

TOGIAK NATIONAL WILDLIFE REFUGE  
Dillingham, Alaska  
ANNUAL NARRATIVE REPORT  
CALENDAR YEAR 1987  
U.S. Department of the Interior  
Fish and Wildlife Service  
National Wildlife Refuge System



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US FISH & WILDLIFE SERVICE--ALASKA



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ANNUAL NARRATIVE REPORT

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

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Dillingham, Alaska

ANNUAL NARRATIVE REPORT

Calendar Year 1987

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Date





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## 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 NWR absorbed the former Cape Newenham NWR, 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 NWR. 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 NWR, were withdrawn in 1971, under Section 17(d)(2) of the Alaska Native Claims Settlement Act (ANCSA). 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. ANCSA 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 NWR, under Section 17(d)(1), of ANCSA. 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 (FLPMA) to protect these lands, and withdrew nearly 110 million acres of land throughout Alaska. Most of the present Togiak NWR 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 FLPMA, 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.

In December 1980, Congress enacted the Alaska National Interest Lands Conservation Act (ANILCA). 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 NWR. The first refuge manager subsequently reported for duty in October, 1981.

ANILCA is the primary statute affecting the planning and management of Togiak NWR. 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 ANILCA, stated four purposes of Togiak NWR. 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 Togiak NWR. They are also the criteria for developing and evaluating management alternatives for the refuge. These purposes are:

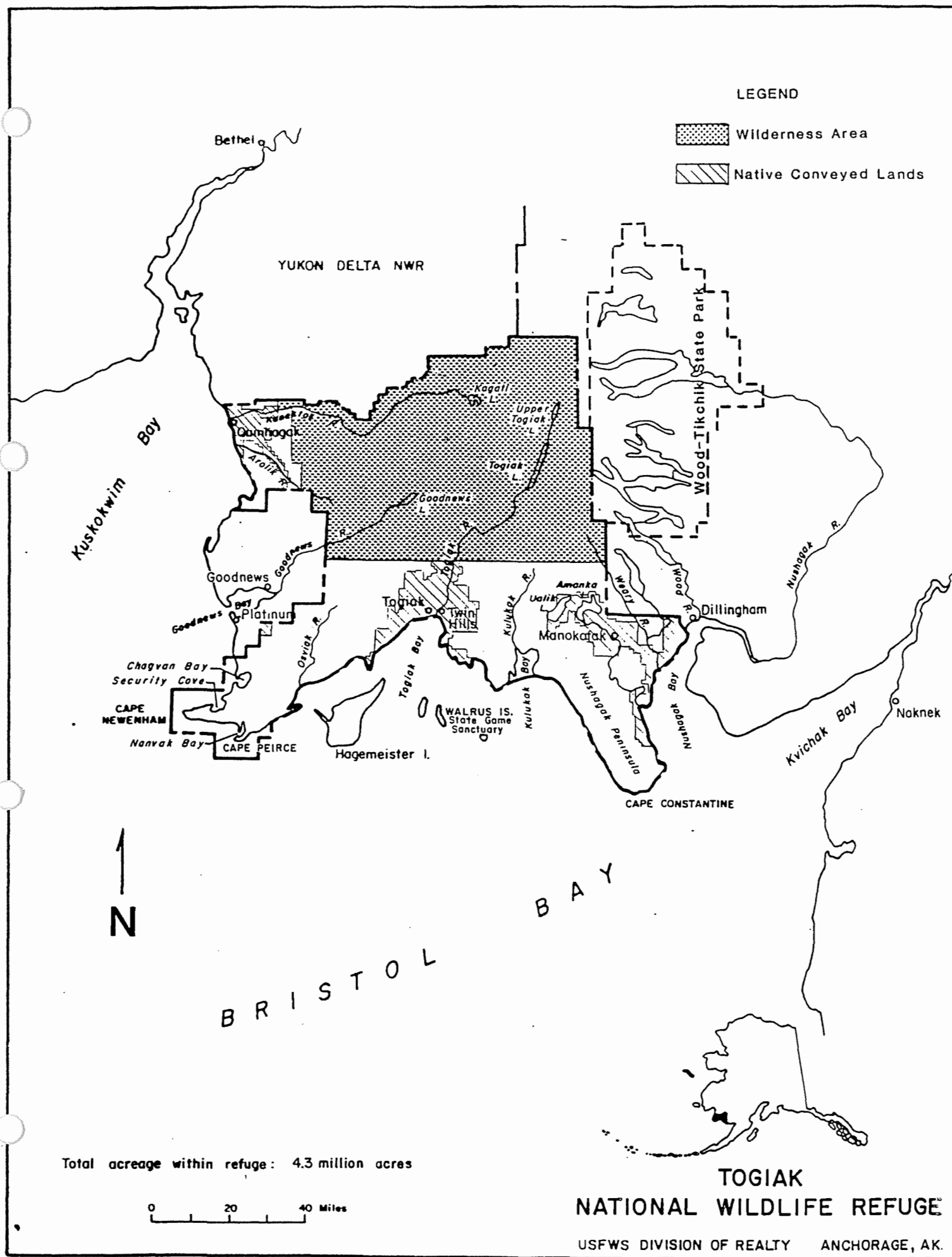
1. To conserve fish and wildlife populations and habitats in their natural diversity, in order to:
  - preserve a natural diversity and abundance of fauna and flora on refuge lands;
  - conserve salmon populations and their habitat;
  - conserve marine bird populations and their habitat;
  - conserve 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.







## A. HIGHLIGHTS

The long awaited caribou reintroduction project became a reality. By the end of the year a cooperative agreement with ADF&G, two villages, one village corporation and the service had been finalized; a video tape explaining the reintroduction had been produced; and a cooperative management plan with ADF&G had been consummated. The actual capture and relocation of animals is scheduled to begin in early February, 1988.

Construction started in June on the much needed bunkhouse and storage building. These facilities are located at the administrative site on Windmill Hill.

The refuge fishery management plan was completed in draft form and forwarded to the region for review.

The refuge office in the Kangiiqutaq Building was moved from a small unit on the first floor to larger accommodations on the second floor.

Ms Kim Custis replaced Ms Karen Brandt as the refuge secretary.

Mr. Jon Dyasuk from the village of Togiak joined the staff as the refuge interpreter.

Regional office staff conducted a station program review.

Cessna N748 flipped over on take-off and sunk in Nanvak Bay, Cape Peirce. Fortunately, no one was injured.

The Record of Decision for the refuge comprehensive conservation plan was signed by the Regional Director.





One highlight of the year was the seemingly good weather and spectacular sunsets. BS, 1987.



## 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 8.1 degrees F. in December, to an average maximum of 64.0 degrees F. in July. (Table 1). 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 -36 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.

TABLE 1  
Climatic Conditions in the Dillingham Area  
Long Term Average (LTA) (1922 - 1984)

Month	Temperatures (F)			Precipitation	
	Maximum	Minimum	Mean	Inches/Rain	Inches/Snow
JAN	23.2	9.7	16.4	1.87	14.3
FEB	25.0	10.4	17.7	1.37	10.7
MAR	29.6	12.2	20.9	1.61	13.9
APR	38.6	23.2	30.9	1.23	5.4
MAY	51.1	33.5	42.3	1.63	0.3
JUN	60.7	41.3	51.0	1.70	0
JUL	64.0	45.7	54.8	2.69	0
AUG	62.3	45.6	54.0	3.73	0
SEP	55.5	39.3	47.4	3.37	0.1
OCT	41.9	27.0	34.5	2.44	2.2
NOV	30.6	16.9	23.8	1.75	11.1
DEC	21.6	8.1	14.8	1.69	15.3
Annual					
Average	42.0	26.1	34.1	25.08	73.3

(The above data comes from "Climatological Summary, 1922-1984; Arctic Environmental Information and Data Center, University of Alaska-Fairbanks.)



## January - March

The high of 39 degrees F. occurred in March. The low of -22 degrees F. occurred during January, (Table 2). The average temperature for the quarter was 22.8 degrees; higher than the long term average (18.3). There were 54 days of precipitation; 1.64 inches of rain (4.85 inches LTA), and 57.6 inches of snow (38.9 inches LTA). The most snowfall (25.7") for the quarter was recorded in March.

TABLE 2  
1987 Climatic Conditions

Month	Temperature (F)			No. Days	Precipitation	
	Maximum	Minimum	Mean		Rain (in.)	Snow(in.)
JAN	36	-22	20.3	23	1.13	17.91
FEB	36	-03	22.3	15	.24	14.0
MAR	39	0	25.7	16	.27	25.7
APR	46	06	30.6	5	1.2	10.7
MAY	56	31	40.1	10	1.5	0
JUN	65	29	49.3	17	5.27	0
JUL	78	44	56.0	17	7.20	0
AUG	77	42	56.8	13	8.64	0
SEP	63	29	45.0	15	4.14	0
OCT	50	27	37.0	20	3.3	T
NOV	38	-14	18.0	21	2.26	21.4
DEC	36	-22	7.6	21	1.6	18.0
Annual	51.7	12.2	34.1	193	36.8	107.7

## April - June

The average temperature for this quarter (40.0 degrees F.) was slightly below the long term average of 41.4 degrees F. A low of 6 degrees F., was registered in April, and the high of 65 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 32 days of precipitation there were 8.0 inches of rain recorded during this quarter, and 10.7 inches of snow; both 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 52.6 degrees F. was similar to the long term average of 52.1 degrees F. Although the average temperature for the month of July was 56 degrees F., a high of 78 degrees was recorded. 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 45 days of precipitation this quarter (19.98 inches of rain). This was well above the long term average of 9.79 inches of rain. On both August 4 and 5, rainfall accumulated to over 3 inches. This two day period accounted for a third of the quarters rainfall.

#### October - December

It is fairly common knowledge in this area that freeze-up begins by October 20. This year, however, temperatures remained above freezing until October 27th.

Overall, this quarter average temperature of 20.9 degrees F. was below the long term average of 24.4 degrees F. The high of 50 degrees F. was recorded in October, and the low of -22 degrees F. occurred in December.

Precipitation was recorded on 62 days this quarter, with an above average rainfall (8.16") and snowfall (39.4"). The first snowfall occurred on Halloween Saturday. This snow has miraculously stayed with us all winter.

There were 193 days of precipitation during 1987. Snowfall for the year (107.7 inches) was well above the 73.5 inch long term average. Rainfall (36.8 inches) was also well above the long term average of (25.08 inches).



## C. LAND ACQUISITION

### 1. Fee Title

The Service purchased 4.24 acres in May of 1986 for use as an administrative site. Construction of a storage building and bunkhouse began in June at the site. Eventually, an office will be added.

### 2. Easements

Section 17(b) of the Alaska Native Claims Settlement Act directs the Secretary of the Interior to reserve easements for public use, as determined reasonable, on lands to be conveyed to village or regional corporations. The first step of this easement identification process was to request easement recommendations from various public agencies and organizations. In most instances, easement sites were identified prior to the establishment of the refuge. As the Bureau of Land Management (BLM) conveyed land to native corporations, we were asked to review previous site easements and recommend new ones.

In 1987 BLM added two easements on the Goodnews Rivers;

- a. A one acre site easement upland of the ordinary high water mark along the southeastern portion of an island in the Goodnews River in the N 1/2 of Section 29, T.11S., R.72W.
- b. A one acre site easement upland of the ordinary high water mark along the right bank of the Middle Fork of the Goodnews River in the N 1/2 Section 3, T.12S., R.72W.

The easements were reserved to accommodate transportation along the waterways not for recreational purposes. Uses allowed are; vehicle parking (ie. aircraft, boats, ATV's, and snowmobiles), temporary camping, and loading, or unloading, all limited to 24 hours.

The traditional access to the Kanektok River was discontinued prior to the 1987 season of use. The access point was located at the east end of the runway in the village of Quinhagak and provided a good take-out spot for recreational floaters. The proximity of the site to aircraft landing and taking off created the potential for a serious accident. For that reason, the Village of Quinhagak notified State authorities and the use was discontinued.

Recreational floaters were forced to use one of two other alternatives. Access up a very shallow muddy slough to the



runway apron or to a road that was about 1/4 mile from the runway. While initially there was a concern that neither alternative would be acceptable, as the season progressed the problem disappeared.

During the summer, the feasibility of securing a permanent easement was discussed by the Service and the State. The use of Dingell-Johnson money was identified as one solution. If existing access becomes a problem in the future, this discussion will probably arise again.

### 3. Other

There were no major land status changes during 1987. Table 3 shows the current land status as of the end of the year.

TABLE 3  
Land Status of Togiak NWR as of December, 1987

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 (ROD) for the Final Comprehensive Conservation Plan/Environmental Impact Statement (CCP/EIS) and Wilderness Review for the Togiak National Wildlife Refuge was signed by the Regional Director on February 12, 1987

In the ROD, Alternative C Modified was selected for implementation. Under this alternative about 334,000 acres are proposed for wilderness designation. The Service also determined that oil and gas exploration and development in that area is incompatible with the purposes of the refuge.

With the publication of this document, a lengthy and complicated planning effort nears completion.

### 2. Management Plan

Several recommendations in the Togiak Comprehensive Conservation Plan (CCP) 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 CCP. Because of the controversies surrounding public use issues on the refuge, the refuge staff initiated planning on a Public Use Management Plan and a Fisheries Management Plan this year.

The initial planning phases of the fisheries management plan (FMP), and the public use management plan (PUMP) were begun in 1986. The preparation of these two plans was identified in the RCCP as a high priority, and will be necessary to develop meaningful resource programs on the refuge. The FMP is scheduled for completion during 1988, while a PUMP will be completed in 1989.

## FISHERY MANAGEMENT PLAN

The King Salmon Fisheries Assistance Office (FAO) had the lead in developing the Refuge fishery management plan. Refuge fishery biologist Ken Harper spent considerable time meeting with the King Salmon station project leader Gary Sonnevil, outlining goals and objectives and writing and editing portions of the plan. Several meetings were held with the Alaska Department of Fish and Game, Commercial, Sport and Subsistence Divisions. These meetings were useful in developing strategies and identifying issues and concerns of this agency and deriving public issues identified in other documents. Several meetings were also held between the refuge, the regional office fishery staff, and the King Salmon



Fishery Assistance Office in developing the strategies and writing the objectives.

On March 18, RM Fisher, FB Harper and Project Leader Sonnevill presented phase I of the FMP to the Regional Director and Regional Office Fisheries Staff. A draft Phase II of the FMP was delivered to the RO in mid September and a final was handed in for review the middle of November, 1987.

The document has identified several issues of concern that include competition between user groups, timely escapement monitoring, inadequate escapement data bases, potential overharvest of fish populations, lack of baseline fishery data to base management decisions on, interception of refuge originating fish stocks, oil and gas leasing development, and inadequate fishery law enforcement.

A large amount of work needs to be completed to address those issues and concerns to fill in data gaps. This data and other monitoring will help the refuge and state better understand and manage resident fish and anadromous salmon runs. Setting of task priorities was similar to a political convention. Everyone had an opinion and there never was a consensus between the different agencies, the refuge and the Fishery Assistance Office. The priorities identified, however, best meet the needs of the refuge, the subsistence users, and the resources of the refuge.

By year end this document had consumed over 3 staff months of work, and numerous reams of paper.

The document will be sent out to the State Fish and Game Department some time in the spring of 1988 for their review prior to its public release. The regional office is planning a full blown public review of the document in 1988.

#### PUBLIC USE MANAGEMENT PLAN (PUMP)

Initial scoping for the PUMP began in January 1987. Workshops were held in Dillingham, Togiak, Goodnews Bay, and Quinhagak. It was recognized early in the process that most of the issues facing refuge management did not relate to impacts to biological resources but rather represented conflicts between various refuge user groups. As a result, a process was developed to provide opportunities for interest groups to resolve conflicts and achieve consensus when possible. Local subsistence users, guided and unguided recreational interests, wilderness advocates, and fisheries management interests organized work groups to develop recommendations for Service planners.

The following general management directions represent a summary of those workshops and provide the basis for the draft PUMP:



1. Establish appropriate levels of use on refuge rivers.
2. Maintain natural diversity and abundance of refuge fish populations.
3. Develop a process for managing entire river systems with management consistency between landowners and managing agencies.
4. Work with the local people to explain ways in which each village can contribute to management on refuge rivers.
5. Establish a program to increase the awareness of various refuge user groups (particularly unguided users) to river resource issues such as trespass, litter, crowding etiquette, etc.
6. Implement existing Alaska Land Use Council trespass recommendations.
7. Re-evaluate escapement goals for salmon by species. (Fisheries Management Plan).
8. Develop a management concept of "in-river abundance" to maintain availability of salmon in refuge rivers throughout the season (Fisheries Management Plan).
9. Enhance wilderness values within the Togiak Wilderness Area. Consider using the following tools: start dates, limits on length of stay, use of river rangers, user fee systems, and horsepower limitations.
10. Manage the Kanektok River, within the wilderness area, as a "float only" river.
11. Refuge rivers should be considered and managed individually, recognizing the unique physical and biological characteristics of each river.
12. Develop a better law enforcement program.
13. Consider and provide opportunities for all recreational user groups within the refuge.
14. Develop an appropriate program for administering and managing public use on refuge rivers. Consider establishing user fees, sport fish rights, the need for a concession program, etc.

During the summer, an internal Service review draft of the PUMP was prepared by refuge staff. As a result of a review by the



regional solicitor, it became apparent that the plan would need to be prepared in conjunction with the State of Alaska in order to insure consistent management on navigable rivers. By December 1987, a joint federal-state task force was being organized to continue the planning effort.

While progress to date has been slow, it is recognized that the complexity of land ownership patterns and management jurisdictions on the refuge rivers make cooperative involvement essential in order to insure long term resource protection, continued subsistence opportunities, and visitor satisfaction.

### 3. Public Participation

Several refuge projects required extensive public involvement this year. Two, 2-day workshops were held in Dillingham during preparation of the public use management plan. The workshops were well attended with over fifty people participating, representing several refuge interest groups. Additional public meetings were held in Togiak, Goodnews Bay, and Quinhagak.

Substantial public involvement was incorporated into the caribou reintroduction project. Numerous meetings were held in the villages of Manokotak, Togiak, and Twin Hills to explain the reintroduction effort and to develop public support for village participation through a cooperative agreement. In addition, a video tape was prepared by the Service to explain the reintroduction effort, both English and Yupik versions of the tape were produced and sent to village governments, schools, and agencies.





Bob Olendorf (Audio Visual Officer) video taping in  
Togiak for the caribou reintroduction I/E effort.  
DAF, 1987.

Additional public meetings were held to discuss management of  
marine mammals, waterfowl regulations, and land bank agreements.



## 5. Research and Investigations



Togiak Lake is the site of much refuge activity and visitor use. Public use surveys, salmon counting tower, lake surveys and angler creel surveys all target on the Togiak system. DAF, 1986.

### PUBLIC USE SURVEY CAMPS

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. This year, Togiak and Kagati lakes each had one camp, staffed with volunteers. The camps were each provided with an 10x12 weatherport cook tent, 8x10 weatherport sleeping tent, HF single side band radio, inflatable (Zodiac or Avon) boat, and outboard motor. A kayak was also used at Kagati Lake to minimize motor use on nice days. Goodnews Lake was not staffed in 1987.

Their primary goal was to contact all visitors landing at the lake. The purpose of these contacts was 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 4). Volunteers also talked to visitors about the refuge, wilderness ethics, private land status, and demonstrated proper catch and release fishing techniques.



In 1987 only the Kagati Lake field camp was set up. Togiak Lake visitor information was gathered by our volunteers working with the Alaska Department of Fish and Game salmon counting tower project at the outlet of Togiak Lake. Goodnews River visitor information was gathered from air taxi trip reports and sport fish guide weekly use reports.

Since 1984, interviewed guided float use on the Kanektok has tended to increase. The slump observed in 1985 can be primarily attributed to weather conditions which limited river access early in the season. The current moratorium on issuing new special use permits to sport fish operators has only limited the growth in the wilderness portion of the Kanektok River. Our interviewed use considers the entire river length with much of the float effort occurring in the non-wilderness portion of the river. Guided float use accounted for 81% of the total.

Unguided float use on the Kanektok peaked in 1986 at 164 visitors and 1,548 use days. In 1987 unguided use had declined by nearly 50%. Increased motorboat traffic and an uprising by local commercial fisherman who wished to close down the sport fishery in 1987 have detracted from the wilderness experience and sent some unguided anglers elsewhere.

The Togiak River system has in the past ranked out as the refuges' second most popular float river. In 1987 it fell to number three. Our volunteers interviewed 109 people for 781 use days, a decrease from 1986 of 233 use days. Both guided and unguided use were down in 1987. Guided use accounted for 44% of the float use.

Float use on the Goodnews River has remained relatively steady from 1985 to 1987, fluctuating between 600 and 900 use days. In 1987 float use was up to 1985 levels, but a shift was observed between user groups. Guided use increased six fold and accounted for 41% of the total float use. This increase was due primarily for two reasons: 1) Operators having had permits to operate on the system did actually run float trips in 1987, and 2) The conflict that arose on the Kanektok River between commercial and sport fisherman caused a couple operators to shift their use to the Goodnews for that time period. Approval by the refuge manager allowed operators to use this system.

Overall guided float use on the refuge was up slightly over previous years while unguided use was down nearly 1,100 use days. Guided use accounted for 69% of the refuge float effort. It appears as though unguided float use has peaked and possibly leveled off. Preliminary results from the National River Recreation Survey (NRRS) conducted by the refuge on all three rivers in 1986 revealed that float users were becoming dissatisfied with motorboat traffic and the degradation of wilderness solitude. The Kanektok River controversy and its



media coverage undoubtedly affected some unguided users desire to float the system in 1987. Guided use appears to be generally less affected due to advertisement and promotion by sport fish guides.

TABLE 4.

Public Use Float Interviews, 1984-1987  
Goodnews, Kagati, and Togiak Lakes

	KAGATI LAKE				TOBIAS LAKE			GOODNEWS LAKE			TOTAL		
	1984	1985	1986	1987	1985	1986	1987	1985	1986	1987**	1985	1986	1987
<b>GUIDED</b>													
NO PARTIES	35	28	36	43	17	8	9	2	1	7	47	45	59
NO CLIENTS	194	170	209	247	68	28	33	5	3	26	243	240	306
NO GUIDES	100	81	114	126	13	14	14	3	1	11	97	129	151
TRIP LENGTH	8.1	8.3	8.7	7.9	7.6	8.9	7.4	10.0	15.0	11.7			
CLIENT USE DAYS	1,602	1,407	1,877	1,977	510	264	243	50	45	258	1,967	2,186	2,478
GUIDE USE DAYS	826	688	1,045	1,029	91	121	100	30	15	111	809	1,181	1,240
TOTAL USE DAYS	2,428	2,095	2,922	3,006	601	385	343	80	60	369	2,776	3,367	3,718
<b>UNGUIDED</b>													
NO PARTIES	21	27	36	22	10	19	14	25	19	22	62	74	58
NO PEOPLE	90	120	164	92	36	75	62	109	63	67	265	302	221
TRIP LENGTH	8.1	8.2	10.0	10	7.5	8.2	7.6	7.6	9.2	7.9			
NO USE DAYS	691	951	1,548	710	267	620	438	810	601	526	2,028	2,769	1,674
<b>TOTAL*</b>													
NO PARTIES	71	65	79	65	36	28	23	28	22	29	129	129	117
NO PEOPLE	433	408	509	465	151	126	109	123	72	104	682	707	678
NO USE DAYS	3,361	3,167	4,492	3,716	958	1,014	781	896	664	895	5,021	6,170	5,392
% USE DAYS GUIDE	78%	69%	65%	81%	69%	38%	44%	9%	9%	41%	58%	55%	69%

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

\*Includes parties that flew into the headwater lake but didn't float the river

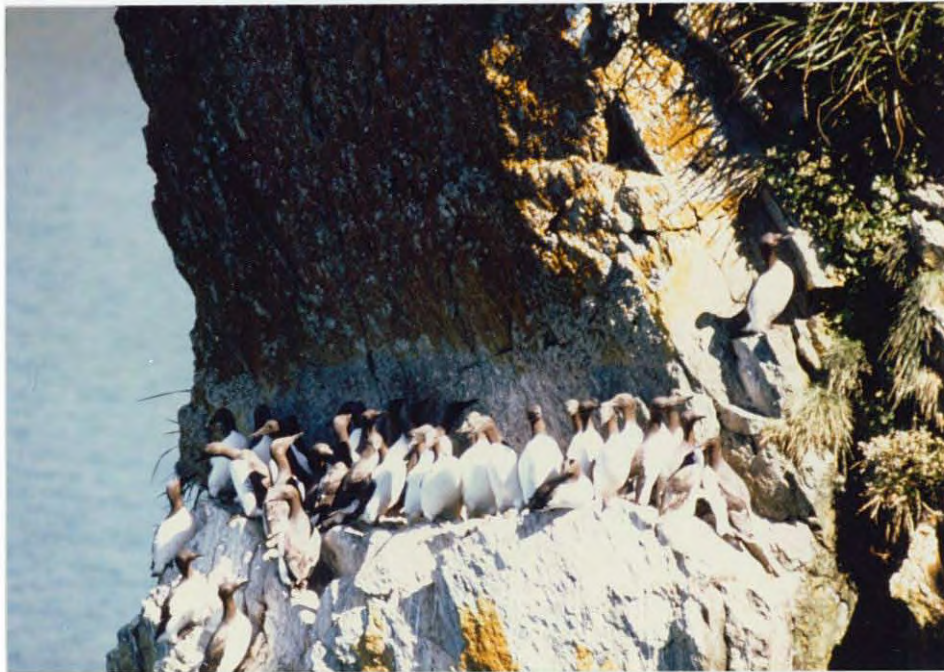
\*\*1987 Goodnews Lake float information derived from guide and air taxi use reports.



### SEABIRD COLONY CENSUSING AT CAPE PEIRCE

This study was a continuation of the work contracted to LGL-Ecological Research Associates 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.

Volunteers Lisa Haggblom and Allyn O'Neil were 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 with some accuracy. However, due to erosion, plot boundaries may become altered from year to year.



Common murres are one of the species of cliff-nesting seabirds present at Cape Peirce. A0, 1987.

Nesting phenology of the seabirds at Cape Peirce was slightly later in 1987 than in 1986. The nest building activity for black-legged kittiwakes and common murres began on May 30, four days later than in 1986 and appeared to be finished by June 15. When the observers arrived at the study site on May 19,



cormorants were already well into nest building.

The first pelagic cormorant eggs were observed by the end of May; common murres on May 24, and black-legged kittiwakes on June 9. All three accounts of first observation were related to egg predation. The shells of cormorant eggs were found along the cliffs and murre and kittiwake eggs were observed being carried by ravens. Once again, glaucous wing gulls and common ravens were the most aggressive predators consuming large numbers of murre and kittiwake eggs. Cormorants seemed to suffer less predation than kittiwakes and murres, and puffins suffered least of all. Preliminary data from surveys conducted from 1985-1987, indicates that avian predation might be a major factor in kittiwake and murre population fluctuations at Cape Peirce.

Black-legged kittiwakes have improved production from 0.00 chicks fledged per nest attempt in 1986 to .06 chicks fledged per nest attempt in 1987. Pelagic cormorants also seem to have improved production from 1.09-1.20 chicks fledged per nest attempt in 1986 to 1.43 chicks fledged per nest attempt in 1987. (Table 5).

TABLE 5  
Productivity Parameters and Results of Black-Legged Kittiwakes  
and Pelagic Cormorants at Cape Peirce, 1986 and 1987

	Kittiwakes		Cormorants	
	<u>1986</u>	<u>1987</u>	<u>1986</u>	<u>1987</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

Total populations of black-legged kittiwakes, on established survey plots, in 1987 was almost twice that of 1986. Common murre populations appeared to stabilize from 1986 to 1987, and cormorants, although slightly lower in population estimates than in 1986, appeared to have a successful breeding season (Table 6).



TABLE 6  
Cape Peirce, 1986-1987  
Mainland Population Estimates for Seabird Species

SPECIES	1986	1987
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. The Round Island sanctuary, located in north Bristol Bay, has been the main focal point for terrestrial haul-out by walrus using this region. The Cape Peirce site began to be used on an intermittent basis during 1981 and 1982; however, during 1983, more walrus were attracted. Since then, haul-out activity increased each year, from approximately 5,000 animals in 1983; to 8,600 in 1984; and 12,000 in 1985. In 1986, numbers began a slight decrease, with a peak haul-out of 11,800. In 1987 a peak of approximately 6,300 animals was observed. Studies prior to 1981 mention walrus sightings, but include no data to indicate walrus utilization of the Cape Peirce haul out.

From May 19 to October 12, the social behavior and fluctuating population of the walrus herd utilizing Cape Peirce was monitored and recorded. Specific objectives were to collect data on population size and distribution, and to record any tagged animals.

No tagging was attempted at Cape Peirce during the 1987 season, however, three walrus were tagged with radio transmitters at Round Island.

Other data collected on the haul-out were: date, time, tide, weather, age group classification, frequency of tagged animals, feeding behavior, and sightings of other marine mammals in the area. Observation periods lasted from 2.5 to 3 hours per sitting and were conducted twice a day, from a vantage point approximately 100m from the haul-out grounds. Closer observations (as close as 5m) were made on a regular basis.

Age classification of the walrus was based on tusk size and



length, and on body size. Tusk sizes used to categorized ages: animals with tusk length from 5-15 cm were classified as sub-adult, 20-55 cm as adult, and old aged adults had missing tusks or tusks in excess of 60 cm long.

During 1986, time lapse photography was used as a census method. An 8 mm movie camera, with an XL601 intervalometer was placed on a vantage point to record movements on and off the haul-out beaches. The camera was set to take one frame every 15 minutes, continuously, for 40 days. As the primary haul-out activity shifted from one beach to another, the camera was moved and reset. This method of census was attempted again in 1987. Unfortunately, the camera became inoperable and was not repaired until after the field season.

Data collected at the Cape Peirce haul-out grounds during this two year period 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 1986 season, when approximately 700 animals were observed hauled out on a stretch of beach on the south side of Cape Newenham. This site was not a previously documented haul-out location; however, it was used extensively during the 1986 season. No animals were observed utilizing this area in 1987, but animals were seen using a haul out area on the northwest side of Newenham. Activity had been reported in this area in the past, but was never observed by refuge personnel. During an aerial survey on August 20, approximately 70 animals were seen hauled out and another survey on December 10 found an estimated 200 animals still utilizing the beach.





Pacific walrus haul-out numbers were down in 1987 for reasons unknown. AO, 1987.

#### TOGIAC RIVER SPORT FISHERY INVESTIGATIONS

The intensive creel census project started on the Togiak River in 1986 was conducted again in 1987. In the Bristol Bay area there is a lot of controversy over the sport fish harvest of fish voiced by commercial and subsistence fishermen. To better understand the impacts of the fishery and to have some data to base management decisions on an intensive creel census was performed. The objectives of the study were:

1. Estimate total numbers of angler hours expended on the Togiak River from June 15, to September 15.
2. Estimate catch and retention rates of the anadromous and resident species caught in the river.
3. Estimate use by guided and unguided anglers above and below the wilderness boundary.
4. Compare data to Alaska Department of Fish & Games Mill's report, a mail-in survey of anglers, and determine if the Mill's data is acceptable and/or accurate enough to preclude use of extensive creel and aerial surveys.



The 58 mile stretch of river from Togiak Lake to the Bay was surveyed using a roving creel census design. Preliminary information gathered in 1984 and 1985 was used to develop the 1986 study. The 1987 study was again a refinement of the 1986 study, increasing the frequency of surveys.

The fishing season was divided into three periods to accurately estimate effort, and derive catch statistics for the major species. PERIOD I, June 15 to July 31 followed the King salmon run. PERIOD II, AUGUST 1-15, an intermittent period between king salmon and coho, when the chum, and red salmon were running. PERIOD III, August 15 to September 15, the late summer season when the coho salmon were running in the river.

The river was divided into five subsections that could be motored through in one hour to obtain an instant count of the number of anglers present. The sections were then revisited immediately to interview the fishermen and determine catch statistics and associated demographics.

Fishing days were further divided into three time strata corresponding to prime and off hour use periods. 8:00 am - Noon; Noon - 4:00 pm; and 4:00 pm - 8:00 pm. The time strata corresponded to a prime time period 8:00 am to 4:00 pm when most of the fly-in anglers use the river. The off-hour period of 4:00 pm to 8:00 pm covered the fishing times of base camps and some floaters still on the river.

Areas and times were randomly selected for each day in the subsample time periods, using non-uniform probability sampling. Sampling effort was selected so that 60% occurred below the wilderness boundary in sections A and B, and 40% in sections C, D, and E. Daily sample times were also similarly selected, with 40% of the sampling time going to the period 8:00 a.m. to noon, 40% to 12:00 to 4 p.m., and 20% for counts and interviews occurring in the 4:00 p.m. to 8:00 p.m. time period. Several days each week were also selected for no sampling to conserve on fuel.

Data collection was performed primarily by refuge volunteers. Once basic training and familiarization with the river was accomplished by the Refuge Fishery Biologist, two volunteers were placed on the river to conduct the creel census. These people were spelled with the personnel at the Togiak Counting Tower on a staggered two week basis. This schedule kept one person on the river that had been there the previous week. The refuge is highly indebted to the following volunteers; Ed Weiss, who took on a major responsibility of the creel census, data entry, and compilation. Ruth Roelse, Dan Green Brent Kuhl, Matt Heubers, and Allyn O'Niel also played major roles in data collection and keeping the camp running smoothly.



Data was collected using Alaska Department of Fish and Game (ADF&G) creel census mark sense forms. These waterproof sheets have small boxes that are checked for date, sub-location, start/end time, guided or unguided, shore, boat, species (numbers kept or released), target species, and angler characteristics. Data recorded on these forms was read by the ADF&G optical scanner and transferred to a floppy disk. Calculations were performed by the refuge staff on personal computers.



Togiak river creel census camp was moved from the 1986 location due to high waters. The field crew had to jack up the platform several feet to keep the cooking facilities dry. KH, 1987.

1987 was predicted as a weak coho run, based upon the escapement estimates in the brood years of 1983 and 1979. Several indicators such as the high seas catch of coho by the Japanese, and other district early fishing catches of coho before 15 August also pointed to a possibility of not reaching the escapement goal for the river. The ADF&G Commercial and Sportfishing divisions closed the commercial fishery, and restricted the sportfishing to the catch and release of all coho salmon, 17 August through 1 November. This unprecedented decision probably affected the amount of sportfishing effort that the river experienced in 1987, as some clients wanted to have the opportunity to harvest cohos during their Alaska visit.



By September 15, all of the guide camps had been pulled from the lower river, and very few were still flying into the river on a daily basis. The creel census camp was closed down on September 15.

A total of 1,081 counts of anglers were made and 761 angler interviews were conducted between 15 June and 15 September, 1987. (139 complete daily trips and 588 incomplete daily trips were interviewed).



Refuge Volunteer Ed Weiss interviewing anglers on the Togiak River. J. Finn, KSFAO, 1987.

Anglers were estimated to have fished  $16,922 \pm 2,132$  (95% CI) hours in 1987, Table 7. Fishing effort was approximately equal in both periods I and III. Approximately 63% of the fishing effort occurred below the Wilderness boundary sublocation 1 & 2. Guided and unguided anglers comprised approximately 74% and 26% of the total respectively.

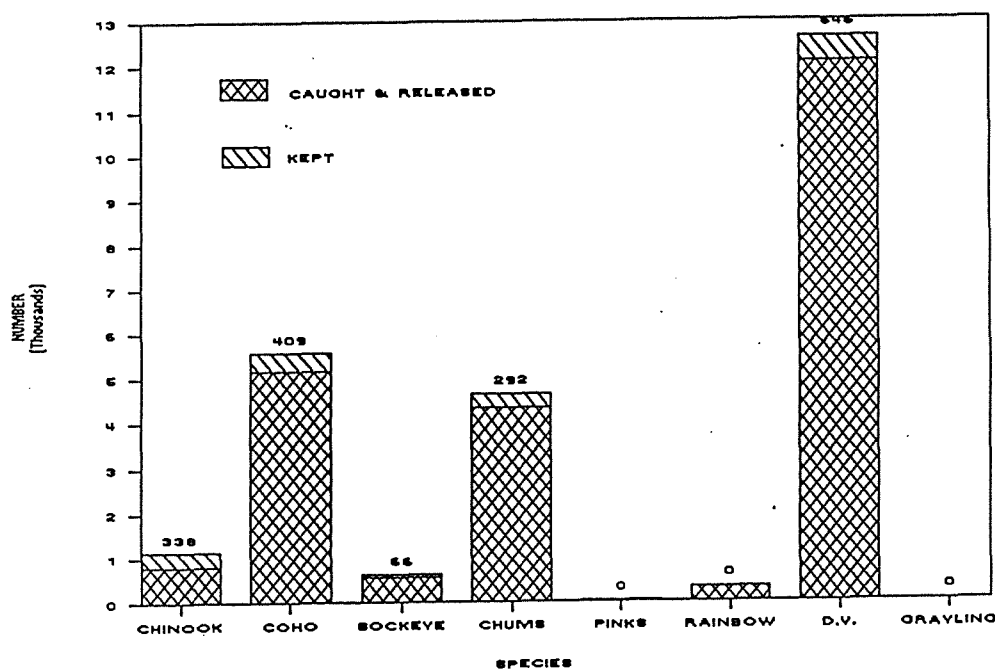


**TABLE 7**  
**Summary of Togiak River Sport Fishing Effort (in angler hours)**  
**by period and location, 1987**

DATES	RIVER MILE	SUBLOCATION					TOTAL	95% CI	
		001	002	003	004	005			
		-----0-7	7-16	16-28	28-37	37-53			
PERIOD 1 (JUN 15-JUL 31)	EFFORT	1415.6	3223.7	1498.5	661.3	847.2	7646.3	7646.3 -	7646.3
PERIOD 2 (AUG 1-AUG 15)	EFFORT	169.4	1111.8	300.0	350.0	112.0	2043.2	2043.2 -	2043.2
PERIOD 3 (AUG 15-SEPT 15)	EFFORT	1960.2	2796.9	1191.8	558.0	725.4	7232.3	7232.3 -	7232.3
TOTAL	EFFORT	3545.2	7132.4	2990.3	1569.3	1684.6	16921.8	16921.8 -	16921.8

Anglers harvested a total of nine different species, including Arctic char, Dolly Varden, grayling, rainbow trout, chinook, sockeye, pink, chum, and coho salmon. A total of 23,225 fish were estimated to have been caught in 1987. Only 1,651 fish were harvested which were comprised primarily of Salmon and Dolly Varden (Figure 1). Dolly Varden and Arctic Char were combined for this report, as both species are reported, however the taxonomy of the species in refuge rivers has not been fully understood. Exterior traits have proven unreliable for separating these two species.

**Figure 1. Togiak River Sport Fish**





Dolly Varden were the most prevalent species with 12,076 caught and 546 harvested. Coho were the second most prevalent fish with 5,152 fish caught and only 409 fish harvested. This harvest represents less than 1% of the estimated total run of 65,000 coho, and is directly attributable to the emergency coho sport fish closure. During this period all sport caught coho salmon had to be released.

Chinook salmon are caught almost exclusively in the lower two sections below the wilderness boundary. A total estimate of 796 were caught and 338 harvested in 1987, which comprised less than 1% of the total Togiak River run, (Figure 2). The 1987 catch is down by 30% in total numbers from the 1986 season.

Rainbow trout do not occur in the river in very large numbers. Only 323 were caught in 1987 and 0 were reported to have been retained.

The low coho harvest in 1987 is due to the closure after the 17th of August. In 1986 the sport harvest was estimated at 5,651 coho or approximately 10% of the total run of 54,800 fish.

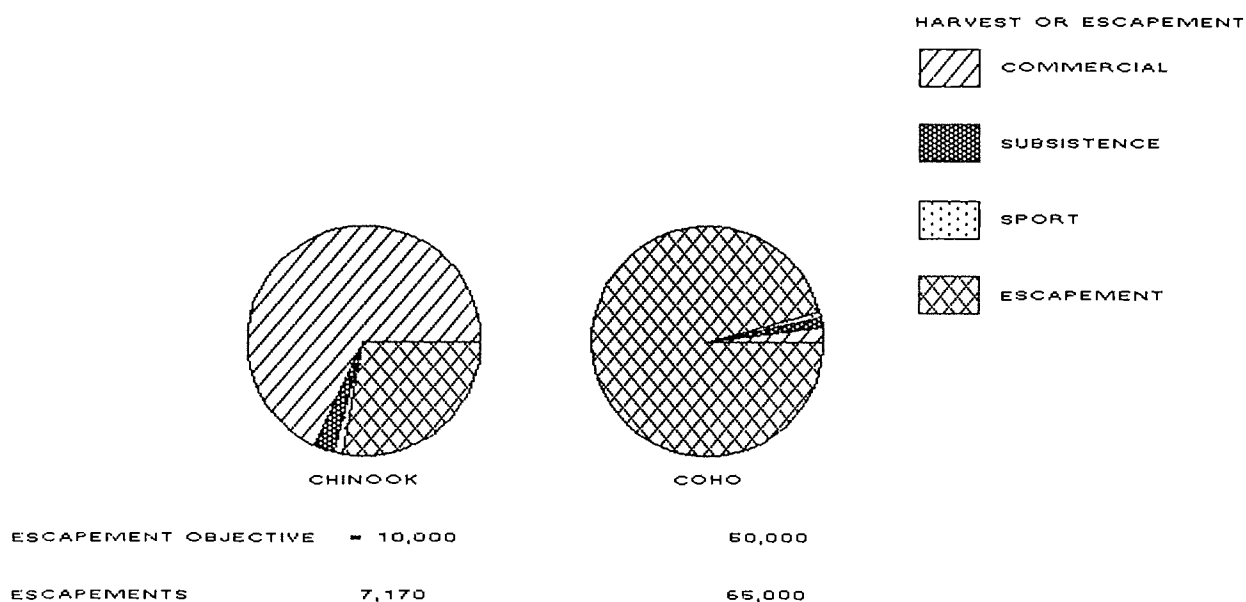


Figure 2. Togiak River Chinook and Coho Salmon Runs 1987. Harvest estimates for commercial, subsistence, sport, and proportion left for escapement.



TOGIAC RIVER SALMON ENUMERATION TOWER COOPERATIVE PROJECT

Refuge and ADF&G personnel combined forces on the Togiak lake counting tower project during 1987. The refuge placed three refuge volunteers on the site on June 10. These employees in addition to the escapement enumeration/tower responsibilities collected public use information from guided and unguided floaters and fly-in-daily anglers who used Togiak Lake and River. An ADF&G employee also served as the tower project leader joined the crew July 6th and the official counting of sockeye escapement began. The tower was closed on August 7.



A portable counting tower set up on the east bank of the Togiak River to enumerate fish as they pass over the flash boards laid on the bottom of the river.  
KH, 1987.

Sockeye were sampled throughout the run to obtain age, length and sex composition. Two thousand two hundred fifty seven (2,257) sockeye salmon were sampled using a 10 x 100 foot beach seine. The number sampled each day was approximately 1% of the



escapement for the day. Sampling was carried out on the beaches near the lake outlet to get a representative sample.



Dan Green and Ruth Roelse, refuge volunteers pulling seine at Togiak Lake. DC, 1987.

The escapement goal of 150,000 sockeye was reached on July 22 and an accumulative escapement of 244,752 for all species had passed on August 7 when the tower was closed. The total sockeye escapement for the Togiak drainage, including all downstream tributaries, was estimated to have reached 249,676.





Flash boards set up on the bottom of the Togiak River to count fish as they pass over. Chum salmon visible in picture. DC, 1987.

Side scan sonar project Togiak River.

During 1987 the King Salmon Fishery Assistance Office initiated a three year side-scan sonar salmon enumeration study on the Togiak River in cooperation with the Refuge and the Alaska Department of Fish and Game. 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.

Personnel from KSFAO used the Togiak Refuge creel survey camp as a base of operations during site selection. High water during late June and early July delayed site selection activities until July 15. Extensive reconnaissance of the river from Twin Hills Cutoff, (RM 12.5) to the Kemuk River (RM 31.0) were conducted. Optimal sites were located upstream of the Pungokepuk River (RM 17.5). Sonar equipment was deployed on both sides of the river at about river mile 18.0 by July 29. Highwater and movement of equipment to fine tune sonar beam aiming delayed regular counting from the east bank until August 11 and from the west bank until



August 15. Operation of the sonar equipment and fish sampling for species composition, age and length data continued through September 22.

The sonar transducers were mounted on a tripod instead of the old substrate method. This allowed aiming of the beam directly across the river bottom out to a distance of 100-200 feet. Not having a substrate (a tube on the river bottom which forces the fish to swim up into the beam) allow inhibited fish passage.

The site selected was usable during high and medium flows and an alternative site for low flows was identified. Because of delayed operations the Sonar operation was only able to estimate coho salmon escapement which was approximately 65,000 fish. Operational plans for 1988 include commencing by late June, experimentation of the equipment at the low flow site, additional sampling effort for species apportionment, and age and length data.



Preliminary investigation using the sonar, prior to setting up a weather port, and summer equipment.  
1987, JF.



### Kanektok River Rainbow Trout Sportfishery Investigation

The Refuge became concerned in 1984 when it was evident that the sport fishing effort on the refuge was increasing. Numerous reports came in that angling pressure was impacting the age class structure and removing a significant proportion of the sexually mature rainbow trout from the river. Over exploitation was a possible consequence of this heavy pressure which could possibly lead to a significant population reduction. The refuge requested that the U.S. Fish and Wildlife Service, King Salmon Fishery Assistance Office study the population and the exploitation rate and determine the allowable harvest of fish on the Kanektok River. The Study initiated in 1985 got into full swing in 1986, and was completed in 1987. Objectives of the study included: A) To estimate population size using mark-recapture methods; B) To determine fish distribution; C) To record population characteristics and structure; D) To collect creel census information and determine angler harvest.



Lengths and weights were taken from all rainbow trout captured. Tags were used in the mark recapture population estimates. KH, 1987.

A. To estimate population size using mark-recapture methods.

The study plan called for the tagging of a representative sample of the population throughout the mainstream of the river. 293 fish were marked in 1985 using Floy tags during successive sampling trips. Only 7 were recaptured during 4



sampling float trips undertaken in the summer.

Changes for the 1986 season included the placement of a camp on the Kanektok River within the study section. For an intensive period during May and June, 407 rainbow trout were tagged then replaced in their original locations. To date, approximately 12 percent of the 1985 and 36 percent of the 1986 tagged fish have been recaptured at least once. Several fish have been captured several times throughout the study. This tagging effort provided information on seasonal movements of rainbow trout as well as a population estimate of 17,000 (+ 3000) within the 20 mile study area.

B. To determine fish distribution.

1985 data suggest that the fish are concentrated in the lower portion of the study area. Information from the 1986 season also indicates that the fish are distributed throughout the river but concentrated in the lower portion of the study section.

C. To Record Population Characteristics and Structure Information.

1987 efforts centered around the capture of more fish to verify the age composition of the population. By the end of 1987 a total of over 1000 fish had been sampled. Scale samples were taken from almost all fish in the sample. Otoliths, and vertebrae were also taken from some of the fish to verify the ages. Age classes vulnerable to sport fishing ranged from IV through XIII, with the majority between ages IV and VIII which ranged in size from 400 mm to 525 mm. Kanektok River rainbow trout mature at approximately age VII and appear to be non-consecutive spawners.

D. To Collect Creel Census Data and Determine Angler Harvest of Sport Caught Fish.

Creel census information was gathered by voluntary reports from commercial guides and collected from the unguided anglers by the King Salmon Fishery Personnel. They were responsible for interviewing anglers on the river, to collect angler hours fished by the various user groups and determine the number of fish caught and kept for the various species.

Total estimated angler days on the river within the study section was estimated to be 1,656 days. Anglers caught a total of 23,943 of eight different species and kept a total of 754 fish. (Table 7).



TABLE 7  
ESTIMATED ANGLER CATCH AND HARVEST FOR THE KANEKTOK RIVER  
WITHIN THE STUDY SECTION 1987.

TOTAL		
SPECIES	CAUGHT	KEPT
CHINOOK	576	105
SOCKEYE	923	63
CHUM	1,001	14
PINK	73	1
COHO	1,169	117
RAINBOW TROUT	6,245	105
DOLLY VARDEN	11,674	305
GRAYLING	2,282	44
TOTAL=	23,943	754

Unguided anglers within the wilderness portion of the river caught 11% of the rainbow trout. Guided float anglers caught 53% and guided motor boat anglers caught 36% of the rainbow trout. Within the study area the guided motor-boaters accounted for 770 angler days (47%), unguided floaters 282 angler days (17%) and guided floaters 604 angler days (36%).

#### Other Sportfish Studies

The Bristol Bay ADF&G Sportfish office in Dillingham conducted an intensive creel census study in the lower Kanektok River in 1987. This study used a roving creel census design and 5 periods during the day to randomly sample the river section below the wilderness boundary. Their study was conducted from 6/20-7/24 1987. Total fish caught and total kept is presented in Table 8. Total effort during the study was estimated at 3890 angler hours.



TABLE 8  
TOTAL CATCH AND HARVEST BY SPECIES FOR THE KANEKTOK RIVER,  
MILE 0-20, FROM 6/20-7/24, 1987  
(ADF&G data)

<u>SPECIES</u>	<u>CATCH</u>	<u>TOTAL</u>	<u>KEPT</u>
CHINOOK	1,903		375
SOCKEYE	214		18
CHUM	1,090		112
PINK			
COHO			
RAINBOW TROUT	164		25
DOLLY VARDEN	149		20
GRAYLING	28		0
TOTAL=	3,548		550

#### Other Fisheries Studies

##### A. Kuskokwim Bay Commercial Fisheries Catch Monitor

The ADF&G Office in Bethel normally conducts several projects on the Kanektok and Goodnews Rivers. A fisheries technician was stationed in Quinhagak from June 2 until August 20, 1987. This technician was responsible for monitoring commercial and subsistence harvests, collecting age, sex, length, and scale samples from catches; dissemination of fisheries information to the public; assisting F&W protection; enforcing regulations; compiling historical data on the fishery; and providing logistical support for the ADF&G field camp projects (Kanektok Sonar and Goodnews Tower).

##### B. Kanektok River Side Scan Sonar Project

ADF&G operated a Bendix Side Scan sonar counter on the Kanektok River approximately 2 miles above the village of Quinhagak from June 23-July 18, 1987. During this time period 32,833 counts were made using the sonar equipment. Preliminary species apportionment using beach seining data indicates that during this period 11,031 chinook, 10,520 sockeye, 11,132 chum and 150 char passed the counter.

##### C. Goodnews Counting Tower

The ADF&G operates a salmon counting tower approximately 12 miles upriver from the mouth on the middle fork of the Goodnews River. This tower has been in operation since 1981, and was operational from June 15 to August 1 in 1987. The tower counts are used to



regulate in-season fishing times, by allowing adequate salmon stocks to escape into the rivers to spawn. Information gathered on escapements is also being used with AWL data to develop spawner recruit data, and will be used in the future to develop escapement goals for the sockeye and chinook salmon.

#### D. Goodnews River Reconnaissance Study ADF&G

The Alaska Department of Fish and Game did not conduct any salmon carcass sampling in the Goodnews River in 1986, or 1987. The department normally floats the river once in the late summer to collect AWL data from the salmon carcasses that are washed up on gravel bars. Readable scales however were collected from 599 sockeye, 467 chums, and 50 chinook by beach seining at the tower site. The majority of the fish were 4 years old for both species. The AWL information is used in analysing spawner recruit information and determining the age and sex composition of the runs.

#### E. Kanektok River Escapement Survey

The refuge staff and King Salmon Fishery Assistance Office collected scale samples from 150 chinook for AWL information. Information was also collected by the State on chinook salmon during one float trip during the first week of August.



FB Harper and BT Lisac sampling chinook salmon carcasses on the Kanektok River. DAF, 1987.



#### F. Kagati Lake Sockeye Salmon Escapement Survey

Refuge Volunteers Dan Green and Brent Kuhl collected AWL data from 300 sockeye salmon in Kagati Lake during August of 1987. A 100' x 10' beach seine was used to collect the fish samples. The entire lake shore was surveyed by boat. Very few sockeye were found in the Pegati arm with the exception being a small concentration at the head of the arm. Two major concentrations of sockeye were found at the mouths of two creeks in the Kagati arm and spawning reds were seen predominantly along the eastern shoreline. This was the first 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. The results were combined with samples taken at the sonar site in the lower portion of the river.

#### G. Togiak River Escapement Survey

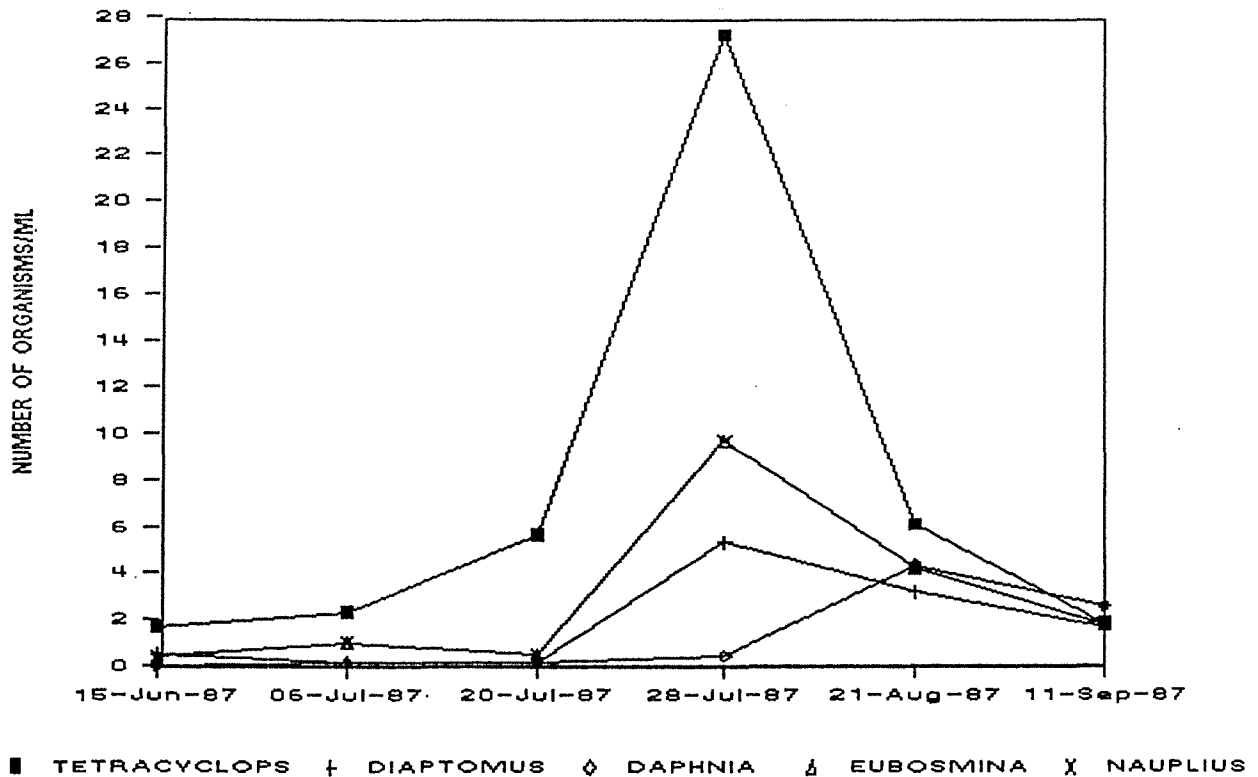
King Salmon Fisheries Assistance Office personnel collected AWL data from 268 coho during the operation of the sonar unit on the river while doing species apportionments. This information is used to determine the age class structure of the spawning fish. It is also used to predict future runs and to look at spawner recruit correlations which can be used to evaluate and determine optimal escapements. High waters throughout the summer did not allow for a large collection of chinook salmon.

#### H. Plankton Sampling and Enumeration on Refuge Lakes

Refuge personnel stationed at Kagati and Togiak Lakes and the lake survey team were requested to collect plankton samples. All samples were collected utilizing a 45 ft. vertical tow with a Wisconsin Plankton net. A total of 39 samples were collected. Volunteer Allyn O'Neil completed the identification of the plankton samples down to genus. Further identification was not possible with the equipment on hand at the refuge. Peak production of zooplankton occurred in Togiak Lake in late July, (Figure 3).



## ZOOPLANKTON ABUNDANCE TOGIAK LAKE 1987

I. Aerial Spawning Escapement Surveys

Personnel from the refuge assisted the State Department of Fish and Game Commercial Fisheries Division with aerial spawning surveys of the rivers in the Bristol Bay section of the refuge. Surveys for chinook salmon were flown on the 19, 21 and 26th of August. 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.

Surveys for coho salmon were flown October 6, 12, and 19th covering the Bristol Bay area from Osviak River on the western side of the bay back to the Tuklung River on the Nushagak Peninsula. During these surveys other species such as char were enumerated and a data base started for this species.



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 continued decline of cackling Canada, Pacific white-fronted, Pacific (black) brant, and emperor goose populations, as well as the recent controversy over the spring subsistence take of waterfowl, the refuge staff initiated a study of hunting activity in Chagvan Bay in 1984. A field camp was established at Chagvan Bay to monitor waterfowl migration phenology with emphasis on the four Pacific Flyway goose species, and the effort and effect imposed by local hunters on the staging population of these geese in the bay.

Refuge bio-techs and volunteers staffed the camp and have maintained a low profile using observation and casual interviews as their primary study tools. An early spring breakup allowed us to establish camp in early May during the front end of the migration curve. For the past four 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

For all four years the bay had still been approximately 40% ice-covered when camp was set up. The remainder of the ice was carried out by the tide within the first few days.

As in previous years, the camp was established in the same approximate location on the south shore. The beach on the north spit provides the best landing location for the chartered DeHavilland Otter used for initial camp setup. This also requires a back-breaking 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 hard boat.

The camp location provides good boat and float plane access;



offers a good vantage point for observation activities in the bay, as well as monitoring the arrival and/or departure of birds and men; and prevents disturbance to bird activity.

Several vantage points were used throughout the bay to make daily observations of hunters and birds, and to estimate staging populations. 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 over large areas by using the vantage points and establishing spike camps. In order to describe the biology and behavior of the geese, observations were made over the entire tidal cycle and recorded on xeroxed copies of USGS topographic maps. Whenever possible, actual numbers were obtained by counting flocks of birds with hand tally meters. Most numbers, however, are estimated in increments of 500 or 1,000.

Hunter observations were gathered, when it was possible to monitor the activity of both hunters and birds from the same vantage point.

Observations of geese included the date and number when each species was first observed, daily staging estimates (usually conducted at low tide when birds were concentrated on the emergent gravel bars), arrivals, departures, and flock sizes. Daily observations by all personnel were compiled by and reported as one observation for each species. By combining observations from this study, with appropriate spring aerial survey estimates over the last four years, 1983-1987, it was possible to establish the migration timing for each goose species, (Table 9).



TABLE 9  
Migration Phenology of Arctic Nesting Geese  
Chagvan Bay, 1983-1987

Species	Date of First Observation	Number of Birds Observed	Date of Peak	Number of Birds Observed
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
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
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
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				

Black Brant: Migration and staging occur from mid-April to early June, with peak staging occurring on or around May 20. Peak staging numbers have ranged from 18,000 to 55,000 birds.

Emperor Geese: Migration and staging occur from late April to mid May, with peak staging occurring between May 15-20. Numbers of birds during peak staging ranged from 5,500 to 12,000.

Canada Geese: Migration and staging occur from late April, to late May/early June, with the peak staging occurring between May 20-24. Peak numbers range from 500 to 8,000. The majority of Canada geese are observed in the upland grasses surrounding Chagvan Bay and it's tributaries. No Canadas were observed from the ground during May 1987.



White-  
fronted  
geese:

Migration and staging occurs in early to mid-May through late May. Peak staging occurs from May 05-28, with numbers of birds ranging from 25 to 600. The majority of white-fronts observed were in the upland grasses surrounding Chagvan Bay and its tributaries. No white fronts were observed from the ground or air during May 1987.

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 the chances of both aerial and ground surveyors 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, also 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 emerging eel grass beds at low tide.

Canada and white-fronted geese appear to concentrate on the uplands surrounding Chagvan Bay and its tributaries. Very few of these species are seen feeding or roosting directly in the tidal zones; occasional observations are made by ground survey crews.

Another factor which may effect the number of birds staging at Chagvan Bay is the amount of human activity. Aircraft traffic 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 all conditions are favorable and the disturbance merely initiated continued migration.

Many ravens were also present in the bay, feeding on seal and sea lion carcasses which had washed up on the north spit. They were also abundant along the Kuskokwim Bay shoreline, approximately 1/4 mile south of Chagvan Bay. They appeared to be roosting on the cliffs with cormorants and great horned puffins. Great horned puffins have been observed flying around and landing on the cliffs south of Chagvan. Small nesting colonies of pelagic cormorants have been observed along the coastal cliffs from Chagvan Bay, south to Security Cove.





BT Mark Lisac and volunteer Ed Weiss interviewing  
a local subsistence hunter at Chagvan Bay. VB, 1987.

Observations of subsistence hunting at Chagvan Bay have been recorded for the past four 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 casual interview, house-to-house survey of subsistence harvest (1984), or by observing hunters in the bay. Some data, such as: numbers of hunting parties, hunters, and length of hunting trips is easily obtained by direct observation as parties come and go from the Bay; the number of hours/day spent hunting is estimated; and the origin of most hunters has been easily obtained from even the least cordial visitor. A summary of the information gathered is found in Table 10.



TABLE 10  
Subsistence Hunters Using Chagvan Bay  
1984 - 1987

Year	# of *Parties	# of Hunters	PLAT.	# of Hunters/Village				# of Use	
				GNB	TOG	QUIN	DLG	UNK	Days
1984	16	41	22	18	1				126
1985	09(12)	18(24)	15	9	0				31(41)
1986	07(17)	18(42)	10	21	2	1	2	6	81(127)
1987	13	33	4	10				19	78

\* Numbers in ( ) are total hunters, others are only waterfowl hunters; this separation was not available for 1984. In 1987 most hunters primarily sought waterfowl.

(Village abbreviations: PLAT=Platinum; GNB=Goodnews Bay; TOG=Togiak; QUIN=Quinhagak; DLG=Dillingham; UNK=Unknown)

NOTE: The harvest information below is sketchy and was not compatible in a chart or table.

In 1984, two parties were interviewed. One party of three hunters stayed eight days and took 30-40 emperor geese. The second party (8 hunters) stayed six days and took 126 geese. This equals 1.8 goose/hunter/day, expanded for the total season would provide an estimate of 232 geese harvested at Chagvan Bay in 1984. In the Goodnews Bay house-to-house survey that same year, a total harvest of 400 geese was reported. This survey was limited to residents of Goodnews Bay and covered Chagvan Bay as well as other areas.

By using the data acquired from the Chagvan Bay studies conducted in 1985 and 1986, and incorporating generalities derived from the house-to-house survey in 1984 (i.e. 5 hunting hours per goose), we were able to estimate the goose harvest for two years at Chagvan Bay. Total geese harvested was estimated to be 43 for 1985, and 113 for 1986. However, these estimates are rough, as they assume constant hunter success over the three year period. The hunter bag composition would have consisted of emperor and brant during the 1984 season, but primarily consisted of brant for both 1985 and 1986.

In 1987 a known harvest occurred of 35 pacific black brant and 3 emperor geese. This known harvest was compiled from eight interviews covering a total of 23 hunter use days. By expanding the interview data to include the total 78 hunter use days observed in 1987, approximately 119 brant and 10 emperor geese were harvested in Chagvan Bay.

Hunting pressure in 1987 consisted mainly of commercial fisherman which were in the bay awaiting commercial herring openings. This made the accurate counting of actual hunters in the bay difficult



as many of the fishing vessels carried skiffs and ATVs which were used to travel the bay. It was difficult to distinguish individual hunters and their home town origin during this time. The peak of activity occurred on May 6 when sixteen fishing boats were anchored in the bay. Once a commercial herring opening is announced hunting pressure falls off. The 1987 waterfowl season was preempted by the fishing season. The early spring run of herring probably had more to do with the level of hunting pressure in the bay as did the lower number of birds, the emperor hunting closure, or the presence of refuge personnel.

Most hunting practices consist of pass shooting at birds from the beach with some skiff hunting being employed. Through several years of observation it appears as though most hunters are not very successful. It takes several shots for a hunter to down a bird. At the local rate of \$13 to \$19 a box for shells it probably cost \$2-5 per bird, not including outboard or ATV gas.

Hunters are opportunistic with most of the hunters fluctuating between waterfowl and marine mammal targets. Success on seals appears to be higher than waterfowl or sea lion, but still the number of shots and hunter hours required can be astounding.

#### 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 from 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 which were numbered. 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.



Four volunteers worked in two teams to gather field data. Volunteers John Sargent and Joanne Samenigo were assigned the plots on Nushagak Peninsula while volunteers Bruce and Jenny Seppi surveyed the plots in the western coastal region. Each team conducted two rounds of surveys, the first from June 15 to July 18 and the second from July 29 to August 16. A total of 45 plots were surveyed during the first round (20 in the western coastal region and 15 on the Nushagak Peninsula) with 31 of these being surveyed again during the second round (14 in the western coastal region and 17 on the Nushagak Peninsula.) Brood observations made by the two teams are summarized in Table 11. 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.



Members of a waterfowl production team surveys waterbodies by walking around their perimeters.  
FP, 1987.

Nushagak Peninsula, primarily consisting of marshy lowland dotted with ponds and lakes, produced 75% of the observed duck broods (91 of 121 broods) and accounted for the only four goose broods observed. Sea ducks and dabblers combined to make up 87% of the 91 broods (40 and 39 broods respectively, Table 11).

The western coastal region consists primarily of open rolling tundra dotted with shallow, hard-bottom lakes and ponds. Only 25% of the observed duck broods (30 of 121 broods) occurred in



this area. Dabblers comprised 50% of the total with sea ducks accounting for an addition 37% and divers made up the remaining 13% (15, 11, and 4 respectively).

TABLE 11  
WATERFOWL PRODUCTION SURVEY 1987  
SURVEY TOTALS  
76 One Square Mile Units Surveyed

SPECIES	NUSHAGAK PENINSULA	WEST COAST	TOTALS
DABLERS:	13	4	54
Gadwall	0	1	1*
Wigeon	3	0	3*
Mallard	5	1	6*
Northern Pintail	5	6	14
Green-winged teal	14	7	21
DIVERS:	8	4	16
Scaup	9	4	13
SEA DUCKS:	23	2	51
Black Scoter	29	2	31
Oldsquaw	11	3	14
Common Eider	0	6	6
GEESE:	4	0	4
Canada Goose	4	0	4
OTHERS:	14	1	36
Loons	19	5	24
Tundra Swan	6	6	12
Unidentified Ducks	12	0	12

Total duck broods = 121 Broods per square mile = 1.59

\* Only broody hens (hens without a visible brood but enacting a distraction display when flushed) were observed.

Production as well as average brood size seemed to be up slightly compared to previous years' data (Table 12). However, this might be attributed to the more intensive effort of 1987.



TABLE 12  
Comparative Brood Survey Totals 1984-1987

YEAR	WATER BODIES SURVEYED	BROODS PER WATER BODY	AVE BROOD SIZE	DUCKLINGS PER WATER BODY
1984	118	0.8	5.3	4.2
1985	104	0.2	7.6	1.5
1986	145	0.3	4.8	1.4
*1987	333	0.4	6.2	2.5

\* Even though a wider variety of habitat and area was covered during the 1987 survey, results were comparable to those obtained when surveying only a small area of the Nushagak Peninsula.



Waterfowl production field camps were light weight and highly mobile. JS, 1987.

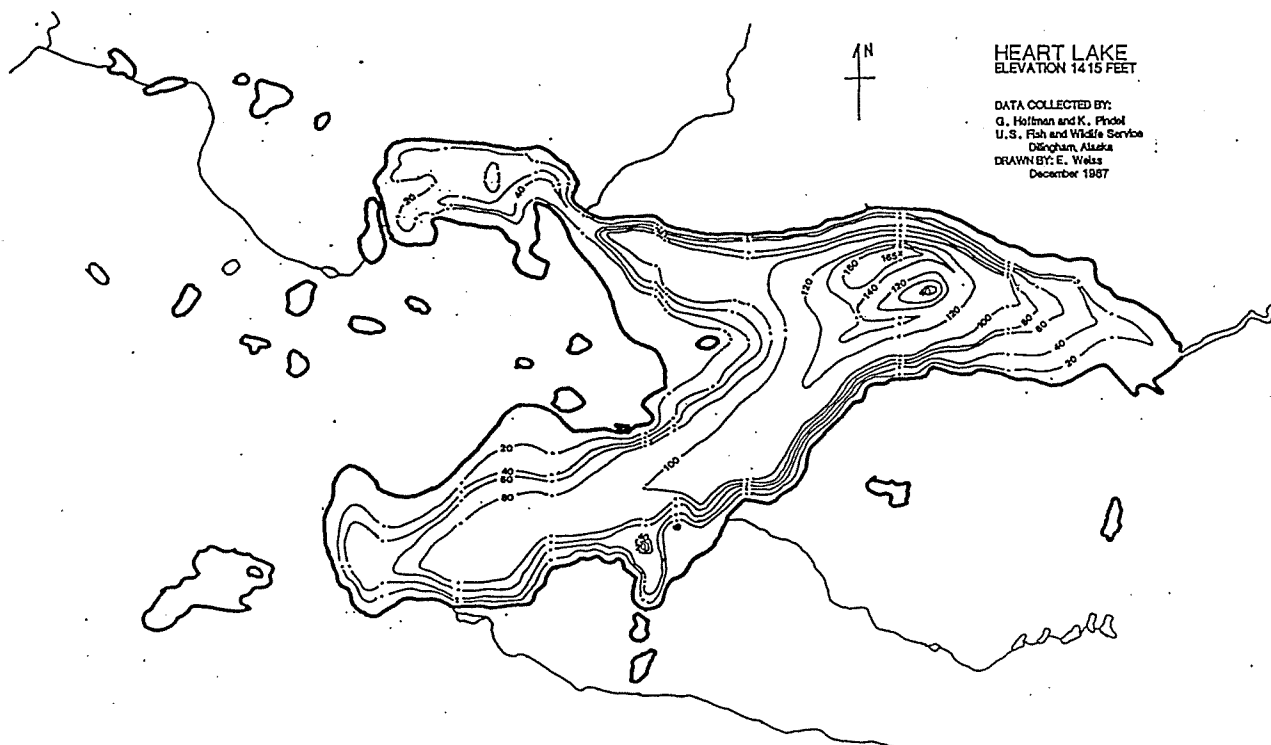


### WATER QUALITY LAKE SURVEY

This study was originally started in 1984, when the first Hydrolab 4041 water quality meter probe was lowered into 21 refuge lakes. The object was to gather baseline information on the seasonal variations in the chemical profiles of each lake; such as pH, DO, conductivity, and temperature, as well as secchi disc visibility. In 1986, we provided volunteers with the necessary equipment to map the depth contours of Togiak, Goodnews, and Kagati Lakes, in conjunction with their other duties.

A portable sonar unit was used to record bottom contours along pre-established transects. This data was transferred to an outline of the lake shore, drawn to a known scale, to produce a bathymetric map (Figure 4). These maps will be useful in calculating lake volume, and the profiles will be used to map important salmon spawning grounds. The maximum depths recorded were: Kagati Lake, 113 feet; Goodnews Lake, 119 feet and Togiak Lake, 485 feet.

Figure 4. Bathometric Map of Heart Lake. Togiak NWR, 1987







A cool clear morning on Togiak Lake.

In 1987 BT Mark Lisac supervised volunteers Kurt Pindel and Greg Hoffman in surveying six lakes of the Togiak River tributaries. The study was expanded to include a near shore substrate survey, fish population sampling, inlet and outlet stream profiles, HACH analysis of surface waters, and plankton sampling. The six lakes sampled were: West Togiak, Upper Togiak, Nenevok, Heart, High, and Ongivinuck Lakes (Table 13). In addition volunteers stationed at public use survey camps on Kagati and Togiak Lakes continued plankton sampling for an additional season.

Thirty nine (39) plankton samples were collected and preserved by the volunteer staff, from the eight lakes. Volunteer Allyn O'Niel identified genus and enumerated the samples during the fall. Generally, each lake was sampled at three locations (inlet, outlet, and mid lake). Only the samples collected in the middle of the lake are presented here. Zooplankton concentrations ranged from 0.0 at West Togiak Lake in mid June (the first lake sampled in 1987) to a high of 56 organisms per liter of lake water at Ongivinuck Lake sampled in mid August (the last lake sampled). Togiak Lake was sampled on six different days from June 15 to September 11. Zooplankton concentrations escalated from 2.7 on June 15, to 43.5 (orgs./l) on July 28, and then fell off to 8.1 by September 11. Kagati Lake was sampled on four occasions between July 19 (27.8 orgs/l) to August 26th (17.1 Orgs/l). A low count of 13.3 orgs/l was sampled on August 11th.



Seven genera of zooplankton were identified. In order of most abundant to least abundant they are: Tetracyclops, Eusbosmina, Asplanchna, Nauplius, Diaptomus, Eubranchiopod, and Daphnia.

Temperature profiles for the six tributary lakes were measured once each during the season. Surface temperatures ranged from 5-12 degrees celsius (41-53 degrees F). Stratification of temperatures became more pronounced as the summer progressed.

pH measured at the surface ranged from a low of 5.6 at Ongivinuck Lake to a high of 8.8 at Heart Lake. pH profiles showed a slight increase from the surface to the bottom.

Dissolved oxygen values were near or below saturation levels for the respective water temperatures for all lakes. Secchi disc visibility ranged between 11 and 30 feet.

Surface water samples were analyzed for alkalinity, carbon dioxide and hardness concentrations. Measurements were in parts per million (ppm), using standard HACH water quality kit procedures. Alkalinity ranged from 17 to 34 ppm. Carbon dioxide concentrations ranged between 10-15 ppm. Hardness values ranged between 34 and 137 ppm.

Further analysis, chemical profiling, discharge measurements, fish aging and report compiling is unavailable at this time.

TABLE 13  
Surface Water Quality Project  
Summer 1987\*

Lake	Dates	Max Depth	Temp (C)	pH	DO (Mg/l)	COND UmHo/cm	Secchi Ft
Heart	11 July	110	8.8	6.9	9.9	83	27
High	31 July	185	12.2	5.5	9.3	54	30
Nenevok	8 July	100	5.1	6.3	10.9	62	11
Ongivinuck	10 Aug	38	11.4	6.4	10.2	59	25
Upp. Togiak	3 Aug	225	8.6	5.7	11.6	57	11
N. Togiak	14 June	57	7.6	6.1	11.4	--	--

\* Data from collection site in middle of lake only



EFFECTS OF PLACER MINING IN AQUATIC ECOSYSTEMS OF THE  
TOGIAK NATIONAL WILDLIFE REFUGE

Under the mandates set forth by Congress in the Alaska National Interest Lands Conservation Act (ANILCA), the region has established a refuge contaminants program. Objectives of the program are to 1) Initiate water quality monitoring on streams of primary importance to refuge resources and having potential development threats to these resources; and 2) To determine the extent of water quality degradation that has occurred as a result of off-refuge placer mining activity and determine levels of heavy metals in water, sediments, and organisms.

Placer mining for gold and other heavy metals has grown dramatically in the past decade, stimulated by the lifting of Federal restrictions on gold prices in the early 1970's. Because of the necessity of removing large amounts of overburden to reach the ancient alluvia and disturbing active stream beds to get to the gold, and because of the large volume of water to sort the gold from the lighter materials, placer mining has been a major source of aquatic and riparian habitat destruction in Alaska. Large amounts of sediment can be transported in suspension and settle out downstream where water velocities are lower; or they can be transported as bedload, blanketing the stream bottom with a layer of fine particles unsuitable for benthic aquatic life or fish egg development. Additionally, heavy metals associated with the target metal can be released into the water at an accelerated rate when exposed by placer mining excavation and sluicing operations.

Prior to 1980, little research was undertaken to study the effects of mining sediment on aquatic life in Alaska waters. In 1981, the Alaska Cooperative Fishery Unit, University of Alaska, was granted funding by the U.S. Environmental Protection Agency (EPA) for a three-year field investigation to study the effects of placer mining on stream ecosystems. A second study was conducted in 1982-83 by the U.S. Fish and Wildlife Service (FWS) and National Park Service on heavy metal concentrations present in streams associated with placer mining activity. The major results from these two studies can be summarized as follows:

- Levels of turbidity, total residue, and nonfilterable residue (suspended sediment), and settleable solids are higher in streams receiving mining effluent.
- Concentrations of certain heavy metals are higher in mined streams in both total and dissolved forms, although the majority is bound to sediment particles.
- Arsenic (As), mercury (Hg), lead (Pb), cadmium (Cd), copper (Cu), manganese (Mn), and nickel (Ni) have been identified as the



metals that are most frequently present at high levels in the waters of mined streams.

-Gross primary productivity and biomass of benthic algae are significantly reduced in the receiving waters of mined streams. Whether this is the result of sediment scour, reduced light penetration, or heavy metal toxicity is not known.

-Benthic macroinvertebrate density and biomass are decreased by sedimentation.

-Arctic grayling generally avoid mined streams and seek out clearwater streams for spring spawning and summer rearing.

-Arctic grayling from mined streams generally exhibit higher metal concentrations and are more likely to have liver and cellular abnormalities in comparison to fish from control streams.

In 1987 the refuge worked closely with Fish and Wildlife Enhancement to determine the level of active mining claims within the refuge and to sample these areas. The only active activity that was identified is the platinum placer mine operated on the Salmon River by the Goodnews Bay Mining Co. This is the site of one of the most productive platinum mines in the world. The mine has been in operation since the 1950's, but has been sporadically operated in more recent times. The last actual dredging was done briefly in 1986. Since the late 1970's the stream channel has been completely blocked and fragmented from approximately 1.5 miles upstream of Kuskokwim Bay stretching through the tailing piles approximately 5.5 miles. Disturbance of the ancient stream bed has allowed the stream to actually flow under and through tailing piles and emerge in several small channels and ponds.

King, coho, pink and chum salmon, as well as whitefish, arctic char, and sculpins are all known to have used the system. Upstream migration of anadromous species and downstream migration of resident species has been blocked for nearly ten years. The natural water quality and bioaccumulated levels of heavy metals in selected food web organisms were to be determined through baseline contaminant sampling of water, soil and fish tissue.





The "No Salmon River" channel snakes through and under the tailing piles from the lower end of photo downstream to Kuskokwim Bay. MJL 1987.

BT Mark Lisac and FWE EB Carla Corin spent a total of four days sampling four sites on the Salmon River and tributaries. Site locations were: #1 Salmon River below mining activity; #2 Medicine Creek tributary above mining activity; #3 Salmon River above mining activity; and #4 Salmon River in the middle of the mining activity near the current dredge location. Although the mine was not operational in 1987 the physical impacts were quite startling. Chemical effects are of course less evident.

Twenty (20) water samples, 12 soil samples and 12 fish tissue samples were collected from the four sites. All samples have been sent to contract labs for analysis. Water samples will be analyzed for total recoverable metals, total metals, and total dissolved metals; sediment and tissue for total metals. Each sample will be analyzed for As, Pb, Hg, Zn, Cd, Fe, Ni, Mn, Sb, Se, Sn, and Cu concentrations. The bioaccumulation and synergistic effects of these toxic heavy metals are known to be acute and chronically lethal. In low dosage amounts they may even interfere with reproductive process and the well-being of the entire food chain. At the writing of this report the



chemical analysis results have not been completed.



A 185mm (7.25) Char sampled from up stream of the mining activity in the medicine creek branch. This was the largest sample collected in the closed system.  
MJL, 1987.

Several water quality parameters may also be affected by placer mine effluent. The results of these tests for each sample site are listed below in Table 14.

TABLE 14  
1987 Contaminant Sampling Salmon River  
Water Quality Parameters

	Site Numbers			
	1	2	3	4
Settleable solids	>0	0	0	0
Turbidity	2.20	0.18	0.41	1.90
pH	~5.0	~4.5	~5.0	~5.6
Dissolved Oxygen	11.14	10.89	11.28	11.56
Total Hardness	30.6	19.6	36.1	35.9
Total Alkalinity	29.4	14.4	35.8	16.5

Comparative analysis of these parameters will be coordinated with the results of the heavy metal analysis to avoid misinterpretation. Once results are received data on metal levels in water will be compared to EPA water quality criteria



for the protection of aquatic life; sediment values, to those from a number of studies of polluted and unpolluted sediment; and tissue data, with a variety of data bases, including those of the National Contaminant Biomonitoring Program and the University of Alaska. Analysis and comparison of lab results and final report preparation will be accomplished by Environmental Contaminants personnel from the Anchorage Fish and Wildlife Enhancement field office.

#### Subsistence/Recreational use Survey

A subsistence survey on the Togiak River was conducted between July 15 and September 15, 1987. The study was designed to document the interaction between recreation and subsistence users on the river. The study was undertaken by the Department of Fish and Game, Subsistence Division and the Togiak Refuge staff. Primary researchers involved in the study were Robert Wolfe, Subsistence Division and Joe Gross, University of Alaska. Interpreter services and skiff operation was provided through the local hire of refuge information technicians from the villages of Togiak and Twin Hills.

The study methodology involved household interviews, field interviews, and field observations. The actual sample of people interviewed was 53 representing 48 households. The 48 households represented 42% of the village population and 35% of the total households in Togiak. Field observations were made over a 23 day duration on the river. During that time, 135 boats from the villages were observed consisting of 404 people. Fifty-five percent of the boats were actually engaged in a subsistence activity. Several sport fish guides were interviewed on an informal basis, and five hundred four (504) sport fisherman were observed.

Following is a brief discussion on the types of problems encountered between the two user groups: The problems that emanate out of conditions of over crowding are numerous and couple that condition to other problems of a Cultural social and political nature and major conflicts between user groups are inevitable. Most problems revolve around three major themes; displacement, catch and release and trespass.

The gear used by subsistence fishermen (gillnets) are incompatible with the rod and reel gear used by sport fishermen. Both user groups emphasize this point. On the one hand, sportsmen feel that net fishing depletes an area of fish. On the other hand, subsistence fishermen argue that sport fishermen get in the way when subsistence fishers attempt to use nets while fishing the same area. This is particularly problematic if the latter are drift fishing with gillnets. Because drift fishing requires a fairly lengthy area in which to fish, the sport



fishermen often get in the way of the fast drifting boats and nets. Unless they move, serious problems can result.

The practice of catch and release was disliked by every villager interviewed. They disliked such a practice because it not only abuses fish by injuring them, causing them suffering and serious injury in some way, but it critically disorients them and often prevents them from spawning. Such playing with fish is not only disrespectful of the proper function of fish as food, according to the villagers perspective, but it threatens the future of salmon runs in the river. Already elders are noting that many streams that were used by salmon in the past in which to spawn no longer have salmon returning to them. These streams, they observe, are near sport fishing camps. Although the mortality from catch and release has not been thoroughly investigated for the Togiak and others rivers of the Bristol Bay region, it is clear from both subsistence users and sport guides that numbers of fish die from catch and release. This perspective has been viewed as a cultural one. Yet, the villagers point out as evidence the decrease in king runs over the past few years not only in the Togiak River but in the Bristol Bay region and Kuskokwim regions.

Residents find that not only are their customary rules breached in regard to fishing methods and locations but sport fishermen are fishing from their allotments, often times without permission of the owner. To add insult to injury, villagers have had the experience where sport guides have chased them from their own allotments and traditional fishing sites.

The results of this study are still in draft form. We hope to receive the final report in early 1988.



## E. ADMINISTRATION

## 1. Personnel



Left to Right: David A. Fisher, Peter J. Jerome, Lee A. Hotchkiss, Ken C. Harper, Mark J. Lisac, Jon A. Dyasuk, Diane M. Campbell.

## Permanent Employees

				EOD:
1. David A. Fisher	Refuge Manager	GS-12		10/22/81
2. Peter J. Jerome	Asst. Manager (trainee)	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. Mark J. Lisac*	Bio-Tech/Fisheries	GS-07		02/14/85
6. Jon A. Dyasuk*	Interpreter	GS-09		09/02/87
7. Kim R. Custis*	Refuge Secretary	GS-05		04/26/87
(Not Pictured)				
8. Karen S. Brandt*	Refuge Secretary	GS-05		04/26/87
(Not Pictured)				
				Resigned on: 05/12/96

## Temporary Employees

				EOD:
9. Diane Campbell	Bio-tech/Wildlife	GS-05		06/07/87
10. Laura J. Sharp*	Refuge Information Tech	GS-06		07/05/87
(Not Pictured)				
11. Jacob S. Bartman*	Refuge Information Tech	GS-06		07/05/87
(Not Pictured)				



- (Not Pictured)  
 12. Steven Gosuk\* Refuge Information Tech GS-06 09/13/87  
 (Not Pictured)  
 13. Dan V. Smith\* Youth Conservation Corps 06/15/87-08/28/87

\*Local Hire Employees

During 1987 several additions were made to the refuge staff. Jon Dyasuk was hired as the refuge interpreter, a long sought after, much needed position. Jon's addition to the staff will enhance village-refuge relationships.

Kim Custis replaced Karen Brandt as the refuge secretary. Karen and her family left Alaska and returned to Montana.

Diane Campbell joined the staff as a biological technician. She had worked as a volunteer for the two previous summers.

Jacob Bartman, Laura Sharp and Steven Gosuk worked intermittently as refuge information technicians, primarily in the village of Togiak and on the Togiak River.

TABLE 15

<u>Refuge Staffing Pattern</u>				
<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

## 2. Youth Programs

One Youth Conservation Corp (YCC) enrollee was hired in 1987. Dan Smith, from Dillingham, held this position for most of the summer. Dan was kept busy filling field camp orders, helping with office/field camp radio communications, assisting secretary Custis, and other miscellaneous activities. Dan's enthusiasm for the job was a real asset to our busy field season.

## 4. Volunteer Program

Togiak National Wildlife Refuge completed its fourth year of participation in the Refuge Volunteer Program. Lessons learned from the 1984 through 1986 field seasons were a tremendous help



years. The 1987 volunteer season proceeded smoothly, with no problems.

Nineteen volunteers, ranging in age from 20 - 72 years old, spent a total of 1,713 person days or 16,980 person hours, in volunteer work for the refuge. The following people participated in the Volunteer Program this year:

Name	From	1987 Service Dates	Total Man-days
Ed Weiss	St Louis, MO	May 04 - Jan 04	217
Vernon Burandt	Lone Pine, CA	May 06 - Aug 27	113
John Sargent	Pullman, WA	May 11 - Aug 18	99
Joanne Sameniego	Anchorage, AK	May 15 - Aug 21	97
Lisa Haggblom	Eugene, OR	May 15 - Dec 14	204
Bruce Seppi	River Falls, WI	May 19 - Aug 28	102
Matthew Hubers	Dielkirchen W. Ger	May 20 - Aug 22	93
Allyn O'Neil	Milford, NH	Jun 01 - Dec 14	185
Kurt Pindel	Stevens Pt, WI	Jun 01 - Aug 24	85
Greg Hoffman	Brookings, SD	Jun 01 - Aug 25	86
Brent Kuhl	Redwing, MN	Jun 01 - Aug 18	79
Dan Greene	Minneapolis, MN	Jun 01 - Sep 02	94
Gordon Kent	Eugene, OR	Jun 01 - Sep 02	94
Jenny Seppi	River Falls, WI	Jun 04 - Aug 07	64
Ruth Roelse	Lansing, MI	Jun 15 - Aug 28	74
Denise Lisac	Dillingham, AK	Jun 01 - Jun 05	4
Cathy Fisher	Dillingham, AK	Jun 01 - Jun 08	7
David Parmalee	Minneapolis, MN	May 19 - May 27	8
Jean Parmalee	Minneapolis, MN	May 19 - May 27	8





The 1987 Volunteer crew from left to right:  
 Front Row: A. O'Neil, B. Seppi, J. Seppi, D. Greene;  
 2nd Row: E. Weiss, V. Burandt, M. Hubers, L. Haggblom,  
           J. Sargent, G. Kent, J. Samenigo, B. Kuhl;  
 Top: D. Campbell, K. Pindel.

The refuge provided all field gear, food, and equipment (except sleeping bags). Round trip air transportation from Anchorage to Dillingham was also provided. Nearly 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 subject matter:

- 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;
- 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; and
- Do's and don'ts when dealing with native residents.
- Drinking water safety, Giardia and water filters.



Volunteers receiving training on the use, care and maintenance of outboard motors. MJL, 1987.

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

- Kagati Lake and Togiak Lake beach seining
- 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 the haul out sites at Cape Peirce and Nanvak Bay
- Public use surveys at Togiak Lake, and Kagati Lake
- Public use surveys and fish sampling on the Togiak River, and Kanektok River
- Waterfowl brood surveys at Chagvan Bay
- Expanded waterfowl brood surveys on Nushagak Peninsula and coastal areas from Chagvan Bay north to Quinhagak
- Seabird surveys at Cape Peirce



- Seabird surveys at Cape Peirce
- Raptor surveys at all field locations
- Compiling data for refuge mammal list
- Continuation of refuge bird list
- Continuation of the refuge herbarium collection
- Fall waterfowl migration/staging data collection at Nanvak Bay
- Sonar graphing and water quality sampling of six refuge lakes
- Plankton sampling and processing of samples from six lakes
- Length, weight, and age ratio fish sampling at six lakes
- ADF&G salmon counting tower
- Radio telemetry of marine mammals and geese at Cape Peirce

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 receive as a result of their efforts would have been otherwise impossible to obtain. We feel we were able to view some potential FWS 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.

The 1987 refuge volunteers were nominated for and received the Director's Outstanding Contribution Award under the Take Pride in America Campaign.

## 5. Funding

TABLE 16  
Funding History For Togiak National Wildlife Refuge

FY	1210	1220	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

\* Includes ARMM and RPRP funds

\*\* Preliminary figures for FY88, includes funds for the



Funding for Accelerated Refuge Maintenance Management (ARMM) and Resource Problems and Related Projects (RPRP) once again brought this stations overall funding to an acceptable level. The funding increase for FY87 covered the following programs and projects; contaminant work, increase in the office lease, increase in travel costs, quarters leases, storage building construction, increased volunteer costs, and planning costs for preparation of the public use management plan. One only hopes that we will continue to receive ARMM and RPRP dollars in one form or another.

## 6. Safety

On September 21 Cessna N748 flipped over on take off and sunk in Nanvak Bay at Cape Peirce. Wildlife Biologist/Pilot Hotchkiss had flown to Nanvak Bay to resupply the camp and replace Bio-Tech Campbell and volunteer Weiss with volunteers O'Neil and Haggbloom and was in the process of leaving Nanvak Bay when the accident occurred. Hotchkiss, Campbell and Weiss escaped from the overturned aircraft and climbed onto a float to await help. Volunteers O'Neil and Haggbloom observed the accident from shore and immediately went to the cabin to radio for help. Refuge personnel at the office in Dillingham were alerted at 12:15 PM to the accident and immediately notified the Coast Guard. In addition two local air charter companies were notified. Each company sent a Grumman widgeon to the scene, arriving about ninety minutes after the accident. Operator Mike Harder successfully landed his widgeon in rough seas and EMT Jay Kennedy and John Bouker were able to inflate a raft and reach the stranded party of three. They were brought ashore and were in the process of struggling to the cabin when the Coast Guard arrived, approximately 3:15 PM. The Coast Guard helicopter evacuated the three to the Kanakanak Hospital in Dillingham. They were treated for hypothermia and released later that evening.





N748 in the prone position, resting on the God-send sand bar which prevented the plane and crew from drifting out to sea with the tide. A0, 1987.

The aircraft was salvaged by a barge crew about two weeks later and returned to Dillingham. Tides, wave action and salt water had destroyed the aircraft.





The salvage and ultimate demise of 748. The floats were removed and hauled aboard separately. A.O., 1987.

Another mishap occurred at our spring waterfowl camp at Chagvan Bay. Apparently, someone had filled the Kerosene can with gasoline. When one of the volunteers attempted to refill the Kerosene heater a fire erupted. Fortunately a fire extinguisher was handy and the fire was immediately put out. No one was injured, just surprised.

Refuge personnel conduct a week long training program for the volunteers prior to sending them to the field. Safety topics covered include the following; firearms (shotgun) safety, CPR, safe drinking water procedures, hypothermia prevention, single side band radio procedures, boating and water safety, and first aid.





Instructors Vern Burandt and Mark Lisac teach  
firearms safety at the Dillingham Gun Range.  
KH, 1987.

#### 8. Other (Special Use Permits)

There were 33 Special Use Permits (SUP) issued this year, Table 17. Nineteen (19) permits were issued to commercial sport fish guides, nine (9) to air taxi operators, and two (2) to big game guides. The remaining three (3) permits were issued to various agencies to support their field operations on the refuge.

The process for determining how future commercial sport fish guiding operations will be managed is being discussed in the public use management plan. We are into our fourth season maintaining the "moratorium" on new commercial sport fish guiding operations. The "moratorium" was established in June 1984 and essentially ceased the issuance of any new permits. Since that time, we have received formal requests for 39 new permits and numerous inquiries concerning our current policies with respect to issuing permits.



TABLE 17  
1987 Special Use Permits

PERMIT #	PERMITTEE	PURPOSE OF PERMIT	FEE
T-01-87	AK River Safaris	Sport Fishing Guide	\$100
T-02-87	N.E. Hautanen	Big Game Guide	\$100
T-05-87	John Peterson	Big Game Guide	\$100
T-07-87	Beyond Boundaries Exped.	Sport Fishing Guide	\$100
T-08-87	Riverbound Float Trips	" " "	\$100
T-10-87	AK Fishing Adventures	" " "	\$100
T-11-87	Branham Adventures	" " "	\$100
T-12-87	Lynn Castle, Master Guide	" " "	\$100
T-13-87	RamGo Enterprises	" " "	\$100
T-14-87	Andy's AK Fish. Adventures	" " "	\$100
T-15-87	Hugh Glass Backpacking	" " "	\$100
T-16-87	Wood River Lodge	" " "	\$100
T-17-87	Bristol Bay Lodge	" " "	\$100
T-18-87	Fish Alaska, Inc.	" " "	\$100
T-19-87	Golden Horn Lodge	" " "	\$100
T-20-87	Tikchik Narrows Lodge	" " "	\$100
T-21-87	Gone Fishin'	" " "	\$100
T-22-87	Dave Duncan & Sons	" " "	\$100
T-23-87	B&B Fishing Adventures	" " "	\$100
T-24-87	AK West Sportfishing	" " "	\$100
T-25-87	AK River & Ski Tours	" " "	\$100
T-27-87	Bush Air, Inc.	Charter Airline Co.	\$100
T-29-87	Hermen's Air, Inc.	" " "	\$100
T-30-87	Ryan Air*	" " "	--
T-31-87	Alaska Cargo Service*	" " "	--
T-32-87	Manokotak Airways, Inc.	" " "	\$100
T-33-87	Armstrong Air Service	" " "	\$100
T-34-87	Yute Air Alaska	" " "	\$100
T-35-87	Peninsula Airways	" " "	\$100
T-39-87	King Air	" " "	\$100
T-40-87	Geological Survey (AMRAP)	Geological Surveys	N/A
T-41-87	Cousteau Society	Walrus Photography	N/A
T-42-87	BLM	Examine Native Allotments	N/A

Total Permits Issued: 33      Total Fees Collected: \$2,800

\* 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 1,000 feet in places around Kulukak Bay, to 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, and 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, msl (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

The refuge is divided into two fire management districts; the Yukon/Togiak Planning Area, and the Kuskokwim/Iliamna Planning Area. There were no fires reported during the year.

Both fire plans were reviewed with DNR personnel and no changes in either plan were necessary. The refuge manager submitted justification for exemption from writing a refuge fire management plan. A response on this is pending.



## 12. Wilderness and Special Areas

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

Wilderness additions proposed in the preferred alternative of the RCCP would add approximately 357,000 acres to the already existing wilderness acreage. The proposed area includes the old Cape Newenham NWR area, 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. The natural diversity protected by wilderness designation will serve as an invaluable source of data for scientific investigations for future fish and wildlife needs.



Outlet at Atmugiak Lake, a small circ lake located near Mt. Oratia in the Togiak wilderness area.

D.F. 1986.



The real challenges facing the Fish and Wildlife Service will be to develop wilderness management programs that will maintain these outstanding values for future generations, without compromising the intent of the Wilderness Act.

This wilderness area 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.



The Cape Peirce area, part of the original Cape Newenham refuge has been recommended for wilderness addition. A.O. 1987.



## 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 (31) species of land mammals, 169 species of birds, and 17 species of marine mammals occur on or adjacent to the refuge. Five species of salmon, and eight 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.

### 2. Endangered and/or Threatened Species

Several sport fishing guides reported seeing a pair of peregrine falcons near a historical falcon eyrie adjacent to the Kanektok River. Refuge personnel observed a pair of peregrine falcons on this same eyrie numerous times during June and July. No nest structure was observed, however only aerial observations were attempted, which may not allow observation of the nest if one was present.

Grey whales are regularly found feeding in the shallow coastal waters between Kulukak Bay and Cape Newenham, on the southern boundary of the refuge, from April through August. 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.

### 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, if not slightly later, this year. The early migrants began to appear on the Nushagak Peninsula, and in the vicinity of Dillingham, by April 24. The first sandhill cranes and pintails were observed on April 24 and Tundra swans on May 5. 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, May 5, 6, 28, and June 5 (Table 18). The waterfowl staging areas were 90% ice covered on the April 24 survey and 90% ice free by May 6. The earliest migrants observed in Chagvan Bay, on April 24, were black brant.



TABLE 18  
Spring Waterfowl Staging Surveys

Waterfowl	Dates of Surveys				
	4/24	5/5	5/6	5/28	6/5
Canada Geese	65	2,869	2,000	1,608	6
Emperor Geese	110	8	11,425	250	25
White-fronted Geese	---	352	---	154	39
Black Brant	110	16,000	25,050	24,610	472
Snow Geese	---	20	---	---	---
Mallard	150	2,305	---	2,069	120
Northern Pintail	50	3,405	4,310	20	43
Greater Scaup	---	740	---	40	10
Stellar's Eider	---	---	---	370	---
Common Eider	70	440	6,650	1,675	259
White-winged Scoter	460	---	---	65	6
Black Scoter	---	2,200	---	1,965	2,359
Tundra Swan	---	22	---	14	60
Sandhill Crane	---	20	---	16	18
Unidentified Ducks	---	---	---	50	39

Overall, spring waterfowl staging numbers were down (approximately 40%), compared to 1986. Emperor geese were present in noticeable larger numbers this year, compared to observations in 1986 (Table 19). Other species showed much lower concentrations on the staging areas during the spring of 1987.

TABLE 19  
Waterfowl spring Migration Peak Populations  
Aerial Surveys Comparison chart, 1986-1987

Waterfowl	1986		1987	
	Peak Dates	Peak Numbers	Peak Dates	Peak Numbers
Canada Geese	MAY 05	10,062	MAY 05	2,869
Emperor Geese	MAY 05	4,450	MAY 06	11,425
White-front Geese	MAY 05	254	MAY 05	352
Black Brant	MAY 20	46,102	MAY 06	25,050
Snow Geese	MAY 13	523	MAY 05	20
Mallard	MAY 27	6,575	MAY 05	2,305
Pintail	MAY 05	6,152	MAY 06	4,310
Greater Scaup	MAY 27	1,375	MAY 05	740
Stellar's Eider	MAY 05	9,900	MAY 28	370
Common Eider	MAY 13	5,015	MAY 06	6,650
White-wing Scoter	MAY 27	200	APR 24	460
Black Scoter	MAY 20	948	JUN 05	2,359
Tundra Swans	MAY 13	44	JUN 05	60
Sandhill Crane	MAY 20	58	MAY 05	20
Unidentified Ducks	MAY 01	450	MAY 28	50



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 a significant decrease of 46% over 1986.

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%.

Emperor goose numbers on spring staging grounds have been declining in past years, but showed an increase of 61% in 1987. White-front geese also showed a slight increase in staging numbers (28%).

A field camp was established at Chagvan Bay for the fourth 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 4, and manned by Bio-tech Lisac, and several volunteers until June 1.

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 staff breeding pair surveys 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 on the refuge.





Harlequin ducks migrate through, stage and nest  
on the refuge. AO, 1987.

Waterfowl production surveys have been conducted along the southern edge of the Nushagak Peninsula for four consecutive years. In 1986, survey areas were extended to include the Igushik River, as well as a portion of the low wetlands on the northern end of Chagvan Bay that is threatened with mining development plans. In 1987 all previously establish plots (except those near Chagvan Bay) were disregarded and a new study plan was written and initiated. (See: D. PLANNING; 5. Research & Investigations, for the new survey strategy and results.)

Fall migrating waterfowl surveys were flown on August 20, 28, September 8, & 17, (Table 20). 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 20  
1987 Fall Waterfowl Staging Surveys

Species	DATES			
	AUG 20	AUG 28	SEP 08	SEP 17
Canada Geese	5,925	9,047	1,685	3,375
Emperor Geese	2	675	1,590	417
White-fronted Geese	1,131	75	53	-
Black Brant	640	31,150	4,945	5,950
Snow Geese	-	-	30	40
Mallard	3,485	3,390	500	210
Northern Pintail	22,085	33,010	21,750	26,144
Green-wing Teal	135	150	65	400
Wigeon	25	-	-	-
Greater Scaup	-	500	500	12,195
Stellar's Eider	200	-	-	-
Common Eider	100	15	215	730
White-wing Scoter	355	175	450	1,725
Black Scoter	255	-	70	-
Tundra Swan	28	29	65	58
Sandhill Crane	17	5	23	-
Unidentified ducks	50	-	-	-

TABLE 21  
Waterfowl Fall Migration Peak Populations  
Comparison Chart: 1986 - 1987

Waterfowl	1986		1987	
	Peak Dates	Peak Numbers	Peak Dates	Peak Numbers
Canada Geese	AUG 29	6,439	AUG 28	9,047
Emperor Geese	AUG 29	216	SEP 08	1,590
White-front Geese	AUG 29	265	AUG 20	1,131
Black Brant	SEP 11	10,523	AUG 28	31,150
Mallard	SEP 18	4,185	AUG 20	3,485
Northern Pintail	SEP 18	11,885	AUG 28	33,010
Greater Scaup	SEP 18	400	SEP 17	12,195
Stellar's Eider	SEP 11	5,570	AUG 20	200
Common Eider	SEP 18	300	SEP 17	730
White-wing Scoter	SEP 18	970	SEP 17	1,725
Black Scoter	AUG 29	341	AUG 20	255

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. Fall staging numbers for all species except Stellar's eiders and Mallards showed an increase of numbers on the staging grounds.

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 Migration Surveys as requested from August 25 - October 12. Small groups (3 to 20 geese) were observed almost daily during early September feeding and staging in the bay. Only 76 emperor geese were observed actively migrating through the Nanvak Bay area during that period.



A group of juvenile emperor geese was observed several days in a row near the field camp at Nanvak Bay. A0, 1987.

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. Areas covered in recent surveys include: the remainder of Nushagak Peninsula, Kulukak Bay area, Ungalikthluk, Negukthlik, and Togiak Rivers, and the coastal area from Togiak Bay to Tongue Point. A total of 97 sightings were recorded. In the 36 family groups observed, 109 cygnets were recorded making the average brood size 3.03.



Swan sightings were also recorded during waterfowl production surveys. Both survey teams recorded the same number of swan broods, however, average brood size differed by 1.5 cygnets. The Nushagak Peninsula team recorded an average of 2.7 cygnets per brood, while the team surveying the western coastal region (from Quinhagak down to Chagvan Bay) recorded an average brood size of 4.2 cygnets per brood.

#### 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 the 1987 spring on April 24, 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; and April 13, 1986.

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 1987 waterfowl production surveys were conducted along the western coastal region of the refuge (from Quinhagak down to Chagvan Bay) as well as on the Nushagak Peninsula. Data recorded by the two teams included loon production observations. Nushagak Peninsula, primarily consisting of marshy lowlands dotted with ponds and lakes, produced 19 of the reported 23 loon broods. Red-throated loons accounted for 10 of the sighted broods with arctic loons making up the remaining 9 broods.

The western coastal region consists primarily of open rolling tundra dotted with shallow, hard-bottom, lakes and ponds. Observers in this area reported only 5 loon broods being seen. Of these five, four broods were red-throated loons and only one, an arctic loon brood. Although common loons were occasionally observed, no nesting activity or broods were noted.

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.



### Marsh and Waterbirds

From May 19 to May 24, David Parmelee (Curator of Birds, University of Minnesota) and his wife Jean visited the Chagvan Bay field camp. The Parmelees observed resident and migratory bird species. A report on their findings, ANNOTATED LIST OF THE BIRDS OF CHAGVAN BAY, ALASKA, is on file in the Togiak NWR office.

#### 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 the 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 May 14. (Additional information/discussion: D. PLANNING; Section 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).





Bonaparte Gulls are most often observed around inland lakes.  
DAF, 1987.

## 6. Raptors

Nine (9) 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 1984-85, 1985-86 and 1986-1987. 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 field season for the first time.

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 ft. above ground level (agl). 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 agl, 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 agl, to determine if the nesting attempt was successful and how many young were produced. The third flight takes place from mid-July to mid-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-one (31) nest structures were located, assigned a waypoint designator, and visually checked to confirm that they were in place and usable by late March 1987. Three (3) eagle nests previously located during 1986 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-one (31) nest structures were checked during the period of May 11 through June 15, 1987. Twenty-three (23) nests were occupied or active; eight (8) were found to be inactive.

An additional three (3) nests were found during August while conducting other surveys in the Togiak River drainage. Of these three (3) nests, one (1) was active and two (2) were inactive. This brought the total nest structure locations up to thirty-three (33) of which twenty-four (24) were active and nine (9) were inactive.

The twenty-four (24) active nests were checked again during the period of July 15 through August 15, 1987, to determine success rate. Twenty-three (23) fledglings were observed in fourteen (14) nests; nine (9) nests contained two (2) fledglings each, and five (5) nests contained one (1) fledgling per nest. The average fledgling success for 1987 was 1.64 fledgling per nest; down from the 1986 average of 1.71 fledglings/nest and the 1985 average of 1.89 fledglings/nest.

Nine (9) nests found to be active during the period May through June 15, 1987 apparently failed.

Twenty-nine percent (29%) of all nest structures located were inactive this year, compared to thirty-six percent (36%) inactive



and forty percent (40%) inactive rates of 1986 and 1985, respectively. These differences may not be significant, but we cannot be sure, based on such a small sample and data from only three years observations.

If there has been a change in nesting attempts and/or productivity, then the 1987 environmental conditions may have had a positive effect. The 1987 season started off warm with an apparently early break up in May, then turned unseasonably wet and cool during June and early July. Late July and August reversed the trend and turned out warm and drier than normal. Salmon runs appeared to be near or slightly below the five year average with the exception of the coho salmon run which was very poor. Lower than normal river levels and clear water conditions prevailed throughout late June and August which allowed for good to excellent access to dead or dying salmon for feeding bald eagles.

In comparison, both the 1986 and to some extent the 1985 spring, summer, and fall seasons were record wet seasons. Precipitation amounts and number of days with measurable precipitation, plus cooler than normal mean temperatures, and high winds (20 knots +), may have caused a slight decline in productivity rates. The salmon runs appeared to be near the five-year average; however, frequent high water levels in the salmon spawning streams caused high turbidity and washed away dead and dying salmon, thereby making them unavailable for the feeding bald eagles, which may have had some effect on productivity.

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. The eaglets appeared to have sufficient growth to assure they would reach flight status.

Ninety-two percent (92%) of all known bald eagle nest structures are constructed in deciduous trees, usually balsam poplar or white birch. The remaining eight percent (8%) of the known nest structures are located in the tops of white spruce trees which stand alone in the 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 groves which appear suitable for nest structures. Most of these timber patches are in close proximity to streams and/or lakes that support salmon runs. In addition, thirty-six percent (36%) of nest structures surveyed and found to be inactive supports the assumption that lack of nesting habitat is not a limiting factor in the bald eagle population.



The golden eagle nest, discovered near Kagati Lake during 1985 and inactive during 1986 was again active during the 1987 season. One eaglet was produced at this site. The only other golden eagle nest found on the refuge and active during 1986 was not active this year. This nest site is located at Cape Peirce on a near shore rock spire.

## 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, juncos, 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.

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.

## 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.

Moose surveys were flown during March and early April, during which twenty-two (22) moose were located. The refuge moose population is down considerably from the thirty-nine (39) moose found during the 1986 surveys. Although some of the moose population is thought to move back and forth across the common boundary between the Wood-Tikchik State Park and the refuge, many moose are lost each year to village hunters during the fall, winter and early spring months.

Seven (7) moose (4 bulls and 3 cows) were found in the Kwethluk River headwaters in the extreme northern portion of the refuge. Six (6) moose (2 bulls, 3 cows, and 1 calf) were located in the Togiak River drainage. Nine (9) moose (6 bulls and 3 cows) were found in the Killian Creek drainage.

Favorable snow and ice conditions during February through April allowed easy access to the refuge interior by snowmachines from



the villages. As expected the moose population declined sharply during this time period.

Acceptance of the Refuge Comprehensive Conservation Plan (RCCP) set the stage for the long awaited and sought after caribou reintroduction to the Togiak N.W.R. A reintroduction proposal written and submitted for funding during FY88 was approved and planning for the transplant effort began in earnest. Many village meetings were held in Manokotak, Twin Hills, Togiak, Goodnews Bay, Platinum, and Quinhagak to notify the villages of the pending project and secure their support. It was essential that villages in the vicinity of the caribou release area were in total agreement with the project and be willing to sign a cooperative agreement with the USFWS, Alaska Department of Fish and Game (ADF&G). After the initial round of meetings, Manokotak signed the agreement. Togiak eventually signed the agreement and Twin Hills declined, apparently not trusting the USFWS and ADF&G motives in pursuing this project. Goodnews Bay, Quinhagak, and Platinum felt that this project was too far away from their villages to be of any concern.

Approval and funding for the project was finally received from the regional office late in December and supplies purchased preparatory to the actual transplant operation began. February 1988 was set for the transplant.

The reintroduction proposal was based upon capturing a minimum one hundred (100) caribou from the Becharof/Alaska Peninsula herd, transporting the live animals to and releasing them on a selected site on the Nushagak Peninsula. A ratio of five (5) or six (6) females per male was established as the optimum for this transplant.

Since these animals are very sensitive to immobilizing drugs, a method of capture new to the continental U.S. and Canada would be tried and used if feasible. This method which had been used successfully for several years in New Zealand to capture red deer consisted of a net gun mounted on a helicopter skid and fired by the helicopter pilot. The net which measures twenty (20) feet on a side is fired from a canister attached to the "gun" mechanism. Four (4) weights, (one attached to each corner of the square net) are fired from angled barrels, propelled by expanding gases of a blank 308 shell loaded with 42 grains of Dupont 4227 powder. The net would hold the animal so that two people could tranquilize it, untangle it from the net, hobble, blindfold and secure it in a canvas sling for transplant back to the site where it would be processed for shipment to the release site. The theory sounds great . . . . .

Funding in the amount of \$100,000.00 for the project was approved. A cooperative agreement transferring \$70,000.00 to ADF&G in order to facilitate purchasing helicopter time, single



engine Otter aircraft time, radio collars, visual collars, and tranquillizing drugs was approved and signed. The USFWS would provide funding for the project and ADF&G would provide expertise and manpower for the caribou capture and release. Volunteers from the villages of Manokotak and Togiak would assist in all phases of the project.

During March and April 1987, the refuge staff was involved in another caribou capture project slightly north of the refuge's northeastern boundary. Togiak refuge staff provided funding, aircraft and manpower to the Yukon Delta NWR for their caribou radio collaring project in cooperation with ADF&G. This project required the locating, capture and radio collaring of nine (9) caribou in the Ahklun Mountains in the vicinity of Kisiralek Lake. This project was designed to determine if a small herd of caribou found in that area were transient animals from the Mulchatna herd or if they were a resident herd in that geographical area. Another question to be answered by this project was if these animals were actually caribou or feral reindeer. A side benefit of the project would be to determine if this herd's range extended south onto the northern most portions of the Togiak NWR. Occasional sightings of one or two caribou in that portion of the refuge were reported but the numbers seen and numbers of observations made per year cast some doubt on this group's normal range including Togiak NWR.

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 and waterfowl brood surveys.

A total of 47 bears were observed during the spring and summer. Staff could be sure these sightings were not recounts because of date and time of observation, family size, colors, markings, or location on the refuge. Family groups and ages of bears are as follows:

Groups Observed	Group Composition	Total
3	Sow plus 1 cub	6
3	Sow plus 2 cubs	9
1	Sow plus 3 cubs	4
2	Sow plus 1 yearling	4
24	Singles	24

Twenty-nine percent (29%) of the bear observations were made on the Ungalikthluk/Negukthlik River drainage; twenty-six percent (26%) were on the Kulukak River drainage; twenty-one percent (21%) on the Togiak River drainage; six percent (6%) each on the



Nushagak Peninsula, and Matogak River; and one percent (1%) on the Slug River

A black bear was observed by refuge staff for the second time in the history of this refuge. This bear, a large adult, was seen on the Negukthlik River October 19 by FB Harper and Bio-Tech Lisac. The only other black bear sighting in the refuge history was made by WB/Pilot Hotchkiss in July 1985 on the Kemuk River.

No bear incidents were reported by our field camps or by refuge visitors this year. So far, in the history of the refuge, no bear incidents have been reported. Bear observations in the near vicinity of guide camps, unguided visitors camps, and refuge field camps are common, but all incidents have been avoided so far.

#### 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 Pacific Ocean, marine upwellings, and ground water run off from the major river systems, contribute to the high productivity of the bays and 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 haul out year-round on several of the islands in the bay and at Cape Peirce. Four species of seal winter along the ice edge, and of these, only the harbor and spotted seal inhabit the refuge coast throughout the year. Steller's sea lions may also be found year-round throughout the bay.

The endangered gray whale migrates through Unmiak Pass and follows the Bristol Bay shoreline on its way north. These animals are observed throughout the summer, feeding in the near-coast waters of the refuge. Group sizes range from singles to 20 whales, with several groups containing calves. These latter groups would generally hold over in the coastal waters, feeding and resting before continuing their journey up the coast.

During May and early June, aerial surveys of the Bristol Bay coastline were conducted. From Kulukak Bay to Cape Peirce, numerous small pods of 10 to 30 whales were observed. In the past, refuge volunteers stationed at Cape Peirce observed gray whales during early June but in 1987, no observations were made.

Other whales passing through Bristol Bay along the refuge coastal area, enroute to the Bering Sea, are the minke and on rare occasions the Baird's beaked whale. Beluga whales, killer



whales, harbor porpoise, and Dall porpoise are relatively common in the area throughout the summer.

Beluga whales are one of the most abundant cetaceans in the North Pacific, and are commonly found in areas of fish concentrations like the mouths of rivers and in bays with high tidal fluctuations. When herring and capelin hit the beaches to spawn, or salmon smolt make their annual out migration, or adult salmon begin to migrate to near shore waters and river mouths; the belugas are not far behind.

Herds of up to 100 individuals, including calves, can be seen migrating along the coast. An estimate of 280 to 300 belugas was made on a flight from Dillingham along Nushagak Bay to the Nushagak Peninsula during late July.

Conflicts occurred from mid June to late August between belugas and float planes utilizing the public dock near the mouth of the Wood River. This area is often used as a loading point for local float planes, including the refuge aircraft, as well as being a boat launch. On several occasions, landings had to be aborted and additional passes were required to avoid hitting the feeding whales.

Sea lions gather annually at traditional rookeries to pup and breed. The adjacent Walrus Islands state Game Sanctuary is essentially the only remaining breeding ground, supporting a population of 4,000 to 5,000 adults. Fish populations supported by the undeveloped refuge coast and rivers, provides highly valuable feeding grounds for this population. The only documented haul out (a terrestrial resting area not used for breeding and calving) on the refuge exists at the western tip of Cape Newenham. Refuge aerial surveys of this area had estimated a peak range of 200-275 adults using this haul out in 1981-1984 from April to September, usually peaking in May. Weather did not permit surveys in 1986, however in 1987 approximately 900 animals were observed hauled out with an additional 50 in the water during an aerial survey on May 28. Sea lions hauled out were reported during two additional aerial surveys: 250 animals on August 20 and 130 animals on December 10.

Sea lions usually begin using the haul out area in April and are seen feeding along the coast and in the bay channels during the herring spawning migration which usually occurs in May. Field camp personnel have observed sea lions and seals feeding heavily on herring in Chagvan Bay during May and June for the past four years.





This sealion pup was observed at Chagvan Bay.  
VB, 1987.

Other pinnipeds include the following ice-associated species: ringed, bearded, spotted, harbor, and ribbon seals. These species occur from the northern Chukchi Sea to the Bering Sea. In the winter, all of these species occur along the ice edge adjacent to the refuge coastline. During the summer, when the ice pack recedes, only the spotted and harbor seals do not follow it northward.

Much of the refuge coastline is utilized by these two remaining species as they follow the concentrations of spawning herring, capelin, or smelt. Spotted seals generally maintain a more northern range, with Bristol Bay serving as the overlap area of the two species.

During the spring waterfowl hunt in Chagvan Bay, populations of spotted seal, harbor seal, and sea lion begin building up (mid-to late May) as the marine mammals begin to follow spawning herring into the bay. At this time much of the subsistence hunting shifts from waterfowl to seals and sea lions.





Sea lions are occasionally hunted for subsistence by local residents, the flippers are a delicacy.  
VB, 1987.

During these marine mammal hunts, the rate and magnitude of shots fired becomes alarming, as attempts to take the animals in the bay increases. Obviously, many of the animals are shot and wounded but not retrieved.

The only major haul out site in northern Bristol Bay, for harbor and spotted seal, is in Nanvak Bay; harbor seals comprise 90% of the total. Some seal pups are born in Nanvak in June and July. This is considered to be the northern most pupping colony of harbor seals. The population generally peaks during the molt in August and September when it is believed that the seals need to remain on land. Peak population estimates at the Nanvak bay haul out have declined in recent years and continued to decline this year. Peak number observed in 1986 was 420 animals on August 27 and in 1987 the peak occurred on September 15 with only 220 animals being reported.

Except for Nanvak Bay, only minor incidental seal haul outs are known to exist: Tuativak Bay, Kulukak Bay, Cape Constantine, Hagemeister Island, Walrus Islands, Cape Newenham, Security Cove, Chagvan Bay, and the offshore sandbars near Quinhagak and Jacksmith Bay. Generally, all these haul outs coincide with, and are adjacent to areas of herring and capelin spawning.

Pacific walrus populations are characterized by extensive



seasonal migrations. Female walrus, and some 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. However, after the breeding season (December through March), a portion of the male walrus remain in the ice free portions of the Bering and Chukchi Seas; rather than resting on ice, these males utilized traditional terrestrial locations.

Every year since 1978, walrus have been reported hauled out on the refuge in the region between Cape Peirce and Security Cove. Most sightings have been on the north side of Cape Newenham. Most of this activity seems to occur from April to June, and usually involves from a few walrus, up to 500 animals. An unusually large sighting of 2,500 animals hauled out at Cape Peirce, south of Cape Newenham, was first reported in November, 1981. Since then, Cape Peirce has been re-established as a major walrus haul out. Its importance has begun to rival the Walrus Island State Game Sanctuary, which was set aside to provide a protected resting place for the walrus.

Large numbers of walrus were observed on the refuge beaches at Cape Peirce throughout the summer months of 1983-1986. These four years revealed extensive use of the haul out by walrus, in numbers of approximately 5,000 in 1983; 8,600 in 1984; 12,000 in 1985; and 11,800 in 1986. A decrease in activity occurred during the 1987 season for reasons unknown. A peak of only 6,300 animals was recorded July 27 for 1987.

#### 1987 WALRUS HAUL OUT DATA

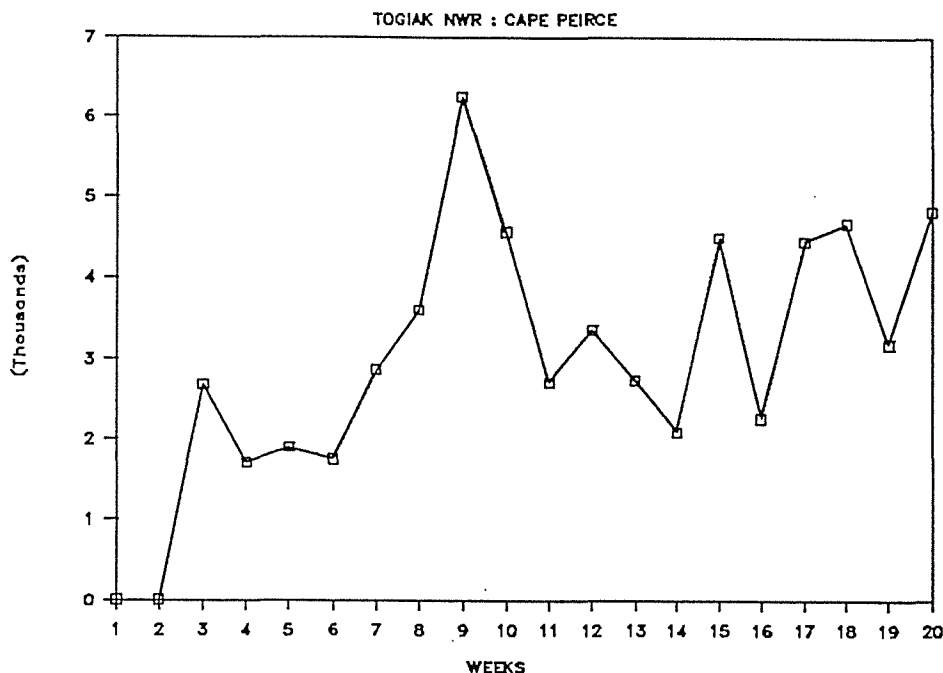


Figure 5. Weekly peak haul outs of Pacific walrus at Cape Peirce, Togiak NWR, 1987. Week #1, May 21-27 through week #20, October 8-12.



## 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.

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.

## 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 1987 was nearly \$20,000,000.

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 the refuge waters. Sport fishermen are estimated to have spent close to \$3,500,000 each year to fish in refuge waters during 1986, and 1987.

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. They 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 (ANILCA), 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, subsistence users will be afforded the priority use of all surplus not needed to maintain viable healthy populations.

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.

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 (ADF&G), 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 ADF&G 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 ADF&G Commercial Fisheries Division personnel. (During 1987 FB Harper participated in the survey for the villages of Quinhagak and Goodnews) (Table 22). This information is very important in the overall management of refuge



fishery resources, since subsistence users are given priority for use of surplus fish.

TABLE 22  
Subsistence Salmon Fishery Harvest  
Togiak/Kuskokwim Bay\* 1987

Village	Chinook	Sockeye	Coho	Pink	Chum	Total
Quinhagak	3,663	1,067	25**	0	1,084	5,839
Goodnews Bay	640	834	--	--	371	1,845
Platinum	176	121	43	--	207	547
Togiak	769	3,696	1,052	9	998	6,524
Twin Hills**	(Included in Togiak estimates above)					
Manokotak	1,347	3,389	268	3	8	8,803
Totals:	6,595	8,107	1,388	12	2,668	23,558

\* ADF&G Data

\*\* Extrapolated to the number of permits issued, but probably doesn't reflect the actual harvest, especially for coho.

### 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 specified 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. Mixed species present in the fishery however present special problems, i.e. low chinook runs coupled with large surpluses of sockeye to be harvested. Two ADF&G Commercial fisheries offices regulate the commercial fishing seasons by monitoring escapements and setting openings. The Refuge and King Salmon FAO helped in the monitoring of the escapements in the Togiak River during 1986, and again in 1987. (See Research Section). The refuge assisted in the operation of the counting tower at Togiak Lake, and flew several aerial surveys for escapement counts. The King Salmon FAO conducted a side scan sonar project and enumerated the coho salmon escapement. ADF&G



used the sonar and aerial surveys for 1987 data and management.

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. 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.

Escapements in the Kanektok are not well documented. ADF&G is currently trying to monitor them with sonar equipment, but they have been plagued by the changing course of the river as well as other site selection problems. Also, the sonar project has only been funded for part of each season, primarily to monitor chinook and sockeye escapements. Therefore, only a portion of the coho run has been monitored. Poor weather conditions result in sporadic aerial surveys, which are completely missed during some years.

The Goodnews River has large sockeye and coho runs (Table 23). The sockeye run, with past 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 ADF&G counting tower 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. ADF&G 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.



TABLE 23  
District 5 - Goodnews Bay, 1987  
Commercial/Subsistence Salmon Catch/Escapement

Harvest	SPECIES					Total
	Sockeye	Chinook	Coho	Chum	Pink	
Commercial	27,758	3,357	29,057	20,381	54	
5-Year Avg.	19,575	8,144	34,679	10,015	2,768	
Subsistence	834	640	++	371	--	
Escapement	51,989	4,490	25,000	37,802	+	
Esc. Objective	45,000	4,000	25,000	18,000	+	
Total Run	80,581	8,487	54,000+	58,554	2,500+	
Ex						
Vessel Value	\$226,310	\$69,903	\$195,034	\$39,896	\$25	\$571,167

ADF&G Data, Bethel

++ subsistence data collected prior to the coho runs.

+ major pink salmon runs occur only in even years.

Sport fishermen are estimated to have paid in excess of \$2,000,000 to fish the Kanektok and Goodnews Rivers in 1987. This money goes to sport fishing guides and lodges, air taxis, village corporations, village stores, and commercial airlines. 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.

Commercial harvests of all salmon species bound for the refuge in the Togiak and Nushagak Districts were worth over 5 million dollars to the commercial fishermen who participated in these fisheries in 1987 (Tables 24 and 25). The wholesale value, which includes distribution, canning, freezing, etc., of this renewable resource was estimated to be in excess of 10, to 15 million dollars in 1987.



TABLE 24  
Togiak District, 1987\*  
Commercial/Subsistence Salmon Catch/Escapement

Harvest	SPECIES					Total
	Sockeye	Chinook	Coho	Chum	Pink	
Commercial**	339,884	17,618	1,356	421,685	24	780,567
10 Year Avg	442,263	31,015	78,719	187,094	39,207	778,298
Subsistence	3,696	769	1,052	998	9	6,524
Escapement	316,076	9,100	65,000	311,000	+	503,000
Total Run	659,656	27,487	67,408	733,683	+	1,488,234
Ex Vessel Value 2,798,000; 485,000; 7,000; 696,000						3,986,000

\*ADF&G preliminary data; includes Togiak, Kulukak, Kanik, Quigmy, Matogak, and Osviak Rivers

\*\*Does not include harvest along the Alaska Peninsula

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 25  
Igushik Section, 1987  
Commercial/Subsistence Salmon Catch/Escapement\*

Harvest	SPECIES					Total
	Sockeye	Chinook	Coho	Chum	Pink	
Commercial**	522,655	+	+	+	+	
Subsistence*	3,389	1,347	659	8	3	
Escapement	169,236	+	+			
Total run	719,835					
Ex Vessel Value	\$1,151,758					

\*ADF&G data

\*\*Does not include the interception of 27,944 along the Alaska Peninsula.



Runs of chinook, coho, and chum are small in comparison to the sockeye runs. However, runs of these species bound for the Togiak District are the second largest in the entire Bristol Bay area. A significant 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 thought to be in trouble. Several factors indicted that the coho runs were weak for 1987. The parental year of 1983 had a poor escapement, and high seas catches in the Japanese fleet prior to the arrival of the fish in the Bay were considerably down. The run for the Nushagak district which normally gets fish 2 weeks earlier than the Togiak River was also showing a very weak run and the possibility of not meeting the escapement goal. To be able to meet the escapement goals the State closed both the commercial and sport fisheries for coho on the Togiak River, an unprecedented action in Bristol Bay. The net result was reaching the escapement goal of 50,000 with a final escapement estimate of 68,000 fish by September 22.

Chinook and chum salmon, bound for the Togiak District, also produce a major portion of the Bristol Bay harvest. Chinook comprised 23%, and chum made up 28%, of the total harvest in 1987.

Counting towers on the Igushik and Togiak rivers are operated by ADF&G, to enumerate the escapement of sockeye salmon into these rivers. The data they collect and aerial surveys are used to regulate commercial fishery openings throughout the season. Due to budget cuts, the Togiak Tower was cooperatively staffed by ADF&G and FWS for the entire season, see section D, planning/research.

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, sockeye below the tower, 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 1987 the refuge cooperated with the state in conducting aerial surveys of the refuge rivers in the Bristol Bay area. (See Section D, planning/research).

The Togiak District is also distinct in that it generally



produces a larger, average sized coho, sockeye, chum, and pink salmon than the other Bristol Bay districts. By contrast, chinook salmon average weight in this district has been generally smaller.

### Herring

Pacific herring (Clupea harengus pallasii) are known to spawn in various coves and bays along the refuge coastline. This species is 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 Togiak Bay area adjoins the southern coast of the refuge and is the only commercial herring fishery in Bristol Bay. This fishery began in 1967 and maintained a low profile for several years. Through 1975, it averaged only 1-3 processors, 24 gill net operators, and an occasional purse seiner.

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 fishing. 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.

Spawning herring were observed in the Togiak District from April 24 - May 14, 1987. This is the earliest reported spawn in the area and the earliest sac roe harvest on record. A record of 76 linear miles of milt in 160 spawn sightings were observed by ADF&G during aerial surveys. The majority of the spawning occurred May 3-7. Based on test fishing results, a commercial opening was allowed on April 27; several days earlier than in 1985, or 1986. The fishing comprised of 5 openings for gill nets totaling 36 hours and 5 openings for purse seiners totaling 5.5 hours.

Although purse seiners fished less time, they accounted for 12,565 short tons (2,000 lbs./st.), making up nearly 83% of the total harvest. The gill net fleet brought in 2,638 short tons, for a total harvest of 15,204 short tons in 1987.





Numerous boats congest one of the Bays on the southern coast of the refuge. MJL, 1987.

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 st of spawning herring, with a 2 - 3 year rotational harvest of kelp beds. The roe-on-kelp (rockweed *Facus* sp) harvest during 1987 was limited to only five openings. A total of 26 hours picking time from April 29 to May 4, yielded 307,307 pounds of harvestable kelp valued at \$187,000 in 1987, (Table 26).



TABLE 26

Togiak District  
Commercial Roe-on-Kelp Harvest

Year	Processors	Number of Fishermen	Pounds Harvested	Short Tons Harvested	Ex Vessel Value
1968	1	1	54,600	27.3	NDA
1969	1	3	10,125	5.1	"
1970	1	5	38,885	19.4	"
1971	1	12	51,795	25.8	"
1972	1	12	64,165	32.0	"
1973	1	10	11,596	5.8	"
1974	3	26	125,646	62.8	"
1975	2	44	111,087	55.5	"
1976	5	49	295,780	148.0	"
1977	5	75	275,774	138.0	"
1978	11	160	329,858	164.9	"
1979	16	100	414,727	209.0	\$248,000
1980	21	78	189,000	95.0	\$ 95,000
1981	7	108	378,207	190.0	\$250,000
1982	8	214	234,924	117.0	\$176,000
1983	4	125	270,866	135.0	\$284,000
1984	6	330	407,587	203.0	\$203,000
1985	0	-----	CANCELLED	-----	0
1986	3	143	374,396	187.0	\$187,000
1987	5	187	307,307	153.6	\$166,000
19 Yr. AVG.	5	92	207,669	85.93	\$108,000

## ADF&amp;G Data

NDA = no data available

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 the herring, and has experienced some commercial interest in the Togiak District. No spawning capeline were observed in 1987 and no fishing season was conducted for this species. Total value of the herring fishery to participating fishermen in 1987 was \$8,780,000.

Kuskokwim Bay herring are harvested on the west coast of the refuge in the Goodnews Bay district, and the Security Cove District. 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 opened on for a total of 11 fishing hours. The average roe content was 7.3%. A total of 321 short tons of herring harvested by 117 fishermen. There were 4 buyers in the area and all of them imposed around a 7% minimum roe content restriction on the herring they bought. If the roe fell below this percentage then the herring were sold for bait or food fish at a substantial price reduction.

The commercial herring season in the Security Cove District opened for three periods during May; 5/2, 6 hrs; 5/10, 3 hrs; and 5/14 for 4 hours. There were 65 fishermen participating in the effort harvesting a total of 313 short tons of herring with an average of 9.7% roe recovery.

## 12. Wildlife Propagation and Stocking

Togiak NWR, in cooperation with ADF&G is proposing to reintroduce 100-150 caribou to the refuge from the Northern Alaska Peninsula caribou herd. The reintroduction is scheduled to take place in early February 1988. See G. Wildlife, 8. Game Mammals.

## 14. Scientific Collections: Plants

Lisa Haggblom, refuge volunteer, created two botanical displays for the refuge office. The displays include specimens collected by volunteers in 1985, 1986, and 1987 and depict flora of Togiak NWR. Some of the flora depicted are the following:

Scientific Name	Common Name
<u>Achillea borealis</u>	Yarrow
<u>Aconitum delphinium</u>	Monkshood
<u>Antemisia arctica</u>	Wormwood
<u>Dryas octopetala</u>	Eight-petaled Dryas
<u>Epilobium angustidium</u>	Fireweed
<u>Geranium erianthum</u>	Wild Geranium
<u>Iris setosa</u>	Wild Iris
<u>Polygonum bistorta</u>	Pink Plumes
<u>Sanguisorba stipulata</u>	Sitka Burnett
<u>Sedum multiradiata</u>	Golden Rod
<u>Solidago rosea</u>	Roseroot





Wildflowers add a splash of color in July.

A.O. 1987.

#### 16. Marking and Banding

During the 1982 field season, concentrations of molting white-fronted geese and lesser Canada geese were observed on the Nushagak Peninsula and on several lakes east of Chagvan Bay. These concentrations of molting geese have remained relatively stable with respect to numbers of birds and water body locations since their discovery. Approximately 1200 Canada geese and 1500 white-fronted geese have been observed molting at these two locations each year. Nothing is known about these particular groups of birds.

A proposal to drive trap and band up to 600 Canada geese and 600 white-fronted geese was submitted to and approved by the regional office. Some of the basic questions we expected to answer about these birds were:

- Are these geese non-breeders or failed breeders?
- If they are failed breeders, where were they attempting to nest?
- Are these birds part of the Yukon-Kuskokwim Delta population or part of the Mulchatna breeding population?
- If they are non-breeders where will they attempt to nest?



Trapping and banding equipment was ordered following approval of the proposal, however, the drive trap net supplier failed to ship the wing trap material and the project was cancelled for the year. This project was rescheduled for July 1988.



## 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. These seven villages contain an estimated 3,932 residents; an increase of 18 people over 1986, according to the 1987 population census (Table 27).

TABLE 27  
Village Population Growth

Year	Quinhagak	Goodnews Bay	Platinum	Togiak	Twin Hills	Manokotak	Dillingham
1930	---	---	---	71	---	---	---
1939	224	---	45	---	---	---	278
1940	---	---	---	10	---	---	---
1950	194	100	72	108	---	120	577
1960	228	154	43	220	---	149	424
1965	---	---	---	---	20	---	---
1970	340	218	55	383	67	214	914
1980	412	168	55	470	70	294	1,563
1981	448	173	58	513	75	300	1,656
1982	427	215	57	507	75	299	1,791
1983	477	215	59	545	76	299	1,896
1984	424	234	59	554	76	299	2,026
1985	451	234	59	556	79	300	2,100
1986	464	247	62	623	64	299	2,155
1987	493	219	62	623	59	318	2,158

Source: Alaska Department of Community and Regional Affairs Community Census.

Residents of these villages, with the exception of Dillingham, exhibit a high degree of subsistence utilization and dependence, although precise harvest data for most species is unavailable. 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.

Residents of Dillingham make less use of subsistence products for a variety of reasons, including a relatively high cash income per capita (by regional standards). Dillingham is a rapidly growing community which serves as the regional center, the focal point for transportation on a year round basis, and for all other services during the summer fishing season.

A small portion (about 36%) of the recreational use on the refuge is generated by residents of the remaining six villages, as they pursue their subsistence lifestyles. For subsistence purposes, the large tracts of land which have been selected and conveyed to village corporations or individuals around village sites, fish camps, and hunting camps, provide a respectable buffer zone between village and refuge lands. The villagers will travel beyond the conveyed lands on to refuge lands during the winter, when snow and ice conditions allow travel by snow machine. Travel by boat, up the rivers to areas of the refuge appears to be dictated by seasonal weather patterns and is more closely related to the commercial fishing season closures.

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.

Over 2,000 visitors and 12,000 estimated use days have been associated with the sport fishery on the refuge in 1987. Use appears to be down from peak estimates in 1986 of 2,500 people and over 11,000 use days. This use primarily occurs on the three major rivers--the Kanektok, the Goodnews, and the Togiak. Guided anglers account for nearly 80% of the sport fishing public use. Unguided anglers' main access is by air taxi to the headwater lakes of the major rivers, either for day fishing or to launch their raft trips down the rivers. Twenty-two special use permits were issued to sport fish guide operators, and two were issued for guided big game hunting, which is generally concentrated on brown bears. An approximate average of 100 use days by guided hunting parties were reported for 1987, with an estimated 20 use days by Dillingham residents.

## 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 on Togiak NWR and the services 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.

RM Fisher operated a booth, presenting the Fish and Wildlife Service management and employment potential during the local high school Career Day.

BT Lisac made three visits to the Dillingham Elementary School during National Wildlife Week, to present a slide show, question and answer session to several students. Fish anatomy was the topic for a kindergarten class dissection project, while the fifth graders wanted to see the insides of their recently deceased pet toad.

FB Harper was an honored judge at the Dillingham Science Fair.

On May 4 and 5, FB Harper took middle and high school students of Togiak on a marine ecology field/camping trip along west Togiak Bay. Major topics discussed were the species of fish and wildlife on the refuge and marine environment, and the importance of salmon to the ecosystem.

Many local village meetings were held in the villages of Togiak, Twin Hills and Manokotak to answer questions and to solicit support for the up coming caribou reintroduction project to take place during 1988. Overall village support is good although some misgivings by local subsistence users were voiced. PUI of Region 7, contracted for a video program production explaining the reintroduction process and purpose. This proved to be a valuable tool to reach a larger number of people. A Yupik translation version was in the works by year end.

ARM Jerome attended the November monthly meeting of the Bristol Bay Native Association (BBNA) to answer questions concerning the Marine Mammal Protection Act.



BT Lisac represented the USFWS at a teachers workshop held in conjunction with the University of Alaska. The purpose of the workshop was to discuss the potential for refuge projects to be incorporated into the schools science curriculum and students Amiga computer training.

## 8. Hunting

Local rural residents engage in waterfowl and small game hunting, as well as limited amounts of big game hunting for moose and bear on refuge lands. Aerial surveys of spring waterfowl subsistence hunting camps indicate hunting between Kulukak Bay and Asigyukpak Spit remained the same in 1987 as in 1986, which was 22 hunting camps. Chagvan Bay had three camps during the spring hunt. Approximately 13 parties or 33 hunters traveled by boat or all-terrain vehicles (ATVs) to participate in short waterfowl hunts. The hunters spent a total of 78 use days hunting at Chagvan Bay. These numbers are down by 24% (number of hunters) and 39% (hunter use days) from 1986. Herring season was earlier during 1987 and most likely interfered with spring waterfowl hunting.

Fall waterfowl hunting pressure was once again very light as compared to the spring hunt. During the fall hunting season, migrating waterfowl move rapidly through the area. Generally mallards and pintails compose the bulk of the hunters bag, however an occasional Canada goose or brant will be found in the bag also. Geese stage at only three locations on the refuge which are located a considerable distance from the villages and are less likely to be taken by fall hunting activity. Very few non-resident hunters, (those people not living in the vicinity of refuge lands), travel to the refuge for waterfowl, upland game birds or small game hunting.

Two big game guides reported guiding a total of seven (7) bear hunters on refuge lands during the 1987 fall hunting season. Forty-two (42) hunter use days were invested to bring in a total of seven (7) brown bear, which all came from the Upper Togiak River and upper Kulukak River drainages. Two (2) brown bears were taken by unguided hunters in the Kulukak River drainage this year.

It is nearly impossible to obtain big game harvest information from local rural resident hunters (village hunters). Reports are usually obtained during the course of general conversations with non-native village residents, or from information gleaned from casual conversations with village residents, who are reluctant to reveal their big game harvest data. This reluctance is due to the fact that most of their harvest usually occurs during closed seasons, or in units on the refuge which have been closed by state regulations. This year was unusual in that



refuge staff was not able to obtain any subsistence harvest information related to moose, bear or caribou. We are aware of six (6) moose kill sites during the spring and one (1) caribou and two (2) bear taken during September by subsistence hunters.

Residents of all six villages, within or adjacent to the refuge, harvest marine mammals throughout the year. This activity is primarily directed towards harbor or spotted seals that are concentrated near coastal fish spawning grounds. Four (4) walrus were taken at Cape Peirce this year for subsistence use. One other walrus was taken by hunters who removed only the flippers, head and tusks and a patch of belly meat measuring 18 inches by 18 inches.



Local residents butchering a walrus at Cape Peirce.  
A. O., 1987.

## 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, trout, cod, smelt, or flounder, while during the ice free season they fish with rod and reel or gill nets for trout, 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 \$1200-\$3400, for 6-10 day fishing excursions which will include float trips, tent base camps on the rivers, and/or full lodge accommodations located off the refuge, with daily fly-in fishing to various refuge rivers and lakes. During 1987 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.

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, and flying 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 28 shows the best estimates for 1987.



TABLE 28  
1987 Estimated Use Day Levels on Togiak NWR

Type of Use	Kanektok	Goodnews	Togiak	Total
Guided float*	1,977	258	243	2,478
Guided fly/mboat**	1,957	1,274	1,576	4,807
Unguided float*	713	526	438	1,677
Unguided Other***	50	60	90	200
Total:	4,697	2,118	2,347	9,162

\* From refuge public use contact stations on Kagati, and Togiak Lakes; (guided use only includes clients), and air taxi reports for Goodnews Lake.

\*\* From special use permit operator use reports

\*\*\* From air taxi trip reports and refuge estimates

The Kanektok River supports a large sport fishery for salmon in the lower river, as well as a rainbow, Dolly Varden, 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 74% of the total use. In 1986, it is estimated that 1,100 people fished the Kanektok River.

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 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. Approximately 70% of the use on the river is by guided motorboat users, while all guided use accounts for approximately 72% of the total use. An estimated 381 people fished the Goodnews River in 1987.

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 1987 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 81% of the use on the river was by fly-in and motorboat users, while guided use accounted for nearly 87% of the total use. In 1987, an estimated 1,000 people fished the Togiak River for one or more days.

#### 10. Trapping

Trapping on refuge lands that adjoin village corporation lands is common when winter snow and ice conditions permit snow machine or three-wheeler travel. Interior portions of the refuge receive relatively light trapping pressure and should be characterized as small mammal or small game hunting by snow machine and rifle, rather than trapping. Special Use Permits for trapping are not yet required on Togiak NWR.

Generally speaking, refuge fur bearer population levels are unknown, and total harvest data is unavailable. Many animals harvested by subsistence users are neither tagged nor reported to ADF&G, unless the trappers intend to sell the pelts. Beaver, weasel, river otter, mink, and fox are the most commonly trapped animals on the refuge, although a few wolverine and an occasional lynx are taken each year.

During the past several years, the amount of aerial hunting for furbearers seems to be increasing. As a result of this activity, the wolverine population on the refuge appears to be in steady decline, based on wolverine observations per hour while flying over interior refuge lands; however, solid quantitative data is not available. Wolverines have become the principal animal pursued by this type of activity, although a few land otter and fox are probably taken incidental to these aerial hunts. Alaska state regulations require that hunters and/or trappers land before attempting to shoot any fur bearers.

Beavers are also heavily harvested. It is estimated that the villages of Twin Hills, Togiak, Quinhagak, Manokotak, Platinum, and Goodnews Bay field nearly 85 trappers every year. ADF&G surveys during 1987, indicate that refuge streams have an average of 2.12 beaver cache per mile of stream surveyed; well above the 1984 survey average of 1.5 caches per mile. Refuge Fur Bearer Inventory Plans call for beaver cache stream surveys when



manpower and funds permit. These surveys will be done in cooperation with ADF&G. No beaver cache surveys were conducted by refuge staff in 1987.

The Dillingham ADF&G biologist reported tagging 350 beaver, 5 lynx, 44 land otter, and 2 wolverine this year. These animals were taken in the Togiak River drainage and all drainages east of the Togiak River. The Goodnews and Kanektok rivers drainage harvest reports showed 578 beaver hides and 67 land otter hides were tagged by the ADF&G office in Bethel. Fur buyers reported that fur quality was good this year.

#### 11. Wildlife Observation

Most wildlife observation is associated with other recreational activities such as; sport fishing, beachcombing (on foot and via aircraft), river float trips, and hunting.

Walrus haul out activity at Cape Peirce continues to draw the attention of a few refuge visitors. Those who insist on observing this activity are instructed to land on the east side of the Cape and walk overland and contact refuge personnel at the cabin.

In 1987 there were an estimated 825 visits to the refuge and 1700 activity hours estimated for wildlife observation.

#### 12. Other Wildlife Oriented Recreation

This is primarily a subsistence activity and consists of berry picking, greens picking and firewood gathering.

Wildlife photography is usually associated with other recreational activities such as sportfishing, hunting, beachcombing, and river floats. Usually there are a few photographers/outdoor writers visiting the refuge each year, who are associated with a sportfish guiding operation and are getting pictures and information for magazine articles. During 1987 there was a video (Rivers Full of Silver) tape produced describing sportfishing at Ron Hyde's Goodnews River camp.

#### 13. Camping

Camping (non-rural resident use) on the refuge is directly related to sport fishing, river rafting, or hunting. The refuge does not provide any camp facilities; however, several sport fish guides provide semi-permanent camps on major river drainages. One big game hunting guide provides a temporary camp for his clients during the fall bear season.



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

#### 15. Off-Road Vehicling

The only off road vehicles authorized for use on the refuge are snow machines. These are for use only during periods of adequate snow cover. Snow machine traffic on the refuge is rather extensive, at times, during the winter. The tracks serve as travel routes, connecting various villages. Three wheelers and the newer four wheelers are primarily used on beaches and native selected or conveyed lands.

Specific for Alaskan Refuges has been the modification of 50 CFR, Part 36.2(h). This amendment further defines an off-road vehicle as follows:

"It includes but is not limited to four wheel drive or low pressure tire vehicles, motorcycles and related two, three, or four wheel drive vehicles, amphibious machines, ground-effect or air-cushion vehicles, air-thrust boats, recreation vehicle campers, and any other means of transportation deriving motor power from any source other than muscle or wind."

This long awaited modification should help us address the issue of "off road vehicles and motorized equipment" in the refuge wilderness area.

#### 17. Law Enforcement

While law enforcement efforts did not dominate personnel time this year, at least three incidents were unusual and worth mentioning.

On July 13, over thirty (30) boats from the village of Quinhagak went up the Kanektok River to "close the sport fishery" on the river. Several sport fish guides were confronted. The guides were asked to take their clients to the airport immediately, when the guides refused, the locals asked for their rods and reels. Fortunately no violence occurred although there were allegations that the locals were armed and threatened the guides.

The next day, representatives from the Service, Alaska Department of Fish and Game and the State Troopers met with the people to discuss the issue. ADF&G fish biologists presented the situation and the reasons for commercial closures. The people insisted that if the commercial season was to be closed, then the



sport season should be closed as well. Ultimately, the commercial season remained closed and the sport fish season remained open.

During the next two days, four state troopers were stationed on the lower river while two Service special agents and one refuge officer were stationed on the upper river. No incidents occurred.

In an incident at Cape Peirce, several walrus were shot and killed by hunters from the villages of Togiak and Goodnews Bay. In the ensuing stampede off the haul out, an additional animal was killed. Information was taken by refuge volunteers stationed at Cape Peirce. Subsequent investigations in Platinum Village by Special Agent Roger Parker and RM Fisher led to an admission by the hunters responsible. By December, this case was before the U.S. Attorney for violations relating to wanton waste under the Marine Mammal Protection Act.

On a routine patrol, RM Fisher, WB/P Hotchkiss, and Int. Dyasuk stopped at Heart Lake to talk with native hunters from the village of Kwethluk. Upon inspection of their camp, caribou and brown bear carcasses were discovered. Unit 18 is closed to the taking of caribou. Information was taken and conveyed to RM Perry at the Yukon Delta NWR headquarters in Bethel. Subsequently, the information was turned over to the State Fish and Wildlife Protection for action.

Moose surveys were conducted on the refuge on March 2 and 3. A total of five (5) unlawful kill sites were found. No evidence was available to legal action.

The annual law enforcement refresher training scheduled in Anchorage during February turned out to be the "real thing". On the third day of the training, refuge officers RM Fisher and WB/P Hotchkiss were notified that they would be part of a nation wide takedown operation. The operation resulted in numerous arrests and seizures.

During November RM Fisher was reviewing brown bear sealing certificates with the local ADF&G biologist and noticed that a big game guide had listed several clients as having killed bears on the refuge. Since a special use permit had never been issued nor had one ever been applied for, we began to get suspicious. Law enforcement was contacted and the information was turned over to them. To be continued.....



## I. EQUIPMENT AND FACILITIES

### 1. New Construction

The refuge headquarters moved upstairs to the second floor of the Choggiung building. The floor space was doubled as a result of the move, thereby alleviating a serious crowding problem for a growing staff.

Construction of the refuge bunkhouse is nearing completion this year. By December the contractors were finishing electrical and plumbing work on the interior. Seasonal refuge staff will now have adequate housing. The refuge house trailer that served as a bunkhouse previously will be available as a residence for refuge staff.



Ground breaking and footings for the new bunkhouse.  
DAF, July 1987.





View of the bunkhouse ready for trusses overlooking  
Nushagak Bay. DAF, July 1987.

A storage building is also nearing completion and will provide facilities necessary to secure, store, and repair refuge equipment.





This 30'x36' storage building will help in organizing and maintaining all our field equipment and supplies.  
DAF, 1987.

These facilities mark the beginning of a long overdue construction program for the refuge. It is hoped that funding will continue long enough for the completion of a combined refuge headquarters and visitor's center as well as new residences for staff.

## 2. Rehabilitation

By the end of this year, plans were being developed for the rehabilitation and expansion of the Nanvak Bay cabin. This cabin is utilized at least five months of the year and is essential for refuge operations at Cape Peirce and Cape Newenham.

## 3. Major Maintenance

All vehicles, residences and equipment received routine maintenance. No major repairs were necessary this year.

## 4. Equipment Utilization and Replacement

Cessna 185, N748 was used extensively this summer to support refuge field camps. As many as seven (7) field camps were being



serviced during one time period with 400 hours of flight time being logged for the season until 748 flipped over and sunk in Nanvak Bay.

Cessna 206, 9497R was borrowed from the Division of Fisheries in Fairbanks to replace Cessna 185, N748 until a replacement Cessna 185 is assigned to the refuge by the Office of Aircraft Services.

A four wheel off-road vehicle and two snowmobiles were purchased this year to assist in the refuge operations. These vehicles will be utilized during the caribou transplant.

## 5. Communications Systems

During the field season, five HF SSB Motorola Micom S radios, two Transworld HF SSB radios, and one SGC 715 portable HF SSB 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 SSB radio.

Probably the biggest radio communication problem we currently face is the amount of traffic that occurs on the 3215.0 frequency. Competition for a time block between 8:00 am and 9:30 am, is fierce. Understandably, each station using this frequency wants to check in with all of their field camps, as soon as possible every morning, to be informed of any problems and determine the needs of each camp. Hopefully, all of the refuges will continue to work out, and stick to, a compatible time schedule in 1988.

As busy as the morning radio traffic was, evening traffic was much worse. In fact, it would be safe to say that evening radio checks were completely out of hand. For the most part, those conversations were just bull sessions which, if kept under control, serve to preserve and/or uplift the morale of all remote field camps. However, we do feel that each station, ours included, should take steps to restrict their evening radio use to 15 minutes. In addition, the FWS should acquire at least two more frequencies in the 3000 - 4000 MHz range, for use by refuges. The higher frequency (5907.5) allocated for our use has been virtually useless for several years because of atmospheric interference.

The SGC 715 portable transceiver, intended to serve as a communications link between mobile field camps and the refuge office worked better this year than it has at any time since its purchase in 1983. Poor power pack storage, low radio transmission power, and inadequate antenna system problems experienced during prior years were rectified by erecting a long line antenna cut for a single frequency and hooking the radio up



to a heavy duty, deep draw, battery which was swapped for a recharged battery each week.

Overall, we are satisfied with the improvement and reliability of our HF radio communications system. However, there is still a great deal of room for improvement in reliability of the system, in order to avoid the existing potential that could escalate a relatively minor field incident or problem into a life-threatening situation. 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.

The refuge acquired several surplus VHF radios from BLM in Colorado. These radios will be installed in refuge vehicles to facilitate communications between the office and Shannons Pond, Airport and the vehicles around the town of Dillingham.

## 6. Computer Systems

Acquisition of a new pc computer was made during the year when the refuge got another KAYPRO pc computer with a 30 MG hard drive. This acquisition has helped with the crunching of numbers associated with the creel census project, walrus data, sea bird data entry, recreational use surveys, and keeping track of refuge public use. These computers have certainly saved the refuge countless staff days of hard labor and data analysis. The refuge is still in need of two additional work stations for the amount of work that is carried out here. These stations would facilitate the bottle neck of data crunching and word processing that takes place at the end of the field season when staff, volunteers and bio-techs are trying to complete their summer reports.

The refuges Data General DG-10SP had major surgery during the later part of the year. All the major internal components of the machine were replaced several times before the company finally sent someone out to repair the machine. Even after this person came out it was necessary to send the complete machine into the Anchorage office to have it repaired. During this down time the office got completely behind in financial tracking and other requirements that the regional office was still placing on the station.

During the year the station switched from the old Data General AOS/CEO program on the DG and installed AOS/Word Perfect software. This was completed in a week. Again it was painful to almost shut down the station as this computer-ectomy took place.



Another item that will greatly help the station is the new tape back up system for DG-10SP. Since the machine went down in October we were afraid that the hard disk had possibly lost all of the programs and information that was electronically stored. To circumvent part of this problem the refuge acquired a tape back up system that will allow the back up of all data in 20 minutes. This new option will allow the secretary to completely back up the system every several days.

## 7. Energy Conservation

The increases in energy consumption for Calendar Year 1987, (Table 29), are primarily due to accelerated field activity.

TABLE 29  
Energy Conservation Comparison

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

\*\*Includes boat gas, kerosene, blazo

The increase in propane use occurred when we switched from Coleman stoves, which use blazo, to propane camp stoves. The propane stove was more efficient, required less maintenance, and was easier to operate.

Miscellaneous fuels increased with the consumption of boat gas. The Togiak River Creel Census, and Lake Mapping projects were new during 1986, and required use of additional boats and outboard motors.



## J. OTHER ITEMS

### 1. Cooperative Programs

WB/Pilot Hotchkiss assisted Alaska Maritime NWR personnel with an aerial survey for reindeer on Hagemeister Island.

Refuge personnel (volunteers) helped ADF&G conduct salmon counts at the Togiak River counting tower. We put three (3) volunteers at the camp to help one (1) state technician. We were still able to obtain most of our public use data and also use ADF&G facilities rather than set up our own camp.

By the end of the year we had entered into a cooperative agreement with ADF&G for the refuge caribou reintroduction. The agreement specified that ADF&G would be responsible for procurement of 25 radio collars and 150 visual collars. ADF&G would also be responsible for contracting to have the helicopter (capturing effort) work completed. Originally the refuge was going to handle this but it became apparent that we were going to get in a tangle of red tape with CGS regarding the radio collars and helicopter operator. It was easier to set up a cooperative agreement with ADF&G and just transfer a set amount of money to them. This way we would get the type of collars we wanted and also the helicopter operator who could do the job.

The refuge (Service) also entered into a cooperative agreement with ADF&G, Togiak Village, Manokotak Village, and Choggiung (Dillingham Village Corporation). The purpose of the agreement is to provide the necessary coordination between the service, department and cooperating villages for the reintroduction of caribou. The agreement was signed in October by all parties except Twin Hills Village and the Service. The regional director was expected to sign the agreement in early January 1988.

### 2. Other Economic Uses

The Bureau of Mines conducted site specific mineral investigations and a recon sampling program in the Goodnews Bay Mining District in 1986. The above area is adjacent to and is part of the refuge. The results of the sampling were received in 1987 and are summarized as follows:

This program is designed to determine the mineral development potential of mineral deposits in the district, identify mineral resources and reserves and evaluate economic feasibility of mining. The results indicate that approximately 70% of the mineral deposits in the district are located in two areas: Slate-Wattamuse Creek and Red



Mountain. Placer deposits with high mineral development potential are located on Wattamuse and Cascade Creeks. Gold was found in rocks associated with the intrusive at the head of Wattamuse Creek.

In the Red Mountain area, platinum-group metals (PGM) and gold were found in the Salmon River and its tributaries and along the beach from Platinum to Chagvan Bay. All of the eastern tributaries of the Salmon River that drain Red Mountain and the beach along Kuskokwim Bay from Platinum to the Salmon River have high mineral development potential for small placer mining operations. The Salmon River has a high mineral development potential for a large operation. PGM and gold were found in the weathered unit on Red Mountain and in the glacial deposits that comprise the bluffs along the beach.

Microprobe platinum-group element analyses of placer PGM grains identified twenty-three platinum-group minerals.

### 3. Items of Interest

The first Public Use Management Plan (PUMP) workshop was held in January. Over forty people participated representing five refuge villages, sportfish guides, air taxi operators and State resource agencies.

RM Fisher and WB/Pilot Hotchkiss attended law enforcement refresher training in Anchorage, January.

FB Harper and BT Lisac attended Lotus 1-2-3 training in Dillingham, January. The training was offered by the University of Alaska Rural Education Program.

Public Use Management Plan meetings were held in the villages of Togiak, Quinhagak, and Goodnews Bay, February.

RM Fisher attended the Citizens Participation Workshop in Anchorage, February.

BT Lisac attended an instructor's course in Hunter Safety. The course was sponsored by ADF&G and the National Rifle Association.

RM Fisher, FB Harper and PL Sonnevill (King Salmon, FAO) presented phase one of the refuge fisheries management plan to the regional director and his staff, March.

ARM Jerome attended the Basic Law Enforcement training course (FLETC) in Glynnco, GA., March, April and May.

The refuge office was moved upstairs in the same building, March.



RM Fisher, WB/P Hotchkiss, FB Harper and BT Lisac attended Cross Cultural training, March.

BT Lisac presented programs to the Dillingham Elementary School during National Wildlife Week.

Subsistence waterfowl hunting regulation meetings were held in Dillingham, Togiak, Twin Hills, Goodnews Bay, Platinum and Quinhagak, March.

Kittiwake Arch (Cape Peirce) collapsed sometime during the spring.

Kim Custis was selected to replace Karen Brandt as the refuge secretary.

FB Harper participated as a judge for the Dillingham Middle School Science Fair.

BT Lisac attended a Service workshop in Fairbanks for refuge contaminant studies.

FB Harper attended a statistics workshop sponsored by the American Fisheries Society, Anchorage, May.

Construction of the bunkhouse and storage building started at the administrative site in June.

The Cousteau Society's "Windship" visited Cape Peirce to photograph walrus, July.

FB Harper attended the Central Bering Sea Advisory Committee in Quinhagak, August.

FB Harper traveled to the Togiak River with Gary Edwards (WO Fisheries), Regional Office fisheries personnel, Bill Bond and Dick Erickson of the Canadian Fisheries and Oceans Department and PL Sonnevil, King Salmon FAO. The group spent the night on the Togiak River to tour the refuge creel survey project and KSFAO's side scan sonar operation.

The refuge participated in the second annual Dillingham Fall Fair.

ARM Jerome and Sec. Custis attended small purchases training in Anchorage, October.

WB/P Hotchkiss attended the North American Caribou Workshop in Fairbanks, November.



#### 4. Credits

The 1987 Narrative Report was written by:

- RM Fisher            Introduction; Section A; Sections E(1,2,5,6);  
F(9); G(12); H(11,12,13,17); J(1,2,3,4);
- ARM Jerome        Sections C(1,2,3,); D(1,2,3); E(8); F(11,12);  
H(15,17); I(1,2,3,4,7).
- WB/P Hotchkiss   Sections E(4); F(1,2,6); G(1,2,6,7,8,10,16);  
H(8,10); I(5).
- FB Harper        Sections D(5); G(11); and H(9); I(6).
- BTF Lisac        Sections B; D(5); H(1,7,9);
- BTW Campbell    Sections D(5); G(3,4,5,14).

The report was assembled and processed by Secretary Johnson, and edited by the entire staff.

Special thanks needs to be given to ADF&G (Commercial Fisheries, Sport Fisheries, Game and Subsistence) offices in Dillingham and Bethel for the fish and wildlife information they provided and support of refuge projects. Thanks also needs to be given to the King Salmon Fisheries Assistance Office for the help and cooperation provided to the refuge throughout the year.

Photo Credits:      Permanent Staff:

DAF: Dave Fisher  
DC : Diane Campbell  
KH : Ken Harper  
MJL: Mark Lisac  
FP : File Photo  
JF : Jim Finn (KSFAO)

Volunteers:

VB : Vern Burandt  
DG : Dan Greene  
AO : Allyn O'Neil  
BS : Bruce Seppi  
DF : Doug Flemming,  
1986  
JS : Jenny Seppi



## K. FEEDBACK

The computer systems and word processors are becoming an integral part of the refuge and sometime in the future every staff person should have a terminal at their desk. The extra time spent drafting a letter to be rewritten by the secretary is purely a waste of time. These work-saving devices however have a definite learning curve that has to be addressed up front.

The date that some important paper work was due in the regional office was made the same week that those that made the deadline were on annual leave hunting. Come on boys lets read the calendars and both benefit from the great outdoors. These deadlines caused the small window for hunting in the fall to be missed. However I feel that it was all a ploy to keep certain members of the hunting fraternity out of the prime areas so the big boys could play.