was made in the identification of at least four different names and possibly different life histories of char before the technician was laid off due to personal problems. The project was cooperative in nature, with the refuge helping the State Subsistence Division collect salmon information. Plans are to hire another technician in 1989 and attempt to collect more data.

SUBSISTENCE FISHERY KANEKTOK RIVER

Katherine Cleveland and Charles Evans from the village of

Quinhagak were hired as Refuge Information Technicians to collect subsistence fishery information. During the months of February, March, and April they made several trips up the river to gather information on the subsistence take. Information gathered included the length of time spent fishing, location of activity, number and species of fish harvested. The information will help in understanding the fisheries of the river and the numbers needed for subsistence purposes.

Numerous problems such as snow machine break downs precluded the team from making the desired number of trips up the river. Also, resistance to the collection of subsistence information was felt in the village. Village residents still have a distrust for the State and/or the refuge since they were unable to get regulation changes implemented by the Board of Fisheries in 1987. Regulation changes would have greatly reduced the number of sport fishermen on the Kanektok River.



Subsistence fishing activity during the winter
on the Kanektok River. KH 2/88

LAKE TROUT TAGGING KAGATI LAKE

During 1987 the Alaska Department of Fish and Game became very concerned over the disappearance of larger sized lake trout in central Alaskan lakes from heavy fishing pressure. It is known that there are populations of lake trout in several refuge lakes, however it is unknown what harvest pressure is exerted. Data about these populations, their size distributions, age classes or other life history characteristics are also lacking.

A preliminary study proposal to tag fish from Kagati Lake was submitted to the regional office. Objectives of the study were to:

- *Determine age and size structure of lake trout populations.
- *Estimate age at maturity and fecundity of females.
- *Determine population size and estimate allowable harvest to protect population parameters.

Pending final approval from the regional office, Refuge Fishery Biologist Harper made a preliminary sampling trip to Kagati Lake. Volunteers stationed at the lake helped to capture lake trout. Information obtained included the most effective capture methods, areas of concentration and when fish are available for capture.

During preliminary sampling (July 8th-15th) 168 lake trout were captured and tagged using numbered floy tags. Nets were employed during the preliminary effort, however numerous sockeye salmon in the sampling area precluded this gear type. The most effective method appeared to be rod and reel and was used to capture the majority of the fish.

Fish sizes ranged from 35.1 to 64.3 cm, with approximately 60% in the 47.5 to 59 cm size range. Only three fish were recaptured during the course of the limited sampling during this experimental phase.

Other useful information included the ability to census fish in shallow waters prior to July 10th when the water temperature was around 12 degrees centigrade. A total of 147 lake trout were counted by slowly motoring on a calm day along a one mile shore area of the lake. Shortly after this time as the water temperatures warmed the fish left the shallow depths and moved into deeper waters.

A more complete study will be accomplished in 1989 if funds are available.

CHAGVAN BAY GOOSE MIGRATION AND SUBSISTENCE HUNT MONITORING

Chagvan Bay, located on the southwestern coastline of the refuge, eight miles north of Cape Newenham, is one of several primary staging areas for waterfowl during spring and fall migrations. The bay and adjacent areas contain eel grass beds, tidal flats, mussels, upland grasses, sedges, and berries which provide necessary nourishment as well as a resting area for migrating waterfowl.

This concentration of waterfowl is also of interest to native populations in the villages of Goodnews Bay and Platinum. They come to Chagvan Bay between spring break-up and the beginning of the commercial herring fishing season to hunt waterfowl.

Due to the increased concern over the decline of cackling Canada, white-fronted, Pacific black brant, and emperor goose populations, as well as the controversy over spring subsistence take of waterfowl, the refuge staff initiated a study of hunting activity in Chagvan Bay in 1984. Refuge bio-techs and volunteers staffed the camp and have maintained a low profile using observation and casual interview as their primary tools. For the past five seasons the project has been operated during the following dates:

1984	May 03 - June 01
1985	May 22 - June 04
1986	May 14 - June 03
1987	May 04 - May 29
1988	May 11 - June 02

As in previous years, camp was established on the south shore. The north spit beach provides the best landing location for chartered planes during the initial camp setup. This also requires a ferrying system via inflatable Zodiac rafts, which has been supplemented by trading gas or food in exchange for the use of a hunter's time and his aluminum skiff. The camp location provides good boat and plane access; offers a good vantage point for observing activities in the bay, as well as monitoring the arrival and/or departure of birds and hunters.

Several vantage points were used throughout the bay to make daily observations of both hunters and birds. Due to the size of the bay, and the difficulties inherent in counting the large numbers of birds found in the bay, the crew members dispersed their efforts and established spike camps at various vantage points up the bay. Observations of geese included the date each species was first observed, daily staging estimates (usually conducted at low tide when the birds concentrate on exposed gravel bars), arrivals, departures and flock sizes. Observations by all personnel were

compiled and reported for each species (Table 8).

TABLE 8
Migration Phenology of Arctic Nesting Geese
Chagvan Bay, 1983-1988

Species	Date of First Observation	Number of Birds Observed	Date of Peak	Number of Birds Observed
Pacific Black Brant	04/14/83	1,825	05/05/83	24,250
	04/28/84	5,500	05/20/84	33,000
	05/20/85	26,500	05/20&26/85	26,000
	05/01/86	4,500	05/18&22/86	55,000
	04/24/87	110	05/23/87	18,000
	05/12/88	10,000	05/21/88	43,000
Emperor	04/12/83	90	05/05/83	9,100
	04/28/84	30	05/14/84	8,000
	05/20/85	5,500	05/20&29/85	5,500
	05/01/86	100	05/18/86	6,000
	04/24/87	50	05/09/87	12,000
	05/12/88	100+	05/18/88	2,000
Canada	04/29/83	300	05/05/83	500
	04/30/84	50	05/24/84	4,500
	05/20/85	8,000	05/20/85	8,000
	05/01/86	450	05/05&20/86	2,000
	04/24/87	65	05/06/87	1,800
	05/20/88	10	05/20/88	10
White-front	04/29/83	20	05/05/83	25
	05/04/84	150	05/24/84	600
	05/20/85	50	05/28/86	150
	05/01/86	75	05/05/86	250
	None Observed			
	05/18/88	2	05/18/88	2



Pacific black brant about to land on Chagvan Bay to feed on eelgrass. MJL 5/88

Pacific black brant are the most readily observed species using the Chagvan Bay area. Their marine habits keep them generally confined to the open water and tidal zones of the bay. Their predictable movements between roosting and feeding areas improve surveyors chances in making estimates of the daily staging numbers. Brant are generally found concentrated at roosting areas during high tide, flying to emerging gravel bars and eel grass beds as low tide approaches.

Emperor geese also appear to concentrate mainly along the tidal areas of the bay. Observations made in 1987, suggest that some emperors may roost along the tundra ponds and the Kinognak River north of Chagvan Bay, returning to the bay to feed on eel grass beds at low tide.

Canada and white-fronted geese appear to concentrate on the uplands surrounding Chagvan Bay and it's tributaries. Very few of either of these species are seen feeding or roosting directly in the tidal zones.

Another factor which may effect the number of birds staging at Chagvan Bay is the amount of human activity. Aircraft and hunting activity disturbs staging waterfowl. At times, during a disturbance, birds have been seen leaving the bay. It is not known whether these disturbances are the major stimulus for these

departures, or whether conditions are favorable and the disturbance merely initiated continued migration.

Observations of subsistence hunting at Chagvan Bay have been recorded for the past five seasons (Table 9). Specific information concerning daily bag harvests has been gathered infrequently as most hunters do not voluntarily discuss the number of hours spent or number of birds taken during a hunting day. Harvest information has been obtained by interviewing and observing hunters in the field. Some data, such as: numbers of hunting parties, hunters, and the length of hunting trips is obtained by direct observation and friendly conversation.

Most hunting practices consist of pass shooting at birds with some skiff hunting being employed. Through several years of observation it appears that most hunters are not very successful.

Populations of seal and sea lion begin building as they follow spawning herring into the bay. Hunters are opportunistic fluctuating between waterfowl and marine mammal targets. During these marine mammal hunts, the rate and magnitude of shots fired becomes alarming as attempts to take seal and sea lion in the bay increases. Obviously, many of the animals are shot and wounded but not retrieved. At least two dead seals and two dead sea lions with gunshot wounds, were washed up on the beach during the 1988 spring season.

TABLE 9
Subsistence Hunters Using Chagvan Bay
1984 - 1988

Year	# of *Parties	# of Hunters	# of Use Days
1984	16	41	126
1985	09(12)	18(24)	31(41)
1986	07(17)	18(42)	81(127)
1987	13	33	78
1988	13	28	39

Numbers in () represent total subsistence use
Numbers not in () represent waterfowl subsistence use.

Of the thirteen parties that hunted at Chagvan Bay in the Spring of 1988, eleven arrived by skiff, one by three-wheeler and one by motorbike. Total numbers and species taken was censused from seven parties. From these parties, a total of 118 birds were taken. Species are broken down as follows: 75 brant, 21 emperor geese, 5 steller eiders, 5 harlequin ducks, 3 Northern pintail, 3 common eiders, 2 American widgeon, 1 black scoter, 1 red-breasted

merganser, 1 common merganser and an unidentified ptarmigan. A full term pregnant seal and a sea lion were also taken.

WATERFOWL BROOD SURVEYS

In 1983, the refuge began waterfowl production surveys on the Nushagak Peninsula. In 1984, ten brood survey plots were established in two separate areas. These areas were surveyed, on foot, in 1984, 1985, and 1986.

Two areas were added to this on-ground survey in 1986. One was located on the Nushagak Peninsula, north of the original ten survey plots, along the Igushik River. The second area was along the western coast of the refuge on the north side of Chagvan Bay.

In 1987 all previously established plots (except the two on the north side of Chagvan Bay) were disregarded and a new study plan was written and initiated. Sixty study plots, each one square mile, were randomly selected from approximately 900 square miles of habitat. The two main areas selected were the Nushagak Peninsula and the western coastal region ranging from Quinhagak down to Chagvan Bay. Thirty plots were selected from each of these areas.

U.S.G.S. topographical maps were used to divide the study areas into one square mile plots. A computer generated random number list was used to select study plots. Selected plots not accessible (more than two miles from a waterbody large enough and deep enough for float plane landings) were discarded and another number was drawn.

Eighteen additional plots were selected for the 1988 survey, using the same method as in 1987. The new plots were selected from seven areas to complete the representative sample started in 1987. Areas surveyed include Kulukak River (two plots), Kanik River (four plots), Ualik Lake (three plots), Tvativak Bay (two plots), Osviak Slough (two plots), Matogak River (three plots) and Chagvan Bay (two new plots, two previously selected plots).



Tundra swan observed by volunteers during
waterfowl brood surveys. LU 7/88

Volunteers Michelle Bourassa and Laura Umbright worked as a team to gather field data. Two rounds of surveys were conducted. During the first round (June 20 to July 15) 13 one square mile plots were surveyed. A total of 32 broods were recorded, of which 22 were duck broods making the average 2.5 broods per square mile. The second round was surveyed from July 26 to August 18. Fifteen square miles were surveyed with 56 broods being observed. Of those 56 broods, 51 were duck broods making the second round average 3.4 broods per square mile.

Brood observations for the two rounds are summarized (Table 10). Broody hens, (hens with no visible brood, but enacting a distraction display when flushed are considered broody), were also included and counted as having an average size class I brood.

TABLE 10
Survey Totals

Total number of broods observed. Fifteen square miles and 280 water bodies surveyed.

WATERFOWL SPECIES	CHAGVAN	MATOGAK	OSVIAK	TVATIVAK	KANIK	KULUKAK	UALIK	TOTAL
	2 Plots	3 Plots	2 Plots	2 Plots	1 Plot	2 Plots	2 Plots	BROODS
<hr/>								
DABBLERS								
GREEN-WINGED TEAL	8	1	5	4	15	19	0	43
MALLARD	0	0	0	4	1	0	0	5
NORTHERN PINTAIL	0	0	0	0	1	3	0	3
NORTHERN SHOVELER	0	0	0	0	0	2	0	2
UNIDENTIFIED	1	0	0	0	0	0	0	1
DIVERS								
UNIDENTIFIED NEST	0	0	0	0	1	0	0	1
SCAUP	8	1	0	1	1	0	0	11
SEA DUCKS								
OLDSQUAW	1	2	0	1	0	0	0	4
BLACK SCOTER	0	1	1	0	0	0	0	2
LOONS								
RED-THROATED LOON	1	0	1	4	2	0	0	8
ARCTIC LOON	0	0	0	0	1	1	0	2
OTHERS								
TUNDRA SWAN	0	2	1	0	0	0	1	4
RED-NECKED GREBE	0	0	0	0	1	0	0	1
<hr/>								
TOTAL BROODS	19	7	8	14	23	16	1	88
BROODS PER SQUARE MI	9.5	2.33	4	7	23	8	0.5	5.9

Only a slight change was noticed in number of broods per waterbody from that reported in 1987. The average brood size dropped from 6.2 in 1987 to 5.0 in 1988 (Table 11).

TABLE 11
Brood Observation Comparisons 1984-1988.

YEAR	WATER BODIES SURVEYED	BROODS PER WATER BODY	AVERAGE BROOD SIZE
1984*	118	0.8	5.3
1985	104	0.2	7.6
1986	145	0.3	4.8
1987	333	0.4	6.2
1988	280	0.3	5.0

*Observers remained in the same area for the season, monitoring the same waterbodies therefore data may not be comparable.

**1984 through 1987 figures taken from the 1987 Waterfowl Production final report.

GOOSE BANDING

Nushagak Peninsula, located in the southeast corner the refuge, is composed of lakes, ponds, streams, rivers, and marsh areas which combine to offer food and shelter to staging, nesting and molting waterfowl.

In 1982, a large concentration of geese, (white-fronted and Canada), was observed molting on the peninsula. The concentration of geese was noted during aerial surveys in subsequent years. Nothing was known about the origin of these geese or their status (i.e., failed breeders, immatures, etc.). A banding study was designed in 1987 in an attempt to determine a general age class of this molt group as well as to establish which subspecies of Canada geese are present.

The banding effort encountered problems in 1987 when a majority of the wing net material was lost in shipping and resulted in the project being cancelled for the year. Better organization and a change of vendors allowed the project to go on as planned in 1988.

The project was scheduled to begin the week of July 18, however, during a caribou survey of July 8th, 2,500 Canadas and 1,850 white-fronts were observed on the peninsula. Small groups of white-fronts were already able to fly. As a result of this observation the project was moved up and began on July 14th.

Molting geese were captured using a drive trap technique. Study areas were selected primarily by molting concentrations of geese and on the basis of accessibility by float equipped aircraft. The trap crew and materials were transported to each site using the refuge aircraft (N735EA). Personnel were dispatched to their

assigned tasks while the aircraft was used to round up the geese to begin the drive. Two persons were stationed at each end of the trap wing, one person in the middle of each wing, and one person at the entrance to the trap to close the gate. Two Kleppers were also used to drive the birds, one on either side of the aircraft. Constant communication with VHF hand held radios took place between the pilot, Kleppers and persons at the ends of the trap wings. This communication was essential for coordinating the drive.

Birds captured were identified, sexed, aged when possible, banded and released. After all birds were processed and released the trap was dismantled, moved to a new site and reconstructed for the next day's drive.



Completely outfitted white-front about to be released
by Cal Lensink. DAF 7/88

A goal of 600 white-fronts and 600 Canadas was set. Unfortunately when the drive began on July 14, the majority of the white-fronts discovered their molt was sufficiently completed to allow them to fly. It was estimated the white-front molt had taken place approximately two weeks earlier than anticipated. As a result of the error in timing only 45 white-fronts were captured and banded. Of these, seven were fitted with neck

collars and radio transmitters. The seven neck collars, radio transmitters and leg bands for these birds were furnished by the wildlife research division of the regional office. The transmitters and neck collars were applied by Cal Lensink of the regional office. In addition to routine processing, Lensink also measured the culmen, tarsus, and weight of each bird.



Our first effort at banding geese was successful.

MJL 7/88

Timing was perfect for trapping the Canadas. The birds were approximately half way through their molt. Almost all of them still had sheaths on the primaries, though the feathers were emerging. Aside from routine processing, culmen, tarsal, and weight measurements were taken by Lensink in an effort to determine subspecies. The goal of 600 was not only reached but surpassed as a total of 662 Canadas were banded and released. Of these 662 geese, five were found to be cackling Canada geese. From these measurements Lensink was able to place the majority of the Canadas in the subspecies B. c. taverneri.

The project was concluded when the goal for the Canadas was met on July 20. A total of six drives were attempted of which four were successful with a total of 707 birds banded (45 white-fronts, 5 cacklers, 657 Canadas).

ENVIRONMENTAL CONTAMINANTS SAMPLING AT INSTALLATION RESTORATION PROGRAM CLEANUP SITES, CAPE NEWENHAM

The Installation Restoration Program (Program) was developed by the Department of Defense to assure compliance with federal hazardous waste regulations (e.g., Resource Conservation and Recovery Act of 1976, Comprehensive Environmental Response, Compensation, and Liability Act of 1980). Under the program, the Department of Defense has taken steps to identify and evaluate past hazardous material disposal sites on Department of Defense property, to control the migration of contaminants, and to control hazards to health or welfare that may result from these past disposal operations.

The 2,359 acre Cape Newenham Air Force Station is located within the refuge and is the dividing point between Kuskokwim Bay and Bristol Bay. The Station became operational in 1954 as one of the ten original aircraft control and warning sites constructed as part of the air defense systems in Alaska. The original installation has been replaced by more modern systems and facilities. The old building structures have been buried on site.

The Cape Newenham station was inventoried in 1985 by Engineering-Science, under the Phase I, Installation Assessment/Records Search of the Program, for the U.S. Air Force, Alaskan Air Command. The inventory listed past and present installation activities that resulted in generation, accumulation, and disposal of hazardous waste (Engineering-Science, 1985).

Potentially hazardous wastes generated at the Station consist primarily of lubricating oils and some solvents from vehicle, equipment, and power plant maintenance activities. In earlier years, the wastes were used on roads as dust control agents; more recently, they have been accumulated and barged to off-base disposal sites. The presence of electrical transformers which may contain polychlorinated biphenals may also have contributed hazardous waste.

This sampling study has been divided into two phases the objectives of which are:

PHASE I.

1. Perform sampling at Cape Newenham Air Force Station to determine what, if any, contaminants may have entered the environment surrounding the installation.
2. Interpret analytical results and draw inferences as to the data's ecological significance and the source of contamination, if any.

PHASE II.

1. Identify needs for remedial action and coordinate with other agencies to effect cleanup.
2. Conduct followup sampling after cleanup to ensure completion of program.

The sampling portion of Phase I part 1 was completed during a staff visit August 10 and 11, 1988.



Environmental Contaminant Specialist Crayton and
volunteer Lisac collecting contaminant samples at Cape
Newenham. MJL 8/88

Bio-Tech Lisac, Environmental Contaminant Specialist Wayne Crayton (Fish and Wildlife Enhancement) and volunteer Denise Lisac flew to Cape Newenham and collected 54 sediment samples and 24 soil samples at 13 identified problem areas. These were triplicate samples collected using sterile techniques. All samples have been sent to Patuxent contract labs to be analyzed for organochlorines and PCB's, aromatic hydrocarbons and/or the following heavy metals: antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl) and zinc (Zn). Results will be reported as parts per

million, dry weight, and percent moisture for all samples.

Analysis results should be completed by late 1989. The Anchorage Ecological Services field office will prepare the Phase I and Phase II reports as per study plan objectives.

REINTRODUCTION OF CARIBOU (RANGIFER TARANDUS) TO THE NUSHAGAK PENINSULA/KULUKAK DRAINAGE OF THE TOGIAK NATIONAL WILDLIFE REFUGE

Reintroduction of caribou onto Togiak National Wildlife Refuge lands was established as a primary objective when the refuge was established under the Alaska National Interest Lands Conservation Act. Feasibility studies were annual work planned during 1984 as a prelude to a future reintroduction project. Alaska Department of Fish and Game biologists also became interested in the caribou reintroduction concept during that 1984 period.

During February 1984 Alaska Department of Fish and Game Biologists and refuge staff investigated areas on the refuge in the Trail Creek, Togiak, Kulukak and Goodnews River drainages as well as the Nushagak Peninsula to determine suitability for winter range. All areas investigated appeared to be suitable as caribou winter range. Based on these surveys a tentative caribou reintroduction proposal was made during 1985 to test the waters. It became evident immediately that extensive information and education ground work with the native communities on the refuge would need to be done before a caribou reintroduction could be successful. During 1986, talks with village leaders began to explore the possibility of securing cooperation from villages located on or near the refuge. By the end of 1986 the prospect of gaining cooperation on the project from several villages was looking good enough to put together a full blown proposal in hopes of securing funds for the reintroduction. Meetings continued with village leaders to solicit their cooperation in the project. The main villages, Togiak and Manokotak agreed to sign a cooperative agreement with the U.S. Fish and Wildlife Service and Alaska Department of Fish and Game during the early part of 1988. The Choggiung Limited Corporation of Dillingham also agreed to be co-signers on the cooperative agreement. The village of Twin Hills expressed interest in the project but declined to sign. Efforts to convince Twin Hills to be signatories of the agreement continue but have been unsuccessful.

The reintroduction proposal was approved at the beginning of fiscal year 1988 and funds were allocated to the project with a starting date set for early February, 1988. Equipment and supplies were ordered during November and early December. Shipping crates used for the Kenai caribou reintroduction project were shipped to King Salmon and additional crates were constructed by the Dillingham High School shop class.

January 18, 1988 refuge staff transported building materials and base camp equipment to the southwest side of the Nushagak Peninsula which was selected to be the release site. Four days later, the release site was completed. It consisted of an 8' high by 40' diameter plywood corral, four weatherport tents on wooden platforms and antenna installation for HF radio communications system.

Late in January, 1988, Wildlife Biologist/Pilot Hotchkiss and Alaska Department of Fish and Game Area Biologist Taylor traveled to Wasilla, Alaska where they inspected the Soloy Helicopter Inc. Hughes 500D helicopter that was equipped with a skid mounted net gun for this project. This method of capture had never been used on caribou before but it was used extensively and very successfully in New Zealand for capturing red deer. Test firings of the net gun system using various strength blank 308 cartridges were conducted during the first day to obtain optimum net deployment. Minor problems with the firing mechanism were corrected before traveling to the Glenallen area to field test the system on live caribou. Several caribou were captured and fitted with radio collars by Alaska Department of Fish and Game biologists during the test. Following the inspection and testing of the net gun system, the reintroduction project was scheduled to begin February 2.



Loaded net gun consists mounted on helicopter skid.

FP 2/88

The skid mounted net gun consists of a frame supporting two net gun mechanisms combined into one unit. Each net gun has a canister shaped like a square funnel into which an 18' by 18' braided nylon net was carefully packed. Each net has a steel weight (slug) attached at each corner with an 8" nylon rope. The net is packed in a way that leaves the four slugs exposed by the mouth of the net canister. Two canisters are quickly and easily mounted or dismounted from the net gun frame requiring only a single pin to be removed in order to change canisters. Once the canister with a properly packed net is attached to the net gun frame, the four "slugs" are inserted into barrels and tubes mounted above and below the canister. Each barrel (2 above and 2 below the canister) is angled away from the center of the canister in order to deploy the slugs attached to the net forward and at an angle away from the canister. When fired, the slugs carry the net out of and away from the net gun assembly which is attached to the helicopter. The net deploys in a horizontal direction forward of the helicopter approximately 10-20 yards, then drops vertically over the intended target. The slugs are propelled by expanding gasses from the 308 caliber blank rifle cartridge. The rifle cartridge is mounted in a breach block assembly which is fired by an electric solenoid, activated by the helicopter pilot. The electric solenoid drives a firing pin into the 308 cartridge which releases the gasses through metered ports into the barrels that propel the slugs forward deploying the net.

On February 2, 1988 equipment and materials were transported to a frozen lake on the Becharof Refuge, where a base camp or transplant staging areas was constructed. This site consisted of a single weatherport, 3 caribou "motels" for holding caribou prior to shipment, and a HF radio communications system. Each caribou "motel" was a large plywood and 2" by 4" frame structure separated into four stalls, each stall being large enough (6' long - 4' high and 24" wide) to hold one adult caribou. The staging site would be used to process captured caribou for subsequent shipment to the release site on the Nushagak Peninsula.

A spotter plane was used to find groups of caribou and guide the helicopter by radio into position for capture. As soon as the helicopter is working a group of caribou, the spotter plane leaves to locate another group of caribou. Usually only one or two caribou are taken from each group in order to minimize disturbance to the group.



Recently netted caribou waiting to be transported to the capture site. DAF 2/88

Three people are aboard the helicopter, the two person capture team and the helicopter pilot. When an animal is captured the capture team aboard the helicopter is dropped off to subdue and prepare the animal for transport to the capture site. Each team is aboard the helicopter during the chase and capture of the animal. The helicopter lands near the netted animal to discharge the capture team. One person would get initial control of the animal and the other injects it with a tranquilizer drug (Rompun) to calm it down. When the tranquilizer drug begins to take effect, the animal is untangled from the net, all four legs are hobbled with sheepskin lined nylon straps and then it is blindfolded with a specially constructed hood. Vital signs, general condition of the caribou, capture time, drug injection time, and the amount and type of drug used is noted on a data card for each animal. The caribou is then placed in a heavy canvas bag and readied for transport. The capture team then waits for the helicopter to return and pick them up. While all of this is going on, the helicopter is taking the second team out to capture another caribou. After it has captured a caribou and dropped the team off, the helicopter returns to pick up the first team and their animal. One of the team members stands near the caribou and holds the rope in the air. The helicopter then hovers above the caribou while the sling loop is hooked onto the belly hook of the helicopter. Once this is completed, the second team member signals the pilot who moves the helicopter off to the

side and lands. The caribou is then sling loaded back to the capture site for processing and shipping to the release site.

At the capture site, the caribou is gently lowered to the ground as the ground team guides the caribou onto a sled, the pilot releases the rope from the sling hitch with a switch inside the helicopter. Then the helicopter departs the area to capture another animal and the whole process starts over again. Up to 27 animals were captured in one 10 hour day using two capture teams.



State game biologist Taylor (extreme right), processing caribou before transport to release site. DAF 2/88



Weighing caribou at capture site. FP 2/88

The caribou is transported to the processing site by sled where it is unwrapped and weighed. Heart rate, respiration rate, temperature, general condition, sex and approximate age are recorded for each animal. The antlers are removed, ear tags attached, and a numbered 6" wide vinyl neck collar is put on the animal. The caribou is injected with Inverimictyn, a drug to control parasites such as bot fly larvae. Blood samples are taken for later testing to determine what diseases or parasites may be present.

After all this information is gathered, the animal is placed in a stall in the caribou "motel". Hobbles and blindfolds are removed and straw bedding is placed on the floor of the stall so the animal will be as comfortable as possible. These caribou stay in the "motel" until shipped to the release site. They are shipped in the order that they are captured. The longest caribou were kept in the "motel" was overnight following late afternoon capture and were the first ones shipped the following morning.



Caribou about to be loaded in the Otter for transport
to the release site. DAF 2/88



Caribou enroute to their new home. FP 2/88

A DeHavilland Otter DHC-2 owned and operated by "Bo" Dardin, Alaska Cargo Service, was chartered to transport the captured caribou to the release site. Prior to loading the caribou on the Otter, the animal is once again injected with Rompun while still in the "motel", removed from the "motel" after the drug takes effect, hobbled, blindfolded and placed in a kneeling "rest" position on a small polyrope cargo net. The net is wrapped around the animal and secured with cargo straps. Seven or eight animals are loaded aboard the Otter and secured for their one hour and 15 minute flight to the release site. Each group of caribou is accompanied by a veterinarian or some one appointed by him to monitor the animals and correct any problem that might develop while enroute. The plane is met at the release site by refuge personnel and volunteers from the village of Manokotak. The cargo net wrapped around the animal is removed first then the hobbles are removed. The blindfold is left until last to keep the animal calm. The first three plane loads were placed in the corral for observation until the tranquilizing drugs wore off. It was found that the recovery time from the tranquilizer was much quicker than anticipated and those caribou placed in the corral were in danger of causing injury to themselves or others in the corral. As a result, the corral was not used after the first two days of the project. The animals were unloaded and moved a short distance from the plane where there was enough snow to allow good footing. They were positioned so they were facing away from camp, equipment, and people with nothing between them and freedom. Any caribou which seemed to be in distress were placed in the corral for observation. Many caribou stood and walked off immediately while others remained in the "rest" position, some up to 25 minutes, before they wandered off to join the rest of the animals.



Caribou being released on the Nushagak Peninsula.
MJL 2/88

One caribou selected from each plane load was fitted with a radio collar. Twenty radio collars were placed on caribou prior to their release.

One hundred and sixty-one caribou were captured during the period between February 4 and February 17. Of the 161 animals captured 155 were transported to the Nushagak Peninsula, six caribou died of capture myopathy at the point of release. Six died of injuries directly related to the capture technique. These injuries were either broken legs or broken necks. One animal died in the shipping crate while enroute to the release site and one died enroute to the capture site from suffocation. One died while being held overnight in the holding pens, probably from capture myopathy. Overall mortality during the project was 15 animals, 8.9% of the total captured. Three caribou were released at the capture site in good condition and one escaped prior to being shipped. A total of 148 caribou were released.

Caribou are very sensitive to the use of immobilizing drugs during the winter period and a capture/transplant operation of this magnitude would be expected to result in a much higher loss than the 10% loss experienced on this project. This capture operation using the helicopter skid mounted net gun resulted in

the lowest capture mortality rate ever incurred on a caribou capture project of this size and type.

One group of 8 were released near the VOR site at Dillingham February 7, when weather conditions prevented the Otter from reaching the release site. Shortly after their release three of these caribou moved down the Peninsula approximately 35 miles to join up with the rest of the caribou. Two of the 8 released at the VOR site were found 10 miles down the Peninsula in the general direction of the main release site three weeks after their release. One appeared to be injured, and the remaining 2 in this group were never seen again and their whereabouts remain a mystery.

One of the caribou released at the release site fitted with a radio collar, moved approximately one mile south west and died, probably within 24 hours following its release. The radio and visual collars were retrieved when located two weeks following the animals death. Another caribou also died following its release near the Dillingham VOR site after it moved approximately 1 1/2 miles west of its point of release, bringing the total known mortality loss up to 17 caribou. Herd composition of the 146 animals released and known to be alive at the end of the transplant operation was 6 adult males, 8 yearling males, 3 male calves, 111 adult females, 9 yearling females and 9 female calves.

Aerial tracking surveys were conducted once every two weeks to monitor movements and health of the herd. Locations of caribou groups observed were noted on a 1:250,000 scale maps after each survey.

During periods of snow cover it was easier to spot groups and get accurate counts. However, during spring, summer, and fall months, when the ground cover was continually changing colors it was difficult to find groups not containing a radio collar.

The largest number of caribou observed following the transplant occurred near the end of December when 202 caribou were counted.

Through the end of April, the caribou all remained on the peninsula, usually within 10 miles of the release site. By May 4, one group of 5 caribou began working their way up the peninsula in a westerly direction. This group continued to move west and took up residence in the Negukthlik River drainage near the village of Twin Hills prior to calving. Sightings of this group have been frequently reported by Togiak village residents who are keeping a close eye on them.

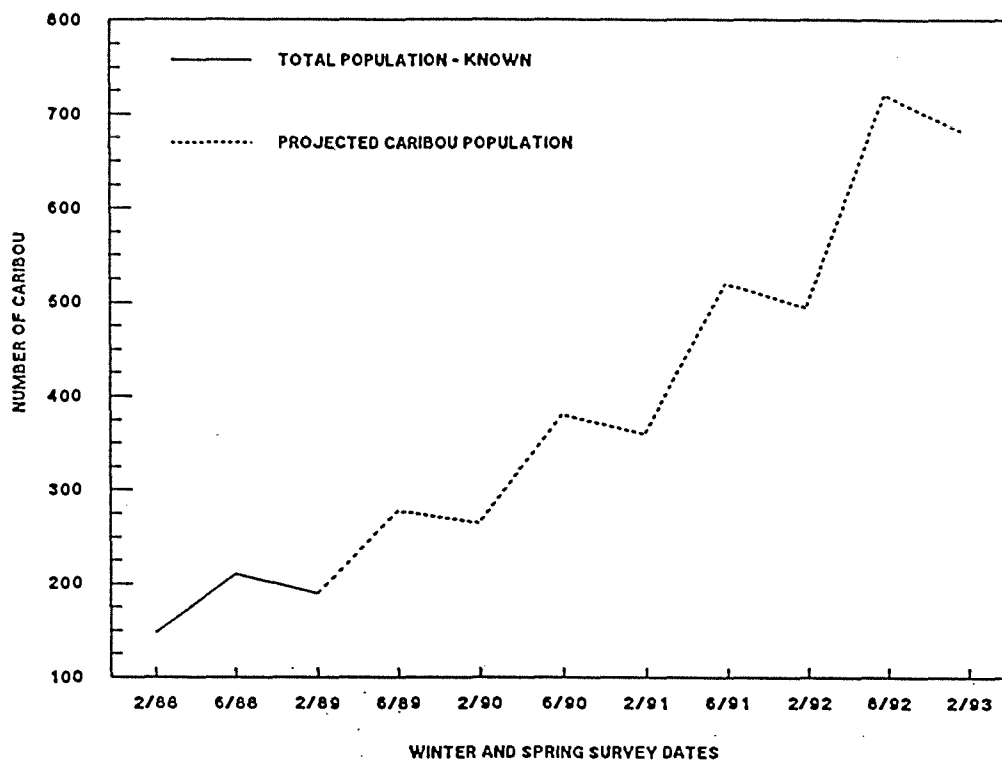
Except for the one small group that moved west, the relocated caribou have remained on the peninsula in the area south east of the release site through December 1988.

The first caribou calf born to the Nushagak Peninsula herd was seen May 24, 1988. At this time, the calf appeared to be only one or two days old. Peak calving seemed to occur between June 14 and June 30 and except for the Twin Hills herd, all calves were born within a 5-10 mile radius of the release site. The high count following calving occurred on June 24, 1988 when 124 adults and 62 calves were observed. If a minimum of 62 adult females dropped calves then 49 adult females either were not carrying calves, aborted when captured or lost calves within a few days of calving. No obvious signs of females aborting calves were observed during the capture, holding and release phases of the operation. The next most reliable count and one that most accurately reflects the number of calves that would survive into the winter period, occurred August 23 when 124 adults and 54 calves were found. Comparing the peak calf count with the August 23 calf count, it appears that a minimum of 8 calves were lost.

Cooperation between the Service, Alaska Department of Fish and Game, the villages of Togiak and Manokotak and Choggiung Corporation continues to operate on a high level. These villages continue to be very interested in the progress and well being of the new herd.

It is hoped that with the combined efforts of the Service, Alaska Department of Fish and Game, and the local native organizations of Manokotak, Togiak, and Dillingham, that these transplanted caribou will prosper to a herd size of 5-700 animals by the year 1993. (See Figure 3)

FIGURE 3
Togiak Refuge Caribou Herd Current and Projected Growth
1988 -- 1993



IMMIGRATION, MOVEMENTS AND SURVIVAL OF MOOSE (ALCES ALCES) IN THE TOGIK NATIONAL WILDLIFE REFUGE

Prior to 1981, moose hunting regulations for Game Management Unit 17A which encompasses those refuge lands south and east of the Goodnews River drainage and south of Hart Lake, permitted the harvest of bull moose only. Very little enforcement of this regulation led to a general disregard of the season and bag limit restrictions, and moose were taken opportunistically regardless of sex or season. Alaska Department of Fish and Game biologists flew an aerial survey of the Togiak River drainage January 1981. After 5.5 hours of survey time in good to excellent visual conditions (fresh snow cover on the ground) only 3 moose were found. This survey prompted the Board of Game to close big game management Unit 17A to the taking of moose in March 1981. The unit has remained closed to moose hunting since that time.

Annual aerial observations during October - March since 1981 have

indicated that small numbers of moose (approximately 15-30) are immigrating to the Togiak and Kulukak Valleys every fall. A total of 27 moose were observed in the Togiak and Kulukak River valleys of Unit 17A during an intensive survey conducted in 1986-87 by State and refuge personnel. It is suspected that most of these are immigrating from the Sunshine Valley portion of the Wood River Mountains, but immigration from the Tikchik Mountains is also probable. Illegal harvest has been documented every year since the season closure. The highest incidence of illegal take occurred during the 1984-85 winter when 19 kill sites were observed. Twelve were taken in the Togiak/Kulukak Valleys and 7 in the Manokotak area. Moose densities continue to remain at low levels throughout the refuge.

Moose have historically existed in the refuge in low densities. Present low moose densities are attributed to the lack of escape cover throughout most of the refuge. Examination of winter range along the Togiak River revealed an abundance of willows (Salix spp.) showing little evidence of having been browsed by moose, indicating that available browse during winter months is not a limiting factor to moose population survival or expansion. Vegetation is ideal for supporting a moose population several magnitudes greater than what currently exists.

A research/management proposal was developed and submitted for approval to accomplish the following objectives:

1. Educate refuge residents on the importance of protecting immigrating moose until a viable population can be established.
2. Determine annual immigration rate of moose to the Togiak National Wildlife Refuge, and determine if this immigration is permanent or seasonal.
3. Determine which areas adjacent to the refuge are the most significant for producing moose that immigrate in to the refuge.
4. Provide representatives of each adjacent village with opportunity to participate in field work associated with objectives 2 and 3.

Thirty moose (20 females and 10 males) will be captured along the eastern border of the refuge in the Ongivinuk drainage, Sunshine Valley, Togiak Lake and Chikuminuk Lake area (Figure 4). An attempt will also be made to collar moose in any other concentrations observed in the refuge. Moose will be captured using the immobilizing drug Carfentanil and fitted with radio transmitter collars. Standard measurements, blood and hair

samples will be taken, and an incisor will be removed from each moose for age determination. Using procedures developed by J. Faro in 1987-88, moose will be immobilized from the ground. This will be accomplished by using snowmachines for access to the proposed collaring sites in Sunshine Valley, Killian Creek, Sunday Creek, Weary River, Trail Creek and Chikuminuk Lake. A spotter plane and three or four snowmachines, depending upon work location, will be used during the capture operation. All ground personnel will be communicating with each other and the aircraft using hand held transceivers with plug-in earphones. Moose will be located and ground efforts coordinated by the spotter plane.

Collaring and subsequent radio tracking is expected to provide the following information:

- *Identify seasonal changes and moose movements between those seasonal ranges.
- *Provide an index of annual moose migration rate between refuge lands and adjacent state lands.
- *Aid in locating moose for obtaining herd composition data and survival rates.
- *Provide data on predation rates, illegal take and act as a deterrent to illegal take.

Information generated by this project and provided to villages will give residents of the area a better understanding of moose ecology and management.

Information gained through this study will benefit the cooperative agreement that is to be developed between Alaska Department of Natural Resources and the refuge. This agreement is for managing common lands located along the western boundary of the Wood-Tikchik State Park and eastern boundary of the refuge.

Educating village residents in the importance of protecting immigrating moose until a viable population is established will be an important part of this project. Development of a conservation ethic among refuge village residents began with the caribou transplant project. During the caribou transplant, village residents showed an interest in establishing a moose population and recognized their participation and cooperation is needed to accomplish these project objectives.

This project is a cooperative effort between the Service, Alaska Department of Fish and Game and area villages. Volunteers from the area villages will be actively recruited during the capture operation for observation purposes and possibly as part of the capture team.

A cooperative agreement will be drafted and presented to the villages for their consideration. Cooperation from each village will be encouraged, however, village participation in the collaring project will not be dependent upon their signing a cooperative agreement.

The Service and State will jointly: 1) share biological information related to this study; 2) protect the study groups of moose from illegal take; 3) equally share the monitoring flights scheduled for this project; and 4) disseminate biological information on the project to village residents within or adjacent to the refuge.

Total costs expected for the project during fiscal year 1989 are \$44,250.

CARIBOU HABITAT STUDY

The caribou habitat study was initiated on Nushagak Peninsula to ultimately quantify food availability for the newly introduced caribou herd. Bill Kirk, Botanist with resource support in the regional office, Diane Campbell (bio-technician), and Lisa Haggblom (volunteer) collected plants from areas on the peninsula between September 14 and October 15. These areas included a diversity of terrain and flora potentially utilized by caribou.

Infrared maps were used to located three areas, each approximately .5 square miles, and individual sites within each area were marked with numbered stakes. Representative plants were collected from each site, and detailed notes of the plant cover composition were made.

The plants, including mosses and lichens, are currently being identified by Bill Kirk in Anchorage. Next spring, exclosures will be placed in caribou grazing areas to determine effects on the flora due to grazing.

E. ADMINISTRATION

1. Personnel



Left to Right: Carol Johnson, Ken Harper, Jon Dyasuk,
Lee Hotchkiss, Diane Campbell, Pete Jerome, Dave
Fisher, Mark Lisac. FP 12/88

Permanent Employees

			EOD:
1. David A. Fisher	Refuge Manager	GS-12	10/22/81
2. Peter J. Jerome	Asst. Manager	GS-11	10/01/86
3. Lee A. Hotchkiss	Wildlife Biologist/Pilot	GS-12	01/24/82
4. Ken C. Harper	Fisheries Biologist	GS-11	09/01/85
5. Jon A. Dyasuk*	Interpreter	GS-09	09/02/87
6. Mark J. Lisac*	Bio-Tech/Fisheries	GS-07	02/14/85
7. Carol Johnson*	Secretary	GS-05	02/22/88
8. Kim R. Custis*	Secretary	GS-05	04/26/87
	Resigned on:		03/29/88

Temporary Employees

			EOD:
9. Diane Campbell	Bio-Tech/Wildlife	GS-05	06/07/87
10. Steven Gosuk*	Refuge Information Tech	GS-06	09/13/87
	Togiak, Alaska	Terminated on:	09/13/88

11. Katherine Cleveland*	Refuge Information Tech GS-06	02/11/88
	Quinhagak, Alaska	
	Returned to School:	09/11/88
12. Charles Evans*	Refuge Information Tech GS-06	02/22/88
	Quinhagak, Alaska	
13. Lou Mark*	Refuge Information Tech GS-06	12/04/88
	Quinhagak, Alaska	
14. Wilbur Bavilla*	Refuge Information Tech GS-06	03/04/88
	Togiak, Alaska	
15. Andrew Myhre	Youth Conservation Corp	06/07/88-08/27/88
16. Jeff Towers	Youth Conservation Corp	06/07/88-08/20/88

*Local Hire Employees

1988 was a normal year with regard to personnel actions. Carol Johnson replaced Kim Custis as refuge secretary. Carol is from Dillingham and brings with her a wide range of secretarial experience. Kim Custis and her family returned to Oregon.

Charles Evans, Katherine Cleveland, Wilbur Bavilla and Lou Mark were all hired as Refuge Information Technicians. Duties during the year primarily consisted of gathering subsistence fishing data and helping disseminate information concerning the Yukon Delta Goose Management Plan.

TABLE 12

Refuge Staffing Pattern

<u>Year</u>	<u>Permanent*</u>	<u>Temporary*</u>	<u>Volunteers</u>	<u>YCC</u>
1981	1	0	0	0
1982	3	0	0	0
1983	3	0	2	0
1984	3	4	11	0
1985	5	1	11	0
1986	6	1	15	0
1987	7	4	19	1
1988	7	6	25	2

*includes local hire

2. Youth Programs

Two Youth Conservation Corps enrollees were hired in 1988. Jeff Towers and Andrew Myhre. Both boys were from Dillingham. They worked at the refuge most of the summer and were kept busy filling field camp supply orders, cleaning and repairing equipment, helping volunteers and at times helping to staff field camps.

4. Volunteer Program

The refuge completed its fifth year of participation in the volunteer program. Lessons learned from 1984 through 1987 were a tremendous help which resulted in the 1988 volunteer season proceeding smoothly, with no problems.

Although the volunteer program has previously been utilized only during summer months, in 1988 eleven people were signed on during February to assist with the caribou relocation project. These eleven volunteers were recruited from the villages of Manokotak and Togiak to provide manpower at the capture and release site camps. They donated 97 person days or approximately 775 hours of volunteer work for the project.



Part of our summer volunteer work force. Front row left to right: Sheffield, Hopkins, Edgar, O'Daniel, Safford, Bourassa; back row left to right: Parker and Doyle. FP 6/88

During the summer season fourteen volunteers, ranging in age from 21 - 63 years old, spent a total of 1,584 person days or 14,296 person hours, in volunteer work for the refuge. Following are most of the people who participated in the volunteer program this year:

Name	From	1987 Service Dates	Total Man-days
Matthew Hubers	Dielkirchen W. Ger	Apr 30 - Oct 03	155
Allyn O'Neil	Milford, NH	Apr 03 - Sep 24	173
Robert Doyle	Gunnison, CO	Apr 30 - Nov 10	194
Donna O'Daniel	Payson, AZ	Apr 30 - Sep 22	145
Gay Sheffield	Newport, RI	May 08 - Dec 15	221
Michelle Bourassa	Randolph, VT	Jun 05 - Oct 30	148
Laura Umbright	South Holland, IL	Jun 03 - Oct 01	119
Rilla Edgar	Reno, NV	May 31 - Sep 22	114
Dave Parker	Mount Juliet, TN	Jun 03 - Aug 22	80
Sue Safford	Darien, CT	Jun 05 - Sep 02	89
Tricia Hopkins	Lake Havasu, AZ	Jun 05 - Aug 08	64
Lisa Haggblom	Anchorage, AK	Sep 12 - Dec 13	76
Denise Lisac	Dillingham, AK	Aug 01 - Aug 06	5
Sue Hotchkiss	Dillingham, AK	Aug 08 - Aug 08	1

The refuge provided all field gear, food, and equipment (except sleeping bags). Round trip air transportation from Anchorage to Dillingham was also provided. Returning volunteers were furnished round trip airfare from Seattle. All of the volunteers arrived in Dillingham prior to our scheduled volunteer training session. While waiting for the field season to begin, volunteers were kept busy preparing field equipment, sorting and packing field supplies, and participating in the week long training program, which consisted of the following:

- * First Aid/CPR Training and certification.
- * A discussion of refuge history, goals, policies, and regulations.
- * Use and care of firearms, including cleaning, handling, and firing range practice.
- * Appropriate refuge visitor interview techniques.
- * Review and completion of all field data forms.
- * Aircraft recognition.
- * Policy on alcoholic beverages and drug use.
- * Alaska State Fishing Regulations.
- * Bear safety.
- * Cold water survival/hypothermia.
- * Aircraft safety, including aircraft survival gear and emergency locator transmitter use.
- * Boat and motor handling, maintenance, and safety.
- * HF radio use procedures.
- * Solar panel and 12-volt battery care and maintenance.
- * Field equipment maintenance and use.
- * Bird identification.
- * Fish sampling and identification techniques.
- * Do's and don'ts when dealing with native residents.

- * Drinking water safety, Giardia and water filters.

A brief description of volunteer projects worked on this year are listed below.

- * Caribou reintroduction project, help at both the capture and release site.
- * Togiak River Creel Census.
- * Spring waterfowl migration and staging surveys at Chagvan Bay.
- * Monitoring spring waterfowl subsistence hunting at Chagvan Bay.
- * Marine mammal monitoring of haul out sites at Cape Peirce and Nanvak Bay.
- * Public use surveys at Goodnews Lake, and Kagati Lake.
- * Public use surveys and fish sampling on the Togiak River, Kanektok River, and Goodnews River.
- * Waterfowl Production Surveys on Kulukak Bay, Tvativak Bay, Kanik River, Matogak River, Osviak Slough, Ualik Lake and Chagvan Bay.
- * Raptor surveys at all field locations.
- * Compiling data for refuge mammal list.
- * Continuation of and completion of a draft refuge bird list.
- * Continuation of the refuge herbarium collection.
- * Collected vegetation samples for the caribou range study.
- * Fall waterfowl migration/staging data collection at Nanvak Bay.
- * Sonar graphing and water quality sampling of eight refuge lakes.
- * Plankton sampling and processing of samples from eight lakes.
- * Length, weight, and age ratio fish sampling at eight lakes.
- * Alaska Department of Fish and Game salmon counting tower at Togiak Lake.
- * Salmon counting tower at Goodnews Lake.
- * Lake trout tagging at Kagati Lake.
- * Radio telemetry monitoring of marine mammals and emperor geese at Cape Peirce.
- * Waterfowl banding.
- * Smolt enumeration project at Togiak Lake.

1988 was another outstanding year for the volunteer program. The refuge staff is fortunate to have this opportunity to work with the many talented people who display a great deal of enthusiasm for working with the general public and wildlife. Much of the field data we received as a result of their efforts would have been otherwise impossible to obtain. We feel we were able to

view some potential Service employees who were well above average in both talent and integrity. Also, each volunteer expressed appreciation towards the Service for the opportunity to view a unique close-up of our programs, projects, and problems; for giving them a chance to use their talents; and for leaving them with a clearer picture of what the Service is trying to accomplish.

5. Funding

Total funding for fiscal year 1988 was \$735,000, this includes \$60,000 for fisheries work, \$100,000 for the caribou transplant and \$35,000 for contaminant work. Monies for the caribou transplant and contaminants are one time costs. Costs for other projects were: Caribou reintroduction information and education program, \$5,000; Arctic nesting geese information program \$35,000; Kanektok River subsistence use survey \$8,000; Replace Nanvak Bay cabin \$35,000; Public use survey camps, Kagati Lake, Goodnews Lake and Togiak River \$25,000.

TABLE 13
Funding History For Togiak National Wildlife Refuge

FY	1210	1220	1230	1260	1332	TOTAL
1981	10,000	20,000		-	-	30,000
1982	130,000	66,000		-	-	196,000
1983	130,000	60,000		-	-	190,000
1984	-	-		250,000	10,000	260,000
1985	-	-		280,000	30,000	310,000
1986	-	-		322,000	60,000	382,000
1987	1,500	-		501,000	60,000	562,500
1988		-		675,000	60,000	735,000
1989 (proposed)		-	6,000	600,000	70,000	676,000

6. Safety

1988 was an accident free year. Monthly safety meetings were held with topics ranging from home fire prevention to aircraft accident survival techniques. An extensive safety program was presented to refuge volunteers during the week long orientation and training session. Subjects covered included hands on training in the safe use of all types of field equipment, boat and motor operations, fuel handling, firearm safety, bear safety and aircraft emergency procedures for passengers.



Safety training, familiarization and operation of fire extinguishers. KH 9/88

Several staff members attended a 40 hour emergency trauma training session in December

Fisheries Biologist Harper was appointed as the station safety officer. By the end of the year he had updated the station safety plan.

8. Other (Special Use Permits)

There were 43 special use permits issued this year, (Table 14). Twenty two permits were issued to commercial sport fish guides, eight to commercial air taxi operations, and four to big game guides. The remaining eight were issued to agencies, individuals, and corporations for survey work, geological studies, Native allotment examinations, and navigation tower sites. A permit was issued for the first time for a shore based commercial fishing activity.

The process for determining an allocation process for commercial sport fish guiding operations is becoming a focal point in the public use management plan. This process is complicated by the Alaska Department of Natural Resources' involvement in the process. Maintaining refuge objectives with respect to recreation management may be difficult.

TABLE 14
1988 Special Use Permits

PERMIT #	PERMITTEE	PURPOSE OF PERMITE	FEE
T-01-88	Alaska River Safari's	Sport Fishing Guide	\$100
T-02-88	N.E. Hautanen	Big Game Guide	\$100
T-03-88	Kelly Vrem/Bob Adams	" " "	\$100
T-04-88	Rainbow River Lodge	" " "	\$100
T-05-88	John Peterson	" " "	\$100
T-06-88	Aleknagik Mission Lodge	Sport Fishing Guide	\$100
T-07-88	Beyond Boundaries Expedition	" " "	\$100
T-08-88	Riverbound Float Trips	" " "	\$100
T-09-88	Charles Vandergaw*	" " "	--
T-10-88	Alaska Fishing Adventures	" " "	\$100
T-11-88	Branham Adventures	" " "	\$100
T-12-88	Lynn Castle, Master Guide	" " "	\$100
T-13-88	Chuck Wirschem	" " "	\$100
T-14-88	Andy's AK Fishing Safaris	" " "	\$100
T-15-88	Hugh Glass Backpacking	" " "	\$100
T-16-88	Wood River Lodge	" " "	\$100
T-17-88	Bristol Bay Lodge	" " "	\$100
T-18-88	Fish Alaska, Inc.	" " "	\$100
T-19-88	Golden Horn Lodge	" " "	\$100
T-20-88	Tikchik Narrows Lodge	" " "	\$100
T-21-88	Gone Fishin'	" " "	\$100
T-22-88	Dave Duncan & Sons	" " "	\$100
T-23-88	B & B Adventures	" " "	\$100
T-24-88	Alaska West Sportfishing, Inc.	" " "	\$100
T-25-88	Alaska River & Ski Tours	" " "	\$100
T-26-88	Jake's AK Wilderness Outfitters	" " "	\$100
T-29-88	Herman's Air	Charter Airlines Co.	\$100
T-30-88	Ryan Air Service*	" " "	--
T-31-88	Alaska Cargo Service	" " "	\$100
T-32-88	Manokotak Air	" " "	\$100
T-33-88	Armstrong Air Service	" " "	\$100
T-34-88	Yute Air	" " "	--
T-35-88	Peninsula Air	" " "	--
T-36-88	Western Alaska Sportfishing	Sport Fish Guide	\$100
T-39-88	King Air	Charter Air Service	\$100
T-40-88	Geological Survey	Geological Surveys	N/A
T-42-88	BLM	Cadastral Surveys	N/A
T-44-88	Nushagak Electric	Construction	N/A
T-45-88	Merriam Olson	Commercial Fishing	\$100
T-46-88	Bureau of Mines	Geological Studies	N/A
T-47-88	Linda Brubaker	Collect Samples	N/A
T-49-88	BLM - Anchorage	Examine Native Allotments	N/A
T-50-88	West. Gold Ex. & Mining Co.	Navigation Transponder Site	\$100

Total Permits Issued: 43 Total Fees Collected: \$3,300

* Permits never returned for validation.

F. HABITAT MANAGEMENT

1. General

The refuge includes a variety of land forms; including mountains, U-shaped valleys with sheer walls, beaches, sea cliffs, glacial lakes, and moraines. Most of the refuge interior is dissected mountainous uplands, stretching from the Ahklun Mountains in the west to the Wood River Mountains in the east. The Wood River Mountains rise in elevation from sea level to 1,000 feet in places around Kulukak Bay and more than 5,000 feet in the northeastern corner of the refuge. In the northeastern Ahklun Mountains, elevations also rise above 4,000 feet, but summits in the southwest are more widely separated, and taper down to lower, smoother hills.

Drainages trend southwest, parallel to the grain of the mountains. The wide Togiak River Valley below Togiak Lake makes an otherwise indistinguishable, separation of the Ahklun and Wood River Mountains. Many of the broad U-shaped glacial valleys, which separate the mountains, contain large, deep glacial lakes and snow-melt streams.

The refuge coastline includes precipitous cliffs, sand and gravel bars, lagoons, beaches, estuaries, littoral and pelagic waters. The most notable lowland areas are adjacent to Jacksmith, Chagvan, Osviak, and Nanvak Bays, as well as the Nushagak Peninsula (i.e., the Nushagak/Bristol Bay lowlands). These lowlands rise from sea level to a maximum of 560 feet near the mountains. Plateaus and benches found on these lowlands contain many small lakes and sloughs. Local relief of the lowlands varies from 50 to 360 feet.

Vegetation on the refuge includes plants common to both arctic and subarctic regions. Tundra, which occurs on nearly all of the refuge, is classified into three general types:

Moist Tundra is found on approximately 50% of the refuge, and usually forms a complete ground cover. This is the most productive of the tundra habitats. It is comprised of cotton grass, sedges, mosses, grass tussocks, and shrubs, which include willow, Labrador tea, mountain cranberry, and bog blueberry.

Alpine Tundra is the second most common type, and is found on the higher mountains and ridges. It consists of low growing mats of lichens, herbaceous and shrubby plants interspersed with patches of barren shelf or broken rock. Plant species found here will primarily include crow berry, dwarf willow, Labrador tea, mountain

cranberry, bear berry and blueberry.

Wet Tundra only comprises about 2% of the area. Being the least common type of tundra on the refuge, it is mostly found in low coastal zones and drainages with shallow lakes, and extensive marsh areas of standing water. The vegetation is made up of a mat of lichens, mosses, and sedges, and may include a few woody species, such as bog cranberry, and bog rosemary. On the drier portions of this type of tundra, dwarf birch and dwarf willow may occur.

2. Wetlands

Most of the coastal areas, and to some extent the low lying interior valleys, are pristine wetlands. They range from coastal brackish and fresh water lakes, ponds, and marshes with both stabilized and active dunes; to large inland areas of wide, shallow valleys studded with shallow lakes, ponds, marshes, and wet meadows, interspersed with dry uplands on buttes, hills, and plateaus.

6. Other Habitats

Willow and alder thickets occur along creek drainages up to elevations of 1,900 feet, (mean sea level). Scattered stands of cottonwood, plus a few well scattered black spruce and white spruce trees are found along the Togiak River drainage. Cottonwood, willow, birch, and alder thickets occur along the Goodnews and Kanektok River drainages.

The eastern portion of the refuge, between the Togiak River drainage and Dillingham, has several relatively large stands of black spruce, birch, and white spruce. These stands are islands of trees representing areas free of permafrost, surrounded by moist or wet tundra plains.

9. Fire Management

Both fire plans were reviewed with Department of Natural Resources personnel. No changes in either plan were necessary.

One fire was reported near Pungokepuk Lake during the summer. Foggy weather prevented aerial inspection for several days. Once the weather cleared Wildlife Biologist/Pilot Hotchkiss inspected the area and discovered that about two acres had burned. Presumably a lightning strike.

11. Water Rights

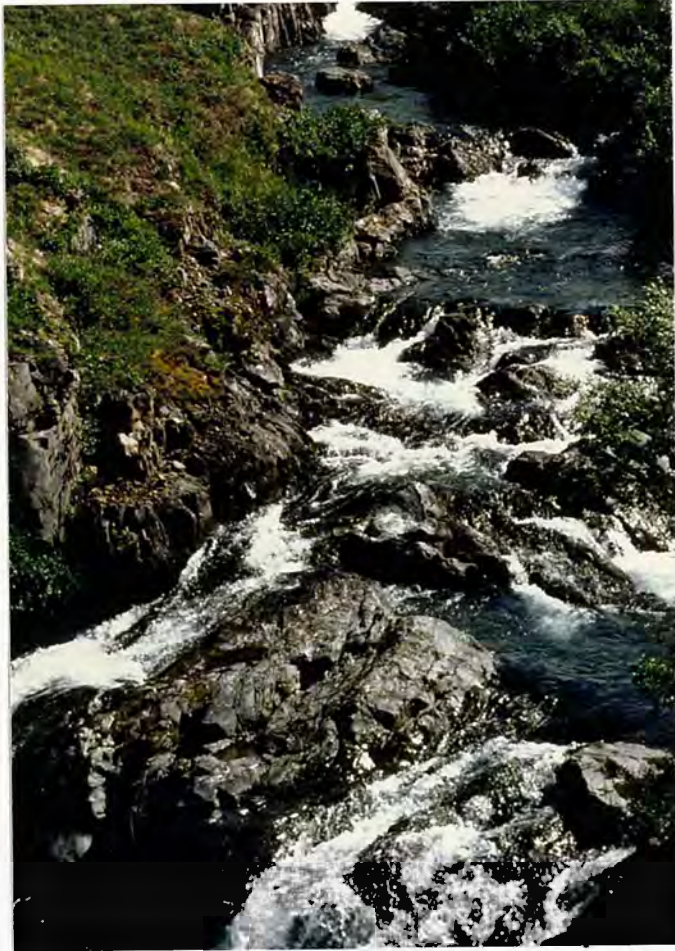
In 1985, the Service was asked by the Alaska Department of Natural Resources to participate in an Interagency Working Group on Federal Reserved Water Rights. The review of the "assertions package" for refuges in Alaska took the better part of two years because there was pending litigation and controversy concerning federal reserved water rights for wilderness values. In 1988, a new Solicitor's Opinion and the Attorney General's concurrence in that opinion provides clear guidance concerning Federal Reserved Water Rights for wilderness values.

Because over two million acres of the refuge have been designated wilderness, the following footnote has been added to the "assertions package."

"Note: Until the legality of Federal Reserved Water Rights for wilderness values (which have been litigated in two U.S. district courts to opposite conclusions) is resolved on appeal, the Fish and Wildlife Service will abstain from asserting reserved Federal Water Rights for wilderness consistent with guidance from the Interior Solicitor (Tarr Opinion July 26, 1988) and the Attorney General (Meese, July 28, 1988). This position does not foreclose our doing so in the future should a higher court rule consistent with the U.S. District Court of Colorado."

12. Wilderness and Special Areas

Approximately one-half (2,270,000 acres) of the refuge is designated as wilderness. It consists of pristine rivers, alpine lakes, sharply sloped mountains, and is located in the northern half of the refuge.



Camp creek, near Goodnews Lake, refuge wilderness area.

MJL 7/88

Wilderness additions proposed in the preferred alternative of the Conservation Plan would add approximately 357,000 acres. The proposed area includes the old Cape Newenham National Wildlife Refuge, plus lands surrounding the headwaters of the south fork of the Goodnews River. This proposal would bring the remainder of the Goodnews River drainages, found within the refuge boundary, under the extra management protection afforded through wilderness designation. It would also provide that same protection to the watershed areas of Cape Newenham and Cape Peirce. This could become extremely important in the near future in protecting the segment of the ecosystem which helps support walrus, sea lions, and seal haul out areas, as well as extensive seabird nesting colonies found at both Cape Newenham and Cape Peirce.

Refuge wilderness provides opportunities for local residents to engage in traditional subsistence activities such as hunting, fishing, berry picking, wood gathering, and trapping. The unique clear water rivers with diverse and abundant fisheries results in ever increasing demands for recreational sport fishing opportunities. Over the past five years many conflicts between refuge users have developed, often, these conflicts have occurred as a result of differing perspectives on appropriate wilderness management. Service policy within Region 7 is just beginning to address these issues, however there is still much work to be completed. The public use management plan for the refuge should positively address many wilderness issues.



Volunteers Doyle and Parker after completing installation of wilderness boundary sign on the Kanektok River. PJ 7/88

Refuge personnel put up wilderness boundary signs on the Togiak, Goodnews and Kanektok Rivers. These signs will indicate to river floaters when they are leaving the refuge wilderness area and hopefully alleviate part of our trespass problem on lower rivers. The signs were fabricated at the Kenai Refuge.

G. WILDLIFE

1. Wildlife Diversity

Togiak National Wildlife Refuge supports an abundant variety of wildlife. The area is a crossroads for waterfowl and shorebirds coming from wintering areas as far away as Russia, Japan, Mexico, South America, New Zealand, and several of the South Pacific Islands. Bristol Bay, which forms a portion of the southern boundary of the refuge, has been described as the southern terminus of the Arctic Bird Migration Route. Birds from the Asiatic Route, mid-Pacific Route, and North American Pacific Flyway, funnel through the area.

Thirty-one species of land mammals and 17 species of marine mammals occur on or adjacent to the refuge. Five species of salmon, and 8 species of fresh water sport fish inhabit refuge waters. There are at least nine additional species of fish occurring in the lakes and streams throughout the refuge, and even though these fish have no commercial or sport value, many of them are used for subsistence purposes and are important links in the food chain. It's estimated that over 180 species of birds utilize the refuge for staging, nesting, and as a year round residence. An up-dated bird list was compiled by volunteer Donna O'Daniel during the 1988 field season and is currently under staff review.

2. Endangered and/or Threatened Species

Grey whales are regularly found feeding from April through August in the shallow coastal waters between Kulukak Bay and Cape Newenham, on the southern boundary of the refuge. These animals are most frequently observed in large groups of 200 - 300 during April, as they migrate into the area from Pacific waters. Later in the summer, small pods of 5-20 whales were regularly observed along the Hagemeister Straits, and in the Cape Peirce/Cape Newenham areas.

One pair of peregrine falcons was observed numerous times this year on a cliff nesting site near Cape Peirce. Volunteer Donna O'Daniel made the identification and located the nest site. This is the first time since the refuge was established that nesting peregrine falcons have been observed by refuge staff. The nesting falcons hatched four young, two of which fledged. No other peregrine falcon nesting sites were found on the refuge. The suspected nesting site near the Kanektok River was not active this year.

In August, Mr. Doug Weir, a biologist from Edinburgh, Scotland was doing consultant work near the Platinum mining camp when he located a possible category II candidate endangered plant species. This plant, the walpole poppy (Papaver walpolei) was found between the 470' and 1300' elevation on Red Mountain—approximately three miles east of the refuge boundary on the northern side of Chagvan Bay. This plant species has also been identified in the headwaters area of the Arolik River and is likely to be found in the mountainous terrain north of Cape Peirce to Jacksmith Bay. Mr. Weir reported the plant as being abundant on the lee ward (eastern) side of Red Mountain.

3. Waterfowl

Nesting of most species of dabbler, diver, and sea ducks, as well as scattered nesting by white-fronted and Canada geese, occurs on the refuge. However, the major attribute of the refuge to waterfowl is the offer of staging and feeding areas during spring and fall migrations. The refuge serves as the apex of a funnel for waterfowl on the Pacific Flyway corridor, heading to or from the nesting grounds of the Arctic coast and the Yukon-Kuskokwim River Delta.

Large eel grass beds in the saltwater lagoons of Osviak Slough, Nanvak Bay, and Chagvan Bay provide important staging and feeding areas. Nanvak and Chagvan bays are the two most important spring and fall staging areas on the refuge; the latter contains an estimated five square miles of eel grass beds.

Generally, throughout the winter months (November through mid-April), waterfowl numbers and diversity are low. Approximately 6,500 common eiders are found in open water leads of shore-fast ice along the Bristol Bay coast. Up to 600 mallards and 300 common goldeneye over winter in any open water available at lake inlets and/or outlets, or along ice free sections of rivers and streams.

Spring breakup appeared to occur on schedule this year. The early migrants began to appear on the Nushagak Peninsula, and in the vicinity of Dillingham, by April 19. The first sandhill cranes and pintails were observed on April 25 and Tundra swans on April 29. As usual, open water was scarce, and early arriving waterfowl congregated on available water bodies consisting of overflows on lakes and coastline tidal pools.

Spring waterfowl aerial surveys were flown on April 24 and May 6 (Table 15). The waterfowl staging areas were 90% ice covered on the April 24 survey and 90% ice free by May 12. The earliest migrants observed in Chagvan Bay, on April 30, were Pacific black brant, Canada geese, Northern pintail and mallard.

Table 15
Spring Waterfowl Staging Surveys 1988

Waterfowl	Dates of Surveys	
	4/24	5/6
Canada Geese	2,350	1,106
Emperor Geese	310	3,093
White-fronted Geese	1,180	1,527
Pacific Black Brant	6,900	36,067
Snow Geese	20	100
Mallard	1,250	3,460
Northern Pintail	2,000	1,405
Greater Scaup	---	1,155
Common Eider	---	4,580
Black Scoter	---	282
Tundra Swan	50	26
Sandhill Crane	12	---
Northern Shoveler	25	---
Wigeon	---	3
Canvasback	2	---
Unidentified Ducks	---	---

Overall, spring waterfowl staging numbers were down slightly (approximately 4%), compared to 1987, (Table 16). Several species showed an increase in number over that observed in 1987. Pacific black brant were up approximately 30%, mallard by 33% and greater scaup increased by 36%. Other species showed lower concentrations on staging areas during spring of 1988.

TABLE 16
Waterfowl Spring Migration Peak Populations
Aerial Surveys Comparison chart, 1987-1988

Waterfowl	1987		1988	
	Peak Dates	Peak Numbers	Peak Dates	Peak Numbers
Canada Geese	MAY 05	2,869	APR 30	2,350
Emperor Geese	MAY 06	11,425	MAY 06	3,093
White-front Geese	MAY 05	352	MAY 06	1,527
Pacific Black Brant	MAY 06	25,050	MAY 06	36,067
Snow Geese	MAY 05	20	MAY 06	100
Mallard	MAY 05	2,305	MAY 06	3,460
Pintail	MAY 06	4,310	APR 30	2,000
Greater Scaup	MAY 05	740	MAY 06	1,155
Stellar's Eider	MAY 28	370		
Common Eider	MAY 06	6,650	MAY 06	4,580
White-wing Scoter	APR 24	460		
Black Scoter	JUN 05	2,359	MAY 06	282
Tundra Swans	JUN 05	60	APR 30	50
Sandhill Crane	MAY 05	20	APR 30	12
Northern Shoveler			APR 30	25
Wigeon			MAY 06	3
Canvasback			MAY 06	2
Unidentified Ducks	MAY 28	50		0

As usual, Pacific black brant were the most prominent species using Chagvan Bay, with a peak of activity occurring during the week of May 6. The number of brant present on the staging areas showed an increase of 30% over 1987.

Canada geese continued their decline on spring staging grounds. This decline in peak population numbers has been observed since 1982, but became very pronounced during spring migration surveys in 1984. The decline between the 1985 and 1986 surveys was less startling, but still noticeable, as Canada geese declined 39% on the refuge spring migration staging areas. The 1987 surveys showed another sharp decline of 71.5% with the decrease beginning to level off again during the spring of 1988 (18% decrease from 1987).

Emperor goose numbers on spring staging grounds have been declining in past years, but showed an increase of 61% in 1987. This increase was not continued in 1988, numbers fell back down to the average level found between 1984 and 1986. White-front geese showed a noticeable increase in staging numbers (77%) in 1988.

A field camp was established at Chagvan Bay for the fifth consecutive year, to monitor and document relative abundance of waterfowl in the bay, document the chronology of peak activity and migration timing, as well as observe and document native spring subsistence waterfowl harvests. The camp was set up on May 10, and manned until June 2 by Bio-tech Lisac, Bio-Tech Campbell, and several volunteers.

Aerial surveys conducted since the early 1970's indicated waterfowl nesting densities on the Nushagak Peninsula to be 32 ducks (16 pair) and 1.2 tundra swans (0.6 pair) per square mile. During 1984, refuge flew staff breeding pair surveys and found 13.8 pair of ducks, 1.4 pair of swan, and 2.25 pair of geese per square mile on the Nushagak Peninsula. No breeding pair surveys were flown by refuge staff since 1984, due to higher priority field projects.

Small breeding populations of oldsquaw, pintails, mallards, green-wing teal, harlequin ducks, black scoters, and red-breasted mergansers nest within the refuge interior. These species usually rear their broods in the freshwater streams that feed (or drain) from large lakes.

Waterfowl production surveys have been conducted along the southern edge of the Nushagak Peninsula for four consecutive years (1983-1986). In 1987 all previously established plots (except those at the northern end of Chagvan Bay) were disregarded and a new study plan was written and initiated. Additional plots were selected and surveyed in 1988. Refer to Section D.5. for additional information.

Fall migrating waterfowl surveys were flown on August 31, September 7 & 13, (Table 17). Surveys were not flown during the end of September, nor in October, due to the refuge pilot being on leave and lack of a refuge aircraft.

TABLE 17
1988 Fall Waterfowl Staging Surveys

Species	Survey Dates		
	AUG 31	SEP 07	SEP 13
Canada Geese	1,595	1,420	2,650
Emperor Geese	2,915	1,370	219
White-fronted Geese	---	---	---
Pacific Black Brant	12,855	5,245	2,125
Snow Geese	---	15	15
Mallard	3,120	6,655	7,240
Northern Pintail	40,195	26,855	36,070
Green-wing Teal	80	1,245	950
Wigeon	---	770	3,460
Greater Scaup	---	1,400	7,665
Stellar's Eider	---	---	---
Common Eider	685	370	215
White-wing Scoter	550	---	285
Black Scoter	350	1,915	2,700
Tundra Swan	99	87	94
Sandhill Crane	5	47	2
Gadwall	---	340	1,570
Northern Shoveler	15	---	175
Unidentified Ducks	---	---	2,535

The lack of survey data from the end of September through October does not appear to be a problem as the peak periods for the geese were well covered. All other species except greater scaup and White-winged scoters also appear to have been well covered.

Volunteers at Cape Peirce continued to participate in the collection of migration survey data on emperor geese passing through Nanvak Bay. The crew conducted specific emperor goose staging surveys from August 29 - October 8. Anywhere from 6-500 geese were observed almost daily during September feeding and staging in the bay. In addition to visual observations, volunteers at Cape Peirce also monitored telemetry equipment in an attempt to locate radio tagged waterfowl. One radio signal was received during the survey. Frequency 167.784, assigned to an emperor goose was heard in both the morning and evening survey on the 1st of September.

In 1984, tundra swan surveys were conducted over most of the Nushagak Peninsula. Due to time and aircraft limitations, surveys were not flown in 1985 and 1986. Surveys were initiated again on a aircraft time available basis during July and August in 1987 and continued in 1988. Areas covered in the 1988 surveys include: the coastal area from Togiak Bay, up around Cape Peirce to Chagvan Bay. Also surveyed were the Osviak, Matogak, Kinegnak, Slug, Quigmy and Nisua Rivers. Only 30 sightings were

recorded this year. In the 9 family groups observed, 25 cygnets were recorded making the average brood size 2.78. These results appear to be comparable to last year's average brood size of 3.03.

Many observations of dry waterbodies were made during this year's flights. Ponds which have existed for years had suddenly gone dry. It was also noted that the number of family groups as well as sightings seemed to be lower than past years. This may be due to the low water conditions.

4. Marsh and Water Birds

Sandhill cranes are usually the harbingers of spring. Consequently, their arrival is closely watched for and dutifully recorded each year. Refuge staff observed the first returning sandhill cranes of 1988 on April 25, near Dillingham. This date appears in keeping with the typical break-up of past years, and is evidenced by previously recorded sandhill crane arrival dates: April 29, 1983; April 29, 1984; April 17, 1985; April 13, 1986; and April 24 in 1987.

Other species in the marsh and waterbird category which utilize the refuge as a migration stop over, feeding area, or breeding ground include; Arctic loons, common loons, red-throated loons, red-necked grebes, double-crested cormorants, pelagic cormorants, and red-faced cormorants. The three cormorant species and the red-throated loons are predominantly found using the refuge coastal and tidal areas. The remaining species are usually found scattered throughout the freshwater lakes and wet tundra habitat on the refuge.

During 1988, waterfowl production surveys were conducted in the areas of Osviak Slough, Kulukak Bay, Kanik River, Ualik Lake, Tvativak Bay, Matogak River and Chagvan Bay. Data recorded by the survey team included loon production observation. The areas surveyed cover a variety of habitat, ranging from marshy bog to open rolling tundra dotted with ponds and lakes. Only ten loon broods were observed during this survey, eight of the ten were red-throated loons with the remaining two being Arctic loons. Common loons are observed on occasion, however no broods have been found.

During the spring and fall, sandhill cranes are frequently found in groups of ten to thirty, in moist tundra habitat, tidal sloughs of the coastline, and along coastal water bodies. During the period of May through July, these birds disperse to establish their breeding territories.

5. Shore birds, Gulls, Terns, and Allied Species

Of the 22 species of shorebirds known to pass through the refuge, the following have been observed on the refuge during nesting season, either accompanied by broods or exhibiting nesting behavior: black-bellied plover, lesser golden plover, semi-palmated plover, bar-tailed godwit, whimbrel, black turnstone, ruddy turnstone, greater yellowlegs, red-necked phalarope, common snipe, short-billed dowitcher, western sandpiper, pectoral sandpiper, and dunlin. In addition, groups of bristle-thighed curlews have been observed feeding in tidal mud flats along the refuge coastline. Many shorebird species using the refuge are migrants, stopping in to feed and rest for short periods before continuing their migration. Some of these species come from wintering grounds in New Zealand, Japan, and the South Pacific islands. Most shorebird peeps begin arriving upon spring break-up (mid to late April), and head south again by mid-September.

The steep sea cliffs along the coast, between Togiak Bay and Cape Peirce, and north around Cape Newenham to Chagvan Bay, provide valuable nesting habitat for numerous seabird colonies; one of the most outstanding wildlife features on the refuge. Population estimates made in the late 1970's, range from one to two million birds using the sea cliffs during nesting season.

Common murres and black-legged kittiwakes are the most abundant of the cliff nesting seabirds. Other seabirds known to nest on these cliffs are: horned and tufted puffins; parakeet auklets; murrelets, and pigeon guillemots. The first kittiwakes and murres were observed on May 6, during a coastal survey flight. All species were present when refuge volunteers established the field camp at Cape Peirce on June 16. For additional information see Section D.5. (Research and Investigations).

Horned and tufted puffins are both eloquent and awkward residents of the Cape. The largest concentrations of puffins were located on the east side of Cape Peirce, which is the same area (with the exception of Shaiak Island) in which kittiwake and murre numbers have declined. Horned puffins outnumber tufted puffins by a 3:1 ratio. Puffins roosted in the uppermost regions of the cliffs, leaving the lower portions to the other seabirds. No information was obtained on productivity due to the puffin's habit of nesting in deep rock crevasses, which likely attributed to the low raven predation on puffins in comparison to some of the other species.

Pelagic cormorants, the largest in size of the seabirds on Cape Peirce, nested in the lowest regions of the cliffs. In addition to the mainland cliffs, adults made extensive use of off-shore reefs throughout the season. Small numbers of cormorants frequent Nanvak Bay, and in June they were seen feeding with kittiwakes in the mouth of the bay.

Arctic terns range widely over the refuge, nesting along coastal habitat and gravel bars, as well as on islands in the freshwater lakes and rivers. They nest either singly or in colonies. Parasitic, pomarine, and longtail jaegers can also be found migrating along the coast, rarely coming ashore except to nest; the exception being the pomarine jaegers which are not known to nest on the refuge at all. Nesting occurs in low, wet tundra or tidal flats and beaches. Jaegers are predatory birds and sometimes appear to be parasitic on gulls and terns, by chasing them until they drop or disgorge food items.

Gull species using the refuge during migration or nesting are: glaucous-winged (most common migrant and nester), mew (migrant and nester), herring gull (rare migrant), glaucous gull (uncommon migrant), Sabine's gull (rare migrant), and Bonaparte's gull (uncommon breeder).

6. Raptors

Nine of the 12 species of raptors that frequent the refuge on a regular basis (bald eagle, golden eagle, peregrine falcon, gyrfalcon, northern harrier, rough-legged hawk, osprey, great horned owl, and short-eared owl) are known to nest on refuge lands. Other raptors, such as the hawk owl, boreal owl, and snowy owl are frequent visitors, but there has been no nesting activity observed. The bald eagle is by far the most visible raptor on the refuge.

The first effort at locating and mapping bald eagle nest sites for annual production surveys took place during the winter of 1983-84. This effort was continued during the winters of 1984 through 1988. Follow-up nesting and production surveys were partially completed during the 1984, 1985, and 1986 field seasons. Complete follow-up surveys were accomplished during the 1987 and 1988 field season.

Eagle nest sites are located by searching timbered areas during January through March, using refuge aircraft. The areas are over-flown at an altitude of 500 to 1,000 feet above ground level. At these altitudes, nest structures are easily visible as a dark mass near the tree top, against the snow covered background. Depending upon the timber density, nests can normally be observed up to one mile horizontally in areas of low density, or one-fourth to one-half mile horizontally in areas of high density. The nest site is locked into the Loran C navigation radio as a waypoint which is later referenced on a refuge 1:250,000 scale map.

A second flight over the nest site is made at 500 foot above ground level during mid-May to mid-June, to determine if the nest is active. Then a third flight is conducted over those nests

found to be active, at 200 feet above ground level, to determine if the nesting attempt was successful and how many young were produced. The third flight takes place during mid to late August. In each of the over-flights, except for the initial nest location flights, only one pass of the aircraft is made (at reduced power) in order to prevent undue disturbance to either the young or the attending adults.

Thirty-five nest structures were located, assigned a waypoint designator, and visually checked to confirm that they were in place and usable by late March 1988. Two eagle nests previously located during 1987 were confirmed as destroyed; either by the wind blowing the nest structure out of the trees, blowing the nest structure support tree down, or snow loads dislodging the nest.

All thirty-five nest structures were checked during the period of May 11 through June 15, 1988. Twenty-six nests were occupied or active; nine were found to be inactive.

The twenty-six active nests were checked again during the period of July 15 through August 15, 1988, to determine success rate. Thirty fledglings were observed in twenty nests; ten nests contained two fledglings each, and ten nests contained one fledgling per nest. The average fledgling success for 1988 was 1.5 fledgling per nest; down from the 1987 average of 1.64 fledglings/nests, the 1986 average of 1.71 fledglings/nest and the 1985 average of 1.89 fledglings/nest.

Fifteen nests found to be active during the period May through June 15, 1988 apparently failed, up from the nine failures recorded during 1987.

Twenty-six percent of all nest structures located were inactive this year, compared to twenty-nine percent inactive during 1987 and thirty-six percent inactive and forty percent inactive rates of 1986 and 1985, respectively.

The number of active nests and numbers of fledgling eagles produced continue to increase slightly each year. Additionally, the declining average of fledglings/nest probably does not have a great deal of significance compared to the overall pattern of increasing numbers of active nests and fledglings produced.

Environmental conditions during 1988 were optimum for eagle production. A mid May breakup was followed by an unusually dry warm summer and below average rainfall. Lower than normal river levels lasted well past the date that fledglings achieved full flight status and left the nest tree area. Water levels did increase considerably by mid September but should not have affected survival of the young. No severe winds were experienced during the nesting season. Salmon runs appeared to be near or

slightly below average with the exception of king salmon and coho salmon. These two salmon species have not had strong runs on the Bristol Bay side of the refuge for the past two years. Lower than normal river levels and predominately clear water conditions following the spring run off prevailed throughout early July and August which allowed for good to excellent access to dead or dying salmon by feeding bald eagles. This years conditions were better than those experienced during 1987 which was considered a good year-environmentally speaking.

Actual clutch sizes are unknown, as the birds are not flushed off their nests during the survey. The final survey to determine productivity was conducted at least 60 days after hatching when eaglets appeared to have sufficient growth to assure they would reach flight status.

Ninety-four percent of all known bald eagle nest structures are constructed in deciduous trees, usually balsam poplar or white birch. The remaining six percent of the known nest structures are located in the tops of white spruce trees which usually stand alone in open tundra areas. The white spruce nesting trees are not located in clusters as are the deciduous trees that support nest structures.

Scarcity of nest structure sites, or nesting habitat, does not appear to be a limiting factor in the refuge bald eagle population. The refuge supports large numbers of tree stands which appear suitable for nest structures most of which are in close proximity to streams and/or lakes that support salmon runs. Yet these areas which appear to have all the qualifications for suitable bald eagle nest sites are unoccupied.

The golden eagle nest site at Kagati Lake was inactive this year. Disturbance may be a factor as one or two fishing guides that stage at Kagati Lake have been showing their clients the nest site on a regular basis. This site was discovered by refuge volunteers who manned the public use survey camp at Kagati Lake in 1985. The nesting attempt by this pair was successful during 1985 and 1987. They were unsuccessful during 1986 and 1988.

7. Other Migratory Birds

Passerine birds are abundant migrants in southwestern Alaska. Species known to migrate to and breed on the refuge include several species of sparrows, dipper, water pipit, juncoes, lapland longspur, common raven, snow bunting, magpie, gray jay, several species of swallows, black-capped chickadee, five species of thrushes (varied, gray-cheeked, Swainson's, hermit, and American robin), Arctic warbler, yellow-rumped warbler, yellow warbler, ruby-crowned kinglet, yellow wagtail, Bohemian wax-wing, and rusty blackbird.

8. Game Mammals

Moose, caribou, brown and black bear, wolves, and a variety of small game, including snowshoe hare and tundra hare are found on the refuge. Wolves and black bear are rare visitors on refuge lands, and caribou are known to utilize the northern and northeastern portions of the refuge as part of their normal range. Caribou now inhabit the Nushagak Peninsula on the southeast corner of the refuge since the successful reintroduction effort of 1988.

Refuge volunteers at Kagati Lake frequently heard wolves howling at night and observed fresh tracks along the shoreline of a small lake two miles east of Kagati Lake during August and September.

Several moose were observed during the summer months by refuge staff. Nine moose were seen regularly during over-flights in the Killian Creek area and three on the Kulukak River near Kulukak Bay during August and September. One bull was seen by volunteers at Kagati Lake in August. Moose surveys flown during December located 31 moose in the Killian Creek/Youth Creek drainage and two moose in the Weary River drainage. These moose are thought to move back and forth between refuge lands and adjoining state lands along the refuge's eastern boundary. The 1989 moose collaring proposal as described in Research and Investigations section of this narrative report was designed to look into this suspected annual moose migration.

Each year, favorable snow and ice conditions exist during February, March and early April which allow easy access to the refuge interior by snow machines from adjoining villages. Many moose are taken each year by village hunters during this period of excellent snow machine travel conditions and the refuge moose population declines sharply.

The long awaited and anticipated caribou transplant planned in 1987 took place during January and February 1988. The operation was an unqualified success and set some respectable records for caribou transplants. The capture and transport mortality loss of 8.9% was the lowest rate experienced by any agency when relocating caribou. Additionally, the 155 animals captured and transported to the release site constitutes the largest group of caribou relocated by any federal or state agency on the northern continent.

The new caribou herd appear to be doing well. A minimum of 62 calves were produced during the calving season. Of those, at least 54 calves were still alive and well at the onset of winter. The high count of 202 caribou was made near the end of December which is a 28% increase in herd size during the first year.

Another "first" for this particular project was the cooperation received from villages involved in the project. Cooperative efforts by village people from Togiak and Manokotak was unprecedented in the history of the refuge. The cooperative spirit fostered by this project continues to this date and appears to be expanding to include other refuge projects and studies.

The caribou herd found north of the refuge boundary in the Killibuck Mountains appear to be expanding down into the northeastern corner of the refuge. Refuge staff observed single caribou bulls at Nagugun Lake in July, Kagati Lake during August, Trail Creek in August, Kagati Lake in September and a group of five (one bull plus four cows) at High Lake during September.

Brown bear are the most abundant big game animal found throughout the refuge. They have been found ranging from coastal beaches inland to high mountain ridges. Nearly all bear observations occurred while over-flying the refuge conducting other missions. A few of the observations were made by staff members as they were conducting creel census surveys on the Togiak River, water quality studies on numerous interior lakes, waterfowl brood surveys, and public use surveys from camps at Kagati Lake and Goodnews Lake.



One of our frequent visitors at Kagati Lake. RD 7/88 ,

A total of 76 bears were observed during the spring and summer. Staff could be sure these sightings were not recounts by comparing date and time of observation, family size, colors, markings, or location on the refuge. Any bear observed that could be a recount of a previously observed bear was not included in the overall count. Family groups and ages of bears are estimated as follows:

Groups Observed	Group Composition	Total
1	Sow plus 1 cub	2
2	Sow plus 2 cubs	6
1	Sow plus 3 cubs	4
3	Sow plus 1 yearling	6
5	Sow plus 2 yearling	15
1	Sow plus 3 yearling	4
39	Singles	39

Four black bear were observed by refuge staff for the third time in the history of this refuge. These bears, all single adults, were observed at Kagati Lake, between Goodnews Lake and Geshiak Lake, Neguthluk River and near upper Togiak Lake during August and early September. The only other black bear sightings on the refuge were made by Wildlife Biologist/Pilot Hotchkiss in July 1985 on the Kemuk River and October 1987 by Fisheries Biologist Harper and Bio-tech Lisac on the Negukthlik River.

No bear incidents were reported by our field camps or by refuge visitors this year. So far, in the history of the refuge, only one bear incident has been reported. This incident occurred in June at Goodnews Lake when a young bear made two consecutive late night raids on the food supply and garbage stash at the King Salmon Fisheries base camp. The camp was moved shortly after the incident to a location downstream from the lake and no further incidents occurred. Our own public use survey camp, located on the lower end of Goodnews Lake, approximately 1 1/2 mile west of the King Salmon Fisheries camp did not experience any bear problems. Bear observations in the near vicinity of guide camps, unguided visitors camps, and refuge field camps are common, but all other incidents have been avoided.

9. Marine Mammals

The marine estuaries of Bristol and Kuskokwim Bays, bordering the refuge, constitute one of the most productive marine systems in the world. Nutrient laden waters from the Bering Sea, marine upwellings, and ground water run off from the major river systems, contribute to the high productivity of the bays in the Bering Sea. Rich in plankton and forage benthos, the bays support an intricate food chain of which marine mammals are the apex predator.

Bristol Bay is a migration corridor for most of Alaska's marine mammals. Walrus seasonally haul out year-round on several of the islands in the bay and at Cape Peirce. Four species of seal: bearded, ribbon, ringed and spotted/harbor, winter along the ice edge with the harbor seals inhabiting the refuge coast throughout the year. Steller's sea lions are also to be found in the bay. Other mammals include harbor porpoise along with gray, killer, beluga, minke, and on rare occasions, Baird's beaked whales.

SEALS

During the summer field season, the ice associated species recede north with the icepack. Spotted/harbor seals were observed almost daily at Chagvan Bay and Cape Peirce while the field camps were operating. At Chagvan Bay the numbers of seals seen corresponded with the herring spawning in the area.

Nanvak Bay, at Cape Peirce, is the only major haul out site in northern Bristol Bay. It is considered to be the northern most pupping colony of harbor seals. Peak populations at Nanvak Bay have declined from numbers in the thousands in 1982 to 420 animals in 1986, 220 animals in 1987, and 194 in 1988.

Other minor seal haul outs are known to exist at: Tvativak Bay, Kulukak Bay, Cape Constantine, Hagemeister and Walrus Islands, Cape Newenham, Security Cove, Chagvan Bay and the offshore sandbars near Quinhagak and Jacksmith Bay. Generally, all these haul out sites coincide with, and are adjacent to, areas of herring and capelin spawning.

SEA LIONS

The only documented sea lion haul out site on the refuge is located on the tip of Cape Newenham. An aerial survey conducted in 1987 showed approximately 900 animals in May and 130 animals in December. No aerial survey was conducted during 1988 but the sea lion population seemed the same according to the report from one of the men stationed at the Cape Newenham radar station.

Sea lions were observed several times feeding, at Chagvan Bay and Cape Peirce. At Chagvan Bay the number of sea lions present corresponded with the number of herring spawning. At Cape Peirce the sea lions observed seemed to be travelling through the area in small groups of 2 to 5.

GRAY WHALES

The endangered gray whale migrates through Unmiak Pass and follows the Bristol Bay shoreline on its way north. These animals are often observed throughout the summer, feeding in the near-coast waters of the refuge. One gray whale was seen in the

channel entrance during May from the Chagvan Bay field camp. Due to a late opening of the Cape Peirce field camp, the volunteers missed the whale's spring migration. One gray whale was observed apparently feeding, close to the cliffs of Cape Peirce in July.

KILLER WHALES

A pod of 5 killer whales was observed in the waters, just offshore, to the northwest of Cape Peirce. The three females and two males passed through the area heading west. This family group or one just like it is seen nearly every year in the waters off Cape Peirce.

BELUGA WHALES

Beluga whales are an abundant cetacean in the Bristol Bay area. Herds of up to 100 individuals can be seen migrating along the coast. During the 1988 season, belugas were observed not only in the Nushagak, Togiak and Goodnews Bay but, for the first time, were seen in Nanvak Bay. Two separate sightings of over a dozen belugas feeding in Nanvak Bay were reported in September.

HARBOR PORPOISE

Two harbor porpoise were sighted in August off Cape Peirce, heading northwest.

WALRUS

The Pacific walrus population has an extensive seasonal migration. Females, and a few of the males, maintain an association with the pack ice by migrating between the Chukchi Sea and the Bering Sea as the pack ice advances in the autumn and recedes in the spring. After the breeding season (December through March), a large portion of the male population remain in the Bering and Chukchi Seas. With the ice disappearing to the north, these males utilize traditional terrestrial haul out sites.

Every year since 1978, walrus have been reported hauled out in the Cape Peirce/Security Cove region. Since 1981 Cape Peirce has been re-established as a major walrus haul out site. Its importance rivals the Walrus Island State Game Sanctuary, which was set aside to provide a protected resting place for walrus.



Somedays the haulouts are wall to wall.

MB 7/88

Large numbers of walrus were observed on the refuge at Cape Peirce throughout the summer months of 1983-1986. Extensive use by walrus was seen with peak populations of 5,000 animals in 1983; 8,600 animals in 1984; 12,000 in 1985 and 11,800 in 1986. A decrease in activity has occurred with only 6,300 animals in 1987 and a peak of 6,900 animals in 1988 on July 17th.



Volunteer Gay Sheffield attempting to locate radio tagged walrus. MB 7/88

MARINE MAMMAL HARVESTS

Native residents of all the villages, within or adjacent to the refuge, harvest marine mammals throughout the year. This activity is primarily directed towards harbor/spotted seals near coastal fish spawning grounds.

Seal harvests were observed at Platinum, Chagvan Bay and Cape Peirce during the spring/summer of 1988. Sea lion kills were observed at Chagvan Bay. Often times it seemed as if an inappropriate portion of the carcasses, of both seal and sea lion, were left unharvested. In Goodnews Bay, Wildlife Biologist/Pilot Lee Hotchkiss observed the harvest of a beluga whale.

Walrus harvest occurred twice this summer at Cape Peirce taking a total of ten animals. The first party caused a major disturbance killing nine animals and removing only flippers, tusks, oosik, and a small amount of meat from two walrus. Investigation of the incident resulted in wanton waste charges being filed against three hunters from Clarks Point. The second party caused only a moderate disturbance, killed one animal and harvested the entire animal.

10. Other Resident Wildlife

Willow ptarmigan are common on the refuge. Flocks of several thousand birds are commonly observed in dwarf willow and alder thickets on the sides of the mountains, and in the alder thickets along interior rivers and lakes.

Fur bearers, such as beaver, river otter, weasel, mink, red fox, and wolverine are common on the refuge. Wolf and lynx, although uncommon, are seen on refuge lands occasionally.



Parka ground squirrels, a common mammal found on the refuge. FP 7/88

Other rare occurrences of southwest Alaska resident species on refuge lands are tundra hare and Arctic fox. These species, when observed, are usually in the vicinity of Cape Newenham and Cape Peirce. Other mammals common on refuge lands, are parka squirrels, hoary marmots, porcupines, and snowshoe hares. Sightings of these animals occur throughout the refuge.

Year round residents include common and hoary red polls, boreal chickadee, pine grosbeak, white-winged crossbill, gray jay, common flicker, magpie, raven, and downy, hairy, and three-toed

woodpeckers.

11. Fisheries Resources

The refuge is bordered by Bristol Bay on the south and Kuskokwim Bay on the west. Refuge waters contribute significantly to the salmon stocks in these world renowned salmon producing regions. Refuge streams and rivers support anadromous runs of all five species of pacific salmon; king, or chinook, Oncorhynchus tshawytscha (Walbaum); chum, O. keta (Walbaum); sockeye, O. nerka (Walbaum); pinks, O. gorbuscha (Walbaum); and coho, O. kisutch (Walbaum). One of the states largest herring fisheries also occurs off the refuge in Bristol Bay. Ex-vessel commercial value or value of catches to commercial fishermen of refuge bound salmon and near shore spawning herring in 1988, was \$35,313,964.

In addition, anadromous runs of dolly varden, Salvelinus malma (Walbaum), and resident populations of rainbow trout, Salmo gairdneri (Richardson); lake trout, Salvelinus namaycush (Walbaum); grayling, Thymallus arcticus (Pallas); arctic char, Salvelinus alpinus (Linnaeus); pike, Esox lucus (Linnaeus); burbot, Lota lota (Linnaeus); and whitefish, Coregonus sp., contribute to both subsistence and sport harvests from refuge waters. Sport fishermen are estimated to have spent over \$6,000,000 to fish in refuge waters during 1988.



Lake survey team sampling fish for species composition,
SS 8/88

Populations of sticklebacks, blackfish, pipefish, and other species exist in the thousands of unnamed lakes, rivers, tundra streams, sloughs, ponds, and bays. Little or no information is known about their numbers or distribution.

Subsistence Fishing

Residents of four villages within the refuge boundary and some others living in rural areas adjacent to the refuge utilize the fishery resources on the refuge for subsistence purposes. Subsistence fishing is open to and practiced by both native and non-native Alaskan residents. Subsistence users harvest all five species of Pacific salmon and several resident species.

The effort required to obtain a subsistence catch of salmon has proportionally decreased with the exchange of traditional fishing methods for the more efficient nylon gill net, outboard motor, and skiff. There are numerous fish camps dotting the refuge rivers, where signs of the old and the new can easily be observed.

Under the Alaska National Interest Lands Conservation Act, creation of national parks and refuges was not to change this lifestyle in any way. The act specifically addresses this issue in Section 804:

"...the taking on public lands, or fish and wildlife for nonwasteful subsistence uses shall be accorded priority over the taking on such lands of fish and wildlife for other purposes."

Therefore, in the event that it is necessary to restrict the harvest of fish and wildlife on refuge lands and waters, subsistence users will be afforded the priority use of all surplus not needed to maintain viable healthy populations.



Interpreter Dyasuk interviewing a subsistence user at
Togiak Lake. MJL 10/88

Subsistence fishermen have specific periods of the year when harvests occur. Generally, these harvests will coincide with the availability of salmon as they enter the rivers. Resident freshwater species are most often sought for fresh protein during the winter, or in some cases, when they are concentrated on spawning grounds during the spring or fall.

Some of the subsistence fishermen in the villages of Togiak, Twin Hills, and Manokotak obtain the required subsistence permit from the Alaska Department of Fish and Game, Subsistence Division, or agents in each village. On the permit, they indicate what they need of each species and at the end of the year return the forms, recording actual harvest. Subsistence personnel from Alaska Department of Fish and Game also travel to the villages to collect permits that were not returned, and to interview permittees. Kuskokwim Bay villages (Goodnews, Quinhagak, and Platinum), by contrast, are not required to have subsistence permits, but are surveyed during the season by Alaska Department of Fish and Game Commercial Fisheries Division personnel.

TABLE 18
Subsistence Salmon Fishery Harvest
Togiak/Kuskokwim Bay* 1988

Village	Chinook	Sockeye	Coho	Pink	Chum	Total
Quinhagak	2,179	767	2,792	0	635	6,373
Goodnews Bay	289	898	1,072		404	2,663
Platinum	21	167	90		43	321
Togiak	285	2,135	549	41	363	3,373
Manokotak	111	5,228	413	3	79	5,874
Totals:	2,885	9,195	4,916	44	1,524	18,564

* Alaska Department of Fish and Game Data

** Extrapolated to the number of permits issued. May not reflect the actual harvest.

Commercial Fishing

Since the late 1800's, commercial fishing has been the mainstay of the economy in communities adjacent to the refuge. Recently, this economy has spread to all villages located within the refuge, and has become their primary source of income.

Salmon stocks, bound for refuge waters, are harvested on a terminal fisheries basis. Specific runs associated with rivers are targeted at the mouth, or within a specific area near the mouth. This insures that the individual runs are afforded maximum management protection. Achieving the escapement goals into individual rivers is possible if data is collected in a timely basis and used to regulate the commercial fishing seasons. Two Alaska Department of Fish and Game Commercial fisheries offices regulate the commercial fishing seasons by monitoring escapements and setting openings. The refuge and King Salmon Fisheries Assistance Office helped in the monitoring of the escapements in the Togiak River during 1986, 1987, and again in 1988. Refer to Section D.5. for additional information.

The Bethel office, located north of the refuge, regulates commercial harvests by setting openings for stocks of fish bound for the western portion of the refuge in Kuskokwim Bay. There are two fishery districts there which affect refuge bound stocks: District 4, Quinhagak, centers on the Kanektok River and encompasses the area from the Arolik River to the Oyak River; District 5, encompasses Goodnews Bay.

The Dillingham office regulates commercial harvests of fish stocks bound for the Togiak and Nushagak districts bordering the southern portion of the refuge. The Togiak district is encompassed entirely on the refuge, while only two sections of the Nushagak district (the Igushik and Snake) target fish bound for refuge waters.

The two Kuskokwim Bay fishing districts affecting refuge fishery stocks are relatively new, and commercial harvest records do not exist prior to 1968 for Goodnews, and 1960 for Quinhagak. The fishery in Goodnews was opened by emergency order due to public pressure and the determination of a harvestable salmon surplus by Alaska Department of Fish and Game surveys.

The commercial catch bound for these rivers was worth \$2,232,191 to participating fishermen in 1988, (Table 19 and 20). The wholesale value of these fisheries is probably worth several million dollars more, making them economically important for the region and the export that goes to Japan. Chinook, coho and sockeye salmon make up the majority of the Kanektok River Fishery; the result of very favorable river and or lake spawning habitat on the refuge. Pink and chum salmon also have relatively large runs, but are not as commercially valuable. The coho harvest from the Kanektok is one of the largest in the state (in numbers).

Escapements in the Kanektok are not well documented. Alaska Department of Fish and Game would like to monitor the escapement with sonar equipment, but have been plagued by the changing course of the river as well as other site selection problems. Budget cuts were responsible for the complete elimination of the project in 1988. Poor weather conditions also precluded the state from conducting any aerial surveys for coho during 1988.

The Goodnews River has large sockeye and coho runs (Table 20). The sockeye run, with escapements approaching 100,000, make this river one of the most northerly producers of significant runs of this species in the state. The coho harvest from the Goodnews is also very large.

Escapements on the Goodnews River have been monitored annually since 1981, by an Alaska Department of Fish and Game counting tower on the Middle Fork and aerial surveys. The tower is normally in operation for only part of the season, targeting primarily on sockeye, chinook, and chum, and is pulled before the coho run. Aerial surveys for indexes of fish abundance in the river are flown but are missed on years when bad weather is a factor. Alaska Department of Fish and Game did not fly a survey in 1986, so coho escapement was not estimated for that year, however, clear weather and water conditions allowed an excellent survey in 1987. Weather again plagued the surveys in 1988 and no surveys were flown. Some of the only escapement data was from

the tower project the refuge operated in 1988 at Goodnews Lake.

TABLE 19
District 4 Quinhagak, 1988
Commercial/Subsistence Salmon Catch/Escapement

Harvest	SPECIES					Total
	Sockeye	Chinook	Coho	Chum	Pink	
Commercial	21,534	13,872	68,591	29,183	21,258	154,438
5-Year Avg.	12,674	31,859	61,007	26,438	5,042	137,020
Subsistence	767	2,179	2,792	635	---	6,373
Escapement** Index	30,440	11,140	N/S	20,063	---	
Objective*1	32,000	5,000	25,000	30,500	---	

Ex

Vessel Value \$222,024 289,083 688,206 85,735 11,685 1,296,733

Encompasses the Oyak Creek, Kanektok and Arolic Rivers.

** Aerial survey flown for index counts are not expanded to total escapement estimates.

*1 Objectives based upon aerial index counts.

Sport fishermen are estimated to have paid close to \$3,000,000 to fish the Kanektok and Goodnews Rivers in 1988. This money goes to sport fishing guides and lodges, air taxis, village corporations, village stores, airline tickets, and sporting goods. The total commercial value for both rivers is estimated in excess of \$5,000,000 including all costs associated with subsistence, commercial, and sport fisheries.

TABLE 20
 District 5 - Goodnews Bay, 1988
 Commercial/Subsistence Salmon Catch/Escapement

Harvest	<u>Species</u>					Total
	Red	Chinook	Coho	Chum	Pink	
Commercial	36,368	4,964	30,832	33,059	5,509	
5-Year Avg.	17,352	6,920	31,154	11,325	1,844	
Subsistence	1,065	310	1,162	447	---	
Escapement	33,457	4,645	N/S	46,640	+	
Esc. Objective	45,000	4,000	25,000	18,000	+	
Total Run	70,890	9,916	31,994/1	80,146	7,353/1	
Ex						
Vessel Value	\$399,595	\$107,000	\$319,121	\$107,083	\$2,657	\$935,456

Alaska Department of Fish and Game Data, Bethel

+Even Run year, odd years only a small number of Pink run.

/1 No escapement estimates or aerial surveys conducted for coho or pink salmon.

Commercial harvests of all salmon species bound for the refuge in the Togiak and Nushagak districts which produce fish from the refuge were worth over \$18,630,775 in 1988, (Tables 21 and 22). The Wholesale value, which includes distribution, canning, freezing, etc., of this renewable resource may exceed 25-30 million dollars in 1988.

TABLE 21
Togiak District, 1988*
Commercial/Subsistence Salmon Catch/Escapement

Harvest	<u>Species</u>					Total
	Sockeye	Chinook	Coho	Chum	Pink	
<u>Commercial</u>						
Harvest/1	816,782	15,615	18,595	470,721	57,016	1,278,729
10-Year Average (1977-87)	653,000	29,000	72,500	271,000	11,000	
<u>Subsistence</u>						
/1	2,135	285	549	363	41	3,373
Escapement	309,012	7,908	69,000	282,000	+	877,028
<u>Total Run</u>	<u>1,003,402</u>	<u>23,515</u>	<u>93,895</u>	<u>753,084</u>	<u>209,116</u>	<u>1,057,052</u>
<u>Ex Vessel</u>						
Value	\$13,441,035	\$355,689	\$87,180	\$1,529,314	\$63,557	\$15,476,775

*Alaska Department of Fish & Game data; includes Togiak, Kulukak, Quigmy, Matogak, and Osviak Rivers

Sockeye salmon comprise the majority of the runs in these rivers, with total runs of approximately 1.5 million fish. The sockeye runs are supported by large lake systems within the exterior boundaries of the refuge, where favorable rearing, and some excellent littoral spawning habitat is found.

Table 22
Igushik Section, 1988
Commercial/Subsistence Salmon Catch/Escapement*

	<u>Species</u>					Total
	Red	Chinook	Coho	Chum	Pink	
<u>Commercial</u>						
Harvest/1	255,178	+	+	+	+	255,178
Subsistence*	5,528	111	413	79	3	6,134
Escapement	170,454	+	+			170,454+
<u>Total Run</u>	<u>431,160</u>	<u>+</u>	<u>+</u>	<u>+</u>	<u>+</u>	
<u>Ex Vessel</u>						
Value	\$3,154,000					

*Alaska Department of Fish and Game data

Runs of chinook, coho, and chum are small in comparison to the sockeye runs. Runs of these species bound for the Togiak district however are the second largest in the entire Bristol Bay area (Table 21). A late season fishery for coho has developed in the Togiak District. Late season markets became available in Bristol Bay in 1977, and fishermen started actively targeting coho. From 1977 to 1985, coho catches have almost tripled those of early year 1883 to 1922 peak level periods. During this time period the Togiak District has produced approximately 28% of the total coho harvest in Bristol Bay. The 1987 run was very weak and the commercial fishery was cancelled. Again in 1988 indicators pointed to the possibility of a weak run and the fishery was again closed to commercial fishing to meet the escapement goal of 50,000 fish. Sportfishing, however, was left open since it was felt that the run was strong enough to absorb the take by sport anglers.

Chinook and chum salmon, bound for the Togiak District, also produce a major portion of the Bristol Bay harvest. Chinook comprised 35%, and chum made up 32%, of the total harvest in 1988 (Table 23).

Counting towers on the Igushik and Togiak rivers are operated by Alaska Department of Fish and Game, to enumerate the escapement of sockeye salmon into these rivers. This escapement data is used to regulate commercial fish openings throughout the season. Due to budget cuts, the Togiak Tower was cooperatively staffed by Alaska Department of Fish and Game and refuge personnel, see Section D.5. (Research and Investigations).

Aerial flights are sometimes used for sockeye and other species during the season to measure abundance; however, lack of water clarity in the rivers and bad weather have not made counts possible every year. Post season aerial flights are also flown to enumerate chinook, chum, and coho salmon on the spawning grounds, if weather and water conditions permit. This post season method of checking escapements does not allow for tight control to be applied to the fishery to ensure that escapement goals are met, but rather measures the success of the management of the commercial openings in the fishery. During 1988 the refuge again conducted spawning ground aerial surveys of refuge rivers that the state had dropped due to budget cuts, see Section D.5.

TABLE 23
 Bristol Bay Salmon Harvest
 District Comparison for Coho, Chinook, and Chum

District	Percentages by Species					
	Coho	%	Chinook	%	Chum	%
Naknek/Kvichak	28,352	14. %	6,677	15%	298,996	20%
Egegik	49,407	24.5%	3,023	7%	244,795	17%
Ugashik	52,272	26. %	3,319	7%	92,360	6%
Nushagak	53,921	27.7	16,501	37.6%	370,224	25%
Togiak	18,595*	0.9%	15,615	35.0%	470,721	32%
Totals	202,547		45,135		1,477,016	

*Coho fishing in the Togiak District was closed down to insure adequate escapement. Togiak District normally produces 25-30% of the total Bristol Bay harvest of coho.

Herring

Pacific herring spawn in various coves and bays along the refuge coastline. This species is also an important link in the Bristol Bay food chain, although not well understood. The dependence of seabirds, marine mammals, and salmon on the herring fry and adults has not been established. The impact of the herring fishery on the sea bird and marine mammal resources that border the refuge has not been studied. Subsistence users have long utilized these fish but more recently, herring have been commercially exploited. Togiak Bay, Goodnews Bay, and Security Cove are the three major areas of herring spawning activity and associated commercial fisheries that lie within the refuge coastline.

The interest in harvesting Alaska herring stocks increased significantly in 1977, due to a decline in world herring stocks and the subsequent reduction in offshore foreign trawling, as well as the elimination of the Alaska coastal near-shore Japanese gill net fishery. As a result of this increased interest, the Togiak District experienced such an increase in effort that the Alaska Board of Fisheries responded by creating commercial fishing districts at Security Cove and Goodnews Bay.

Herring were first observed by the State Biologist in the Togiak District on May 8th and the first spawn observed on May 15th. A total of 66 linear miles of milt were observed by the Alaska Department of Fish and Game during aerial surveys. The majority of the spawning occurred May 15th to 18th. The fishing comprised of one four hour opening for gill nets from which 3,615.5 short tons were harvested and one 0.5 hour opening for purse seiners. The purse seine fishery accounted for 10,370.5 short tons.

A roe-on-kelp fishery, associated with the herring fishery, has also developed along the refuge coastline. This fishery or harvest is regulated by emergency order. The Board of Fisheries adopted a management plan in 1984 which allows a harvest quota of up to 350,000 pounds or the equivalent of 1,500 short tons of spawning herring, with a 2 - 3 year rotational harvest of kelp beds. The roe-on-kelp (rockweed *Fucus* sp) harvest during 1988 was limited to only one opening. A total of 6 hours picking time, yielded 489,320 pounds of harvestable kelp valued at \$346,000 in 1988. Four hundred fishermen participated in the 1988 kelp harvest.

TABLE 24
Togiak Herring Fishery Ex Vessel Value 1988

<u>Product</u>	<u>Value</u>
Herring Sac Roe	\$14,103,000
Capeline (no fishery in 1988)	
Roe-on-Kelp	\$346,000
<hr/>	
<u>Total Estimated Ex-vessel Value:</u>	<u>\$14,451,000</u>
Alaska Department of Fish and Game data.	

Capeline is a member of the smelt family and is also an important food source. In the past this fish has been thought to be just as abundant as herring, and has experienced some commercial interest in the Togiak District. No spawning capeline were observed in 1988 and no fishing season was conducted for this species.

Kuskokwim Bay herring are harvested on the west coast of the refuge in the Goodnews Bay and Security Cove Districts. Since 1978, after the first season, the use of purse seiners has been prohibited and no roe-on-kelp harvest is allowed.

The herring fishery has been relatively unrestricted, and fishermen are allowed to transfer from the Togiak District to the Security Cove District in Kuskokwim Bay. On the other hand, the Goodnews Bay District was established for the exclusive use by the local commercial fishermen from the villages of Quinhagak, Platinum, and Goodnews Bay, and transfers are not allowed.

The herring season in Goodnews Bay opened on May 24th and in Security Cove on May 19th.

12. Wildlife Propagation and Stocking

The refuge in cooperation with the Alaska Department of Fish and Game reintroduced 148 caribou from the northern Alaska Peninsula herd to the Nushagak Peninsula. Primary purpose of the project was to reintroduce caribou to lands of the refuge where they once were historically abundant and establish a healthy population. Refer to Section D.5. for a complete discussion.

14. Scientific Collections

No live birds or mammals were taken for scientific collection purposes during 1988. However, five birds were placed in frozen storage for study skin mounting this year. All birds collected were road kills or donated to the refuge. They were; belted kingfisher, black brant, black-legged kittiwake, common snipe and fork-tailed storm petrel.

B. PLANTS

Plants were collected by refuge staff for the refuge plant collection and as part of the caribou-habitat study. See Section D.5. (Research and Investigations), caribou habitat study.

16. Marking and Banding

GEESE

A goose banding study was conducted from July 14-20 on the Nushagak Peninsula. A total of 707 geese were banded, (5 Cackling Canada geese, 45 White-fronts and 657 Canadas). Each bird was identified, sexed, aged when possible, banded and released. Tarsal, culmen, and weight measurements were also taken on the Canadas by Cal Lensink of the regional office. From these measurements Lensink was able to place the majority of the birds in the subspecies B. c. taverneri.

An insufficient amount of data was collected to determine general age class of the birds present. Additional measurements and a larger sample will be attempted in 1989.



Volunteers and refuge staff banding geese on the
Nushagak Peninsula. MJL 7/88

Radio transmitters were attached by Lesink to seven of the 45 white-fronts. These seven transmitters broadcast on the frequencies: 166.015, 166.033, 166.045, 166.066, 166.085, 166.096 and 166.135. A survey was flown on July 28 in an effort to locate the radio tagged birds. Four of the seven were heard (166.015, 166.033, 166.085, and 166.096), not far from the banding site. Transmitter 166.085 was suspected to be a mortality due to the location of the transmitter and absence of birds.

In early October, two of the radio-packing white-fronts showed up at the Klamath Basin. Another survey in late October found all seven of our white-fronts down at Klamath Basin. Refuge personnel there identified 166.085 by it's neck collar. The radio transmitter, however, is still on the Nushagak Peninsula.

During the project, three Canada geese were found to have been previously banded. One of the bands had to be replaced, but the other two geese were released with their original bands. The two birds released were banded near Wasilla in 1983 by Alaska Department of Fish and Game. One was banded as a gosling and the other was banded as an adult approximately one year old.

Five band return reports have been received so far from this project. Two Canadas were shot on the Theodore River, Alaska on October 23. Two Canadas were reported being taken on the

Chickaloon Flats, Alaska, one on October 1 and another on October 23, and the last report was of one Canada being shot on November 26 near Soap Lake in Eastern Washington. For more background information on this project refer to Section D.5. (Research and Investigations).

FISH

During 1988 168 lake trout were captured and tagged. Refer to Section D.5. (Research and Investigations) for more information.

H. PUBLIC USE

1. General

There are seven villages located either within the refuge boundary or adjacent to the refuge. Quinhagak, Goodnews Bay, and Platinum border on Kuskokwim Bay; Togiak, Twin Hills, Dillingham, and Manokotak border on Bristol Bay.

The Kuskokwim Bay villages concentrate their commercial fishing and subsistence activities north of Cape Newenham, utilizing Bethel as their transportation, service, social, and political center. The western Bristol Bay communities usually focus their subsistence and commercial fishing activities east of Cape Newenham to the Nushagak River. These villages utilize Dillingham as a center for transportation, service, political, and social needs.

Marine mammal hunting, for several species of seal and an occasional walrus, is a significant component of the subsistence activity in the coastal villages on or adjacent to the refuge. This is partly due to the traditional maritime orientation, but also because moose and caribou populations are extremely low in the vicinity of these villages. Several moose are harvested within refuge boundaries, and village residents often travel to areas off the refuge to hunt caribou.

The majority of non-rural resident public use on the refuge, during May through September, consists of either guided or non-guided sport fishing, big game hunting, and river rafting. A few visitors utilize coastal portions of the refuge for photography, wildlife observation, and waterfowl hunting.

Twenty-two commercial sport fish guides have been issued special use permits to operate within Togiak Refuge. Of those, six operate out of lodges based within the Wood-Tikchik State Park. Five operations are located within the refuge and utilize base camp facilities during the summer months. The remaining eleven operate float trips on refuge rivers. In 1988, use by commercial sport fish guides represented more than 73.5 percent of the total sport fishing activity on the refuge.



Permanent sportfishing base camp on village corporation lands, lower Togiak River. MJL 7/88

Most of the recreational use is by float boat trips (45%). Other access includes motorboats (34%), fly-ins (3%), or a combination of motorboats and fly-ins (18%).

Of the 35 river drainages within the refuge, use is primarily concentrated on the three larger rivers, the Kanektok, Goodnews, and the Togiak. The Kanektok River receives the most use by 700 visitors spending 4700 use days annually. Float trips lasting eight to ten days represent a majority of the use. The Togiak River receives about 1000 visitors representing 4000 use days. Fly-in and motorboat use are the principal access types on the Togiak River. On the Goodnews system, about 350 visitors spend 2400 use days annually. Guided motorboat camps and nonguided float boat use characterize the primary user groups. Recreational use also occurs on eleven other river systems in the refuge.

It is difficult to predict the trend in recreational use within the refuge if controls had not been imposed in 1984. It is certain that use would have increased, probably substantially.

One indication of the demand for use is the number of requests for special use permits the refuge has received since 1984. Over 35 new requests have been received to date. Estimates are that

of these 35, 20 new commercial operators would have established viable sport fish guiding operations on the refuge. It is safe to say that these new operations would have represented an additional use level of an estimated 1400 clients and 9800 use days per season. Most of this use would have been through additional temporary base camps or by float boat trips on the Kanektok, Goodnews and Togiak Rivers. In addition, it is estimated that existing refuge guide operations would have increased their use by over 4000 use days.

It is assumed that existing levels of unguided recreation indicate current demand because unguided recreation has not been limited. Unguided use has remained relatively stable since 1984.

Therefore, it is estimated that if no controls would have been applied in 1984, sport fishing use within the refuge would have doubled from 12,000 use days to well over 24,000 use days.

If there are substantial increases, particularly in commercial recreational uses, existing subsistence activities, existing recreational opportunities, wilderness values, and fisheries would be significantly affected within the refuge.

2. Outdoor Classroom - Students

Wildlife Biologist/Pilot Hotchkiss provided instruction and a demonstration of radio tracking technology to University of Alaska X-CED students from Dillingham, Togiak and Manokotak April 21, 1988. Each group was then flown out to the Nushagak Peninsula for a practical demonstration in using the equipment.



Botanist, Bill Kirk describing vegetation during
caribou habitat workshop. MJL 9/88

On September 12, 1988, Bill Kirk, regional office botanist, conducted a caribou habitat workshop in Dillingham for middle/high school students from Manokotak, Naknek, Togiak, and Dillingham. Students were introduced to various ecological principles and vegetation transect methods.



Biological Technician, Lisac, describing caribou monitoring equipment to students. LH 9/88

After a radio-collar and telemetry demonstration by Biological Technician Lisac, the students participated in a "caribou" tracking experiment. One student wore the collar and hid while the others attempted to locate her using only the radio-telemetry unit. They were successful after winding their way through trees, tundra, and front yards.

The workshop concluded with the viewing of the cooperatively produced caribou reintroduction video. Jerry Lipka (University of Alaska, X-CED program) coordinated these community activities with Bill Kirk.

6. Interpretive Exhibits/Demonstrations

The preliminary design of an interagency interpretive display to be located in airports in Anchorage and Dillingham was initiated this year. Final design and construction is scheduled for completion in mid 1989. The purpose of the project is to provide visitors to the region with a better understanding of land ownership patterns, the purposes for the establishment of special management areas such as Togiak National Wildlife Refuge and Wood-Tikchik State Park, and an understanding of the unique cultural, biological, and natural resource conditions. Principal cooperators in this project include the refuge, the Department of

Fish and Game, the Department of Natural Resources, the Bristol Bay Coastal Resource Service Area Board, the City of Dillingham, and seven village corporations within the region.

7. Other Interpretive Programs

The refuge has been becoming more and more visible as opportunities for seminars, lectures, presentations and exhibits become increasingly available and our presence is requested. The Dillingham Chamber of Commerce, formed in 1986, sponsored a local Fall Fair. Local business set up booths to display their products. Refuge personnel staffed an informational booth at the fair. The CBS special "Our Gifts to Us" video which has a short segment of the refuge and the Service's Catch and Release Fishing video were shown. Maps, brochures, and good hearted conversation were on display. A lot of goodwill mileage was gained in our participation. Many people were unaware of the exact refuge boundaries and found that our staff is very congenial and enjoy talking about the refuge.

The refuge held an open house together with other tenants in the office building during the Dillingham Beaver Roundup festival. During the festival residents from the outlying villages come to Dillingham to sell their furs and partake in the festivities. The brochure racks and cookie plates were cleaned off.

Fishery Biologist Harper took 25 Togiak high school students to the sonar project on the Togiak River. The workings of the sonar unit were explained. Students were also shown the different species of salmon found at the site.

8. Hunting

On October 21, 1988, the Alaska Supreme Court handed down a decision (Owsichuk vs. State of Alaska, Guide and Licensing Control Board) that exclusive guide areas are without legal force and have the potential to impact wildlife resources. As a result of this decision, the Service decided to maintain commercial hunting operations at the same level as the past with an interim program for only one or two years to allow the State of Alaska adequate time to develop a legal system for managing commercial sport hunting.

This action was taken to insure consistency with refuge purposes. The Service is charged with responsibility for maintaining wildlife populations in their natural diversity and providing the opportunity for continued subsistence uses by local residents.

This policy is very similar to the current refuge policy with respect to commercial sport fishing guides on the refuge.

Non-local sport hunting. Four big game guides were issued special use permits to operate on the refuge during 1988. Of these, one guide did not bring clients to the refuge. The remaining three guides brought fifteen clients to the refuge and harvested ten bears; five of which were taken during the spring season and five during the fall season. One bear was reported to be a fifteen year old female, the others were reported to be males.

Waterfowl hunting by non-local sport hunters is increasing on the refuge. Several sport fishing guides have expanded their season of use to include waterfowl hunting during the fall migrations. Hunting use days were reported by guides, however actual use is probably higher as many guides have not been previously required to submit reports. Next year more detailed waterfowl harvest reports will be required. Primary waterfowl hunting locations include Shallow Pond, the Negukthlik River, the Kulukak River, the Kanik River, Cape Constantine, and Nichols Spit.

Local, subsistence hunting. As the 1988 commercial fishing season yielded good returns to refuge fisherman, it is suspected that dependency on refuge resources for subsistence purposes was lessened. This situation varies from year to year depending on commercial fishing success. In any case, very little data exists to document actual harvest.

Kwethluk hunters established a hunting camp in the vicinity of Hart Lake again this year. These hunters spend approximately two months in the spring through breakup and two months in the fall through freezeup at this camp. Reports indicate that this hunting pattern has been occurring for many years. Hunters are reported to take squirrels, bear, and caribou for subsistence purposes.

Observations of subsistence hunting at Chagvan Bay have been recorded for the past five seasons. Specific information concerning daily bag harvests has been gathered infrequently as most hunters do not voluntarily discuss the number of hours spent or number of birds taken during a hunting day. Harvest information has been obtained by interviewing and observing hunters in the field. Some data, such as: numbers of hunting parties, hunters, and the length of hunting trips is obtained by direct observation and friendly conversation.

9. Fishing

Sport fishing for resident and anadromous fish in rivers and lakes on the refuge is considered excellent and draws the majority of visitor use. Fishing opportunities include all 5 species of Pacific salmon, rainbow trout, burbot, whitefish, pike, grayling, lake trout, Dolly Varden, char, cod, smelt,

flounder and others. These fish are generally sought at different times of the year with the majority of the use occurring during the summer. Of the available species king and coho salmon, rainbow trout and char (spp.) are the most avidly pursued by anglers.

Subsistence users from the local villages, using various fishing methods, account for the majority of the fish taken from the streams and lakes. They primarily jig through the ice for Dolly Varden/char, trout, cod, smelt, or flounder, while during the ice free season they fish with rod and reel or gill nets for trout, Dolly Varden/char, pike, and salmon.

Both the subsistence and sport fishing efforts are concentrated on the Togiak, Goodnews, and Kanektok rivers. Due to the remote nature of the majority of the refuge, access is primarily by boat or plane.

Approximately 21 guides offer sport fishing packages of various types to people from all over the world. These sport fishing packages range in price from \$1,200-\$3,400, for 6-10 day fishing excursions which will include float trips, tent base camps on rivers, and/or full lodge accommodations located off the refuge, with daily fly-in fishing to various refuge rivers and lakes. During 1988 sport fishermen are estimated to have spent over \$3,500,000 to fish within the refuge. This cost does not include airfare to Alaska or fishing tackle and licenses. Costs of all gear and transportation will probably increase the total expenditures to \$6,000,000.

Unguided anglers constitute approximately 30% of the angling visitors. They are primarily river rafters, hiring one of nine air taxis permitted to operate on the refuge to fly into the headwater lakes of a major river system. There are also some unguided anglers who fly to areas on the rivers to fish for one or two days. There are also those unguided anglers who will fly to one of the villages to launch their own boats, or rent boats, for river use. This type of day trip user is infrequent, and is primarily an area resident.

Estimated use levels for the refuge have been difficult to ascertain. Refuge programs such as the public use contact stations at the three major headwater lakes, and creel censuses conducted by the refuge, the King Salmon Fishery Resource Station, and the Alaska Department of Fish & Game Sport Fish Division have begun to provide a better picture of the use pattern. Most of these studies do not provide complete coverage of an entire river system, nor of all user groups. It has been necessary to rely on use figures reported by the individual permit holders, and staff estimates of unguided users, to acquire a full range of user estimates. Table 25 shows the best estimates for 1988.

TABLE 25
1988 Estimated Use Day Levels on
Togiak National Wildlife Refuge

Type of Use	Kanektok	Goodnews	Togiak*	Arolic	Total
Guided	3,334	1,569	2,824	324	8,051
Unguided	1,245	1,158	612	?	3,015
Total	4,579	2,727	3,436	324	11,066

/1 From refuge public use contact stations on Kagati, Goodnews and Togiak Lakes, air taxi reports and sport fish guide reports.

* Includes Togiak River Tributaries and River drainage into Bristol Bay.

The Kanektok River supports a large sport fishery for salmon in the lower river, as well as a rainbow, Dolly Varden/char, and grayling throughout the river. Twelve guides operate on this system. Eight guides offer float trips from Kagati Lake to Quinhagak, and four guides offer deluxe motorboat tent camps. Approximately 58% of the use on the river is by float trip users, while guided users account for an estimated 72% of the total use.

The Goodnews River, including the main stem, the south fork, and the middle fork, has an excellent population of rainbow trout and grayling, and also fair runs of Dolly Varden/char and all five species of salmon; however, it is the least used of the major river systems. This could be due to the fact that a major portion of this system falls outside of the refuge and the use on this area is not monitored by the refuge.

Several guides operate on this system, within the refuge portion, offering deluxe tent camps with jet boats, or fly-in clients to the lakes for float trips. Over 50% of the use on the river is by guided motorboat users, while all guided use accounts for approximately 60% of the total use.

The Togiak River supports a large salmon and char sport fishery throughout the main river and a vestigial rainbow and grayling fishery in its tributaries. Of the major river systems, the Togiak supports larger runs of four out of the five salmon species; king salmon runs in the Kanektok are generally larger. The king and coho runs in Togiak River are approximately two weeks

behind the other popular rivers. The angling effort follows this cycle as fly-in guides target on Togiak River fish once the in-river escapement builds.

The value of the sport fishery on the Togiak River, based on the reported level of use by the guides, was estimated at approximately \$1,000,000 for the 1988 season.

Seven guides operate on the Togiak River. Two of the guides offer float trips; one offers a deluxe tent camp, and the remaining five offer daily fly-in, or fly-in motorboat fishing. Approximately 70% of the use on the river was by fly-in and motorboat users, while guided use accounted for nearly 82% of the total use.

10. Trapping

Success on the refuge was high this last season as a result of excellent weather conditions and good prices for beaver furs. Otter prices remained low however. Generally, furbearer populations are stable but higher densities of some species such as beaver and otter, are desirable. The number of subadult beavers being taken throughout the refuge is high and should be monitored. If this trend continues, seasons and bag limits will need to be adjusted.

TABLE 26

FURBEARER SEALING DATA FOR TOGIAK REFUGE
1987 - 1988

<u>Drainage</u>	<u># of Trappers</u>	<u>Beaver</u>	<u>Otter</u>
Togiak (17A)	38	484 (27.9% subadult)	59 (54% female)
Igushik	13	222 (36.5% subadult)	41 (41% female)
Snake	14	207 (26.6% subadult)	23 (43% female)
Kanektok/ Arolik			
Goodnews	15	190 (34.2% subadult)	13 (NA)
<u>Total</u>	<u>80</u>	<u>1,103</u>	<u>136</u>

One wolverine was trapped in the Ungalikthluk drainage. No wolves or lynx were sealed during the season.

Data on other furbearer species that do not have sealing requirements can be obtained through fur acquisition reports. These reports are sent to the Department of Fish and Game from fur buyers but the reliability of this data is highly variable and the actual trapping locations are not specific.

Generally, fox and mink populations are reported to be high as a

result of a relatively abundant prey base; both ptarmigan and hare populations are high. Other furbearer species, such as coyote, marten, weasel and muskrat are taken on an opportunistic basis but do not represent a significant fur harvest in the refuge.

11. Wildlife Observation

During 1988 there were an estimated 850 visits and 1700 activity hours associated with wildlife observation. Most of this activity is usually related to other forms of recreational activities (i.e., sport fishing, river rafting and beach combing). An increased interest in wildlife observation is beginning to develop at Cape Peirce (walrus haulout site and sea bird nesting area). Those who go to Cape Peirce are instructed to land on the east side of the Cape or on the north end of Nanvak Bay and walk overland and contact refuge personnel at the cabin.

12. Other Wildlife Oriented Recreation

This activity consists primarily of wildlife photography. It is usually associated with other recreational activities such as sport fishing, hunting, river rafting and beach combing. Just about every year a few outdoor writers/photographers visit the refuge. They are usually associated with a sport fish guiding operation and are getting pictures and information for magazine articles.

13. Camping

Camping, as related to subsistence activities conducted by local village residents, occurs on the refuge during the fall and winter months. These activities include trapping, hunting, fishing, berry picking, and firewood gathering. Most of the camps are located on native land allotments within the refuge wilderness area.

Camping, (non-rural residents use) is directly related to sport fishing, hunting and river rafting. The refuge does not provide any camping facilities. Several sport fish guides provide semi-permanent camps on major river drainages. All other camping is primitive tent camping connected with river rafting and sport hunting.

15. Off-Road Vehicling

Snow machines are the only off road vehicles authorized for use on the refuge and are for use only during periods of adequate snow cover. Their use on the refuge during the winter is quite

extensive and is usually associated with; travel from one village to another, trapping, firewood gathering, ice fishing and hunting.

16. Other Non-Wildlife Oriented Recreation

These are subsistence activities conducted by individuals from villages within and adjacent to the refuge. These activities consist primarily of firewood gathering and berry picking although there is some collection of grasses for basket weaving.

17. Law Enforcement

Two individuals, Nick Bavilla of Togiak and Michael Echuk of Goodnews pleaded guilty to one count of violating the waste provision of the Marine Mammal Protection Act. The actual incident occurred at Cape Peirce in September 1987, and conviction took place on April 25, 1988. This is the first time since the act was passed in 1972 that a conviction of wasting walrus meat has occurred. Bavilla and Echuk were sentenced to a year in jail, but all but three weeks of their sentences were suspended. They were placed on probation for one year.

Refuge Officers, Fisher, Hotchkiss and Jerome attended the annual law enforcement refresher training the week of February 22. Once again scheduled practical exercises turned into the real thing. Refuge officers were briefed and given assignments for participation in a takedown operation that was the result of a four year national undercover investigation. Five aircraft and one van were seized. Several big game guides and numerous hunters were indicted. This was a particularly successful operation for the refuge as one of the guides had been operating illegally on the refuge and another had been attempting to get a sport fish guiding permit. The latter guide had a history of big game violations.

Refuge Officers Fisher and Hotchkiss and Interpreter Dyasuk responded on April 30, 1988 to an anonymous report from a person in Quinhagak that an estimated 60 Canada Geese had been taken by 4-5 village hunters. A visit to the village was made and a meeting with several village leaders was conducted. No one from Quinhagak had any information but they did want to know who had notified us. Village leaders said they would check around the village and attempt to get more information. An incident report was submitted as specified in the Yukon Delta goose management plan. No more information ever surfaced.

Another violation of the Marine Mammal Protection Act occurred on July 27 at Cape Peirce. Refuge personnel stationed at Cape Peirce reported that three men had shot nine walrus. Refuge Officers Fisher and Hotchkiss flew to the Cape and the three men

were interviewed. The men, Joe Clark and his two sons, Sam and Richard all from Clark's Point, Alaska came ashore in a small skiff launched from a fishing boat and killed the nine walrus with rifles. During the interview Refuge Officer Fisher explained that marine mammals can be hunted by natives but only in a non wasteful manner and that all the meat had to be taken from these animals in order to avoid a wanton waste violation of the Marine Mammal Protection Act. The next day it was discovered that the heads from all nine animals had been taken, three animals were left on the beach with only a little meat taken from two of the carcasses. A bogus attempt to tow the remaining six carcasses from Cape Peirce to Clarks Point (a distance of 130 miles) by a fishing boat was futile. All six animals were lost at sea. An incident report was prepared and submitted to the Fish and Wildlife Service law enforcement office in Anchorage. Special Agent Roger Parker and Refuge Officer Fisher interviewed two of the Clarks in Clark's Point on September 14. Field violation reports were prepared, and pictures documenting the incident were assembled and submitted to the U.S. Attorney's office. By mid December an arraignment date of January 5, 1989 had been set. To be continued...

Sport fishing guide, Jim Broady, Aleknagik Mission Lodge was issued a notice of violation for violating his refuge special use permit: i.e., conducting a commercial sport fish guiding operation in an unauthorized area of the refuge; operation of a commercial sport fish guide camp in an unauthorized area of the refuge and unauthorized clearing of vegetation for aircraft landing on or taking off from the refuge. What makes this violation interesting is the fact that Mr. Broady visited the office before the fishing season to discuss his special use permit. Both the refuge manager and assistant manager thoroughly went over his permit and all the special conditions of his permit at this time. Once the season started Broady thumbed his nose at the refuge and conducted his guiding operation refuge wide. We finally caught up with him on the Kulukak River. He was flying clients in and landing (marginal) on a gravel bar adjacent to a camp or landing in the lower river with a float plane and boating clients up river to the camp. Since the refuge plane was on floats and the river area near the camp was too shallow for it to land we were really limited to access this operation. We did discover that a Bureau of Land Management helicopter was operating close to Dillingham. We contacted Bureau officials and explained our situation. They agreed to let us use the helicopter and pilot whenever we needed as long as it didn't conflict with their work. All we had to do now was wait until the camp was in use. Everything came together on August 24 when Refuge Officers Fisher and Hotchkiss flew to the camp via the helicopter. The violation notice was issued on August 24th and the fine was paid on September 20th. Although the fine was only \$100.00 it did surprise Broady and appease several other

guides who had complained about his flagrant permit violation.



Aleknagik Mission Lodge's spike camp on the Kulukak River. DAF 8/24/88

While on routine patrol September 1, Refuge Officers Fisher and Hotchkiss and Interpreter Dyasuk located a hunting camp at Hart Lake and another hunting camp on an unnamed lake nine miles north of Kagati Lake. Interviews of the people occupying both camps established that they were from Kwethluk village on the Kuskokwim River. Both camps had ground squirrels, fish and fresh caribou meat hanging on the drying racks.



Refuge Officer Hotchkiss and Interpreter Dyasuk questioning hunters at unnamed lake near Kagati Lake.

DAF 9/88

In questioning the hunter at the unnamed lake camp it was quite evident that a caribou had been taken in Unit 18, but the hunter tried to tell us he didn't know where the boundary between Unit 17 and Unit 18 was located. The information was turned over to the State Fish and Wildlife Protection Office in Aniak. The officer visited the camp, seized the caribou meat and issued the hunter a citation.

The Hart Lake camp group had been cited the previous year by Fish and Wildlife Protection for taking caribou in Game Management Unit 18 which is closed to caribou hunting. The case was thrown out based on the judge's opinion that the unit boundaries between Unit 18 and Unit 17 were unclear and that the village hunters could not be expected to know they were hunting in Unit 18. This year even though their caribou was taken in the same general area as last year, we turned the information over to Fish and Wildlife Protection.

I. EQUIPMENT AND FACILITIES

1. New Construction

The refuge bunkhouse and storage building were completed and final inspection occurred in May just in time for the field season. The bunkhouse is a welcome addition and provides comfortable accommodations for volunteer and seasonal employees. The storage building has also improved the efficiency of our operations by providing a warm, dry facility to store, organize, and maintain refuge equipment.



Refuge bunkhouse at administrative site, a most welcome addition.

MB 6/88



Interior of new storage building definitely an improvement over a weatherport. SS 6/88

In the future, it is hoped that additional funding will be available to complete the refuge construction program including residences, a headquarters, hangar, and a visitor's center.

2. Rehabilitation

The replacement cabin (Pan Abode design) for Cape Peirce arrived in July. Unfortunately we were unable to get the materials out to the Cape due to a busy field season and a shortage of funds. Materials will be flown or barged out in 1989.

3. Major Maintenance

All vehicles, mobile homes and equipment received routine maintenance as required throughout the year. No major repairs were necessary this year.

A water filtration system and a water softener were installed at the bunkhouse in October. The softener has greatly improved the iron problem.

4. Equipment Utilization and Replacement

N748, the Cessna 185 that served the U.S. Fish and Wildlife Service so faithfully since 1974 was used up and retired in a matter of seconds near the end of September 1987. The refuge entered Fiscal Year 1988 without an aircraft. However, the Office of Aircraft Services came through with a nearly new Cessna 206 temporarily reassigned from the Fairbanks Fisheries station until a replacement Cessna 185 was available for our use. The refuge received the Cessna 206 (N9497R) on October 28, 1987 and used it until receiving the replacement Cessna 185 on June 15, 1988. The new Cessna 185, a 1985 year model Cessna 185F, arrived at Dillingham with 92.5 hours on the engine and airframe. It is an extremely well equipped aircraft and is working out just fine for our programs.



N735EA, the replacement Cessna 185 for N748. MB 7/88

At the end of Fiscal Year 1987, this station ordered two replacement vehicles, a suburban type van and a half ton pick-up, both 4 wheel drive. Both vehicles arrived in Seattle too late (September) in 1988 to make the fall barge trip to Dillingham. Hopefully these vehicles will be on the spring barge in April 1989, 18 months later.

The old Dodge 4 x 4 3/4 ton pickup used since 1982 as the aircraft fuel truck was retired in August of this year. The fuel

tank was switched from the old Dodge 4x4 3/4 ton truck to the newer Dodge 3/4 ton truck.

A new 12 volt Fill-Rite fuel pump was purchased to replace the old Tokhiem 12 volt fuel pump used to transfer aviation gas from the fuel tank to the aircraft. A Digi-Flo fuel metering device was purchased for mounting in the fuel line just ahead of the fuel nozzle.

The Red-Dragon propane heater traditionally used to preheat the aircraft engine during cold weather aircraft operations was replaced with a 1000 watt Honda generator in order to utilize the Tanis engine heater system installed on fleet aircraft by Office of Aircraft Service.

5. Communications Systems

During the field season, five HF-Single Side Band Motorola Micom S radios, two Transworld HF-Single Side Band radios, and one SGC 715 portable HF-Single Side Band transceiver were used by refuge field staff. The SGC 715 was used by mobile field camps, or by personnel on float trips. Also, the refuge aircraft is equipped with an ASB 500 HF-Single Side Band radio.

Three hand held VHF radios were purchased and used for air to ground communications during the caribou transplant, goose banding and other field operations. These radios proved valuable in coordinating air and ground logistics.

Four VHF radios were picked up as surplus from Bureau of Land Management. Three were installed in refuge vehicles and one set up in the office. These were used to better coordinate logistical activities for meeting the refuge aircraft to load and unload supplies and personnel.

The HF-Single Side Band radio served as the link between the office, aircraft and field camps and also a link with the emergency Coast Guard frequencies. Frequency 3215.0 was used as our primary channel for refuge operations during 1988. Frequency 5907.5 was used as a backup channel and proved most useful in the autumn mornings when interference on the primary channel was encountered. Radio schedules were conducted between 8:00-9:00 a.m., and again at 10:00 p.m. when field camps were in operation. This facilitated aircraft scheduling, weather checks and acquiring field camp needs for each day. All field radios functioned properly throughout the season with only minor repairs needed. The biggest stumbling block to refuge communications is the office base station radio. Interference with the local power grid has forced us to eliminate a direct antennae hook up for the office base radio. We have purchased and installed a radio relay transceiver which sends and receives signals through a dedicated

phone line to an antennae. The antennae is located at the refuge trailer houses approximately 1/4 mile from the office. This system has its major quirks, but has improved our reception. A new tunable, whip antennae has been installed on a 40 foot tower at the new bunkhouse location approximately 2 miles from the office. Attempts to balance the phone line between this new antennae and the office have proven unsuccessful. The local telephone company and radio shop technicians have yet to reach a solution.

Unfortunately, it is generally felt that only the occurrence of a major incident will bring this problem into focus, in terms of both the attention and funding required to upgrade the statewide radio communications system for Alaskan refuges. We have been very fortunate considering the inadequacy of the current statewide system.

6. Computer Systems

As has happened in the past, there is a major bottle neck in data processing at the end of each field season. Acquisitions were prepared for the purchase of three new computers for data analysis and word processing.

7. Energy Conservation

Energy consumption for calendar year 1988 was higher than 1987. Full occupancy of refuge trailers and the addition of the bunkhouse and storage building caused an increase in electricity and heating fuel.

TABLE 27
Energy Conservation Comparison

Energy Source	Unit of Measure	Consumption					
		CY83	CY84	CY85	CY86	CY87	CY88
Electricity	KWH	25,087	21,106	24,410	23,049	41,988	40,814
Propane	Gal.	189	142	108	165	200	168
Vehicle Fuel	Gal.	495	821	772	1,098	947	1,256
Aviation Fuel	Gal.	1,390	3,205	3,873	4,581	7,330	5,506
Heating Fuel	Gal.	958	1,188	1,008	1,704	3,291	3,819
Misc. Fuel**	Gal.	0	252	500	3,279	1,081	1,745

**Includes boat gas, kerosene, blazo

J. OTHER ITEMS

1. Cooperative Programs

The regional director signed the cooperative agreement for the caribou reintroduction project in early January. Purpose of the agreement is to provide the necessary coordination between the service, Alaska Department of Fish and Game and cooperating villages (Togiak, Manokotak and Choggiung Limited-Dillingham Village Corporation).

By the end of the year a similar cooperative agreement to provide necessary cooperation for our moose collaring project was being reviewed by the following villages: Togiak, Manokotak and Aleknagik.

Biological Technician Lisac and volunteers O'Neil and Heubers assisted Alaska Department of Fish and Game Sport Fish biologists in beach seining rainbow trout in the Kvichak River. Three hundred fish were sampled and over 500 fish were tagged.

The refuge provided one volunteer to help Alaska Department of Fish and Game (Commercial Fisheries) conduct salmon counts at the Togiak River counting tower.

Wildlife Biologist/Pilot Hotchkiss assisted Alaska Maritime Refuge personnel in the annual reindeer survey of Hagemeister Island. One thousand forty eight reindeer were counted this year, the largest population count to date.

The refuge provided two volunteers (mid May to mid June) to help commercial fisheries conduct smolt outmigration counts (sonar) at Togiak Lake.

3. Items of Interest

The Dillingham high school metal shop fabricated pens for the caribou reintroduction project.

Refuge personnel attended fish and game advisory meetings in Dillingham and Togiak during the year.

Refuge personnel attended several Yukon Delta Goose Management Plan meetings in Bethel during the year.

School programs presenting the caribou reintroduction were conducted to students in the following villages; Togiak, Twin Hills, and Manokotak. An open house was held in Togiak for the general public.

Students from Togiak, Manokotak and Dillingham through the University of Alaska X-CED program, were involved in the capture, release and monitoring of the caribou herd.

Interpreter Dyasuk recruited eleven volunteers from the villages of Togiak and Manokotak to assist in the caribou reintroduction effort.

Refuge Manager Fisher gave a presentation on current refuge public use trends to the Dillingham Chamber of Commerce - visitor industry seminar.

Assistant Manager Jerome attended the advanced refuge manager's academy in Washington D.C.

Refuge Information Technicians Bavilla, Cleveland and Evans attended technical training at the Yukon Delta Refuge, Bethel, Alaska.

Wildlife Biologist/Pilot Hotchkiss assisted the Alaska Aviation Safety Foundation in conducting a passenger awareness and survival equipment program in Dillingham.

Public meetings to provide information concerning enforcement of the Migratory Bird Treaty Act as it relates to spring waterfowl hunting were held in Dillingham, Togiak, Twin Hills, Goodnews Bay, Platinum, Manokotak and Quinhagak.

Biological Technician Lisac presented several slide shows in support of National Wildlife Week at the Dillingham elementary school.

Tim Maynard, Safety Officer, visited the refuge and conducted a defensive driving course for the refuge staff.

Biological Technician Lisac attended contaminant training in King Salmon.

Fisheries Biologist Harper attended the basic refuge managers academy, Blair, Nebraska.

Local radio (KDLG) news editor, Bob King was taken on a caribou monitoring survey. Mr. King reported most of the survey on audio tape and prepared a short program on the survey. Mr. King received an Alaska Public Radio Service award for this program.

Secretary Johnson attended Small Purchases training in Anchorage.

Biological Technician Campbell attended fire management training at the Kenai Refuge.

Fisheries Biologist Harper attended the International Symposium and Educational Workshop on fish marking techniques in Seattle.

Dr. Brina Kessel, Professor of Zoology, University of Alaska and Dr. Robert Dickerman, Research Associate, American Museum of Natural History spent a week observing shorebirds on the refuge at Cape Constantine.

A refuge brochure that addressed subsistence and recreational use on the refuge was prepared, printed and distributed.

Norm Olsen, refuge planning, visited the refuge to discuss conceptual designs for visitor displays at the Dillingham airport. The display will be an interagency project involving State Parks, Fish and Game, Dillingham Chamber of Commerce, Dillingham Museum, Chogguing Limited and Aleknagik Native Corp.

Refuge Manager Fisher gave a presentation for the initiation of the 1988 Duck Stamp program. The ceremony was held at the Dillingham Post office.

Rob Walkinshaw, Alaska Department of Natural Resources, visited the refuge to become familiar with the refuge public use program. Rob is the Department's project leader designated to work with the refuge staff to develop public involvement for the refuge public use management plan.

Togiak Natives Limited (Togiak Village Corporation) constructed sport fishing facilities (eating and overnight accommodations) on the Togiak River. This is a first and signifies a change in thinking for village residents.

Wildlife Biologist/Pilot Hotchkiss attended the Alaska Aviation Safety Foundation fall safety seminar in Anchorage.

Assistant Manager Jerome, Interpreter Dyasuk and Rob Walkinshaw of Department of Natural Resources met with village corporation boards in Quinhagak, Togiak, and Goodnews Bay. Purpose of the meetings were to discuss the public use management plan.

Biological Technician Lisac attended D-Base III Plus training in Anchorage.

Fishery Biologist Harper and family moved into rental quarters after six months of negotiations with homeowners and waiting for a satisfactory contract from contracting and General Services.

Bob Rice and Michelle Chivers, Division of Realty, visited the refuge to assess housing and establish rental rates for Harper.

Secretary Johnson attended a clerks workshop and Lotus spreadsheet training in Anchorage.

Interpreter Dyasuk attended "Effective Letter Writing" training in Anchorage.

Wells Stephenson, Marine Mammal Coordinator visited the refuge to describe the new marking and tagging program being implemented by the Service within Alaska.

Interpreter Dyasuk and Refuge Information Technician Evans attended the annual waterfowl conservation committee tour of refuges and important waterfowl habitat areas in California.

Wildlife Biologist/Pilot Hotchkiss and Alaska Department of Fish and Game biologist Ken Taylor presented school programs on the caribou reintroduction and moose collaring projects to three classes in the Togiak school.

Special thanks need to be given to the staff at Becharof/Alaska Peninsula Refuge and the King Salmon Fisheries Station staff for their help and support with the caribou project. Thanks also should go to the Innoko Refuge for providing a pilot and plane during part of the project. Thanks also needs to be given to those villagers from Manokotak who helped with the project.

Thanks also needs to be given to Jim Frates, Facilities Manager, Kenai National Wildlife Refuge for his help in fabricating wilderness boundary signs for use at this refuge. Thanks also to Red Sheldon, Region 7 Fire Coordinator for his help in obtaining a radio tower, tuner and installation of these facilities at our administrative site.

4. Credits

The 1988 Narrative Report was written by:

*Refuge Manager

Fisher Introduction; Section A; Sections C(1,2,3);
E(1,2,5,6); F(9); G(12); H(11,12,13,15,16,17);
I(2,3,4); J(1,3,4).

*Assistant Refuge Manager

Jerome Sections D(1,2,3); E(8,11,12); H(1,6,7,8,10);
I(1,7).

*Wildlife Biologist/Pilot

Hotchkiss Sections D(5); F(1,2,6);
G(1,2,6,8,10,14,16); H(17); I(4).

*Fisheries Biologist

Harper Sections D(2,5); G(11); and H(9); I(5,6).

*Biological Technician-Fisheries

Lisac Sections D(5); I(5).

*Biological Technician-Wildlife
Campbell Sections D(5); E(4); G(3,4,5,7).

*Interpreter Dyasuk Sections E(1); H(16); J(1)

* Volunteer Sheffield Section B; Sections D(5); G(9).

The report was assembled and processed by Secretary Johnson and Biological Technician Campbell, and edited by the staff.

Photo Credits: Permanent Staff:

DAF: Dave Fisher
PJ: Pete Jerome
KH : Ken Harper
MJL: Mark Lisac
FP : File Photo

Volunteers:

RD : Rob Doyle
LU : Laura Umbright
AO : Allyn O'Neil
GS : Gay Sheffield
SS : Sue Safford
MB : Michelle Bourassa
LH : Lisa Haggblom