

ANNUAL NARRATIVE REPORT

Calendar Year 1988

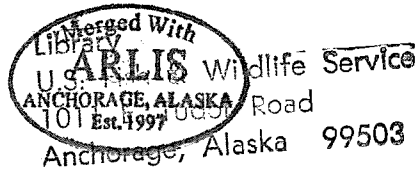
IZEMBEK NATIONAL WILDLIFE REFUGE

Including Izembek, Unimak and Pavlof Units

US FISH & WILDLIFE SERVICE--ALASKA
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IZEMBEK NATIONAL WILDLIFE REFUGE
P.O. BOX 127
COLD BAY, ALASKA 99571

Including:
Izembek, Pavlof and Unimak Units

ANNUAL NARRATIVE REPORT
CALENDAR YEAR 1988

NATIONAL WILDLIFE REFUGE SYSTEM
Fish and Wildlife Service
U.S. DEPARTMENT OF THE INTERIOR



How do you spell that?

- | | |
|---------------|-----------------|
| 1. Isemeek | 40. Eiesenbeck |
| 2. Izembeck | 41. Izember |
| 3. Izembec | 42. Isnbeh |
| 4. Isembek | 43. Izembrek |
| 5. Izenbeck | 44. Izembik |
| 6. Isenbeck | 45. Izemer |
| 7. Iceyembek | 46. Ixembek |
| 8. Izemback | 47. Brombeck |
| 9. Irembeck | 48. Isenbech |
| 10. Izemeek | 49. Izombek |
| 11. 12 Ember | 50. Isenbec |
| 12. I Z Embek | 51. Icenbec |
| 13. Izenbek | 52. Zambeck |
| 14. Izembelk | 53. Rembek |
| 15. Izmebek | 54. Izenbel |
| 16. Izembak | 55. Izenbuck |
| 17. Ezembek | 56. Zaubeck |
| 18. Izambak | 57. Izebbek |
| 19. Izebek | 58. Izembex |
| 20. Izemeck | 59. Bembek |
| 21. Icembec | 60. Jzembeck |
| 22. Izemoeck | 61. Eisenbach |
| 23. Yzembek | 62. Issezenbeck |
| 24. Izembrick | 63. Izembeknwr |
| 25. Isambek | 64. Izumbeck |
| 26. 1 Zembek | 65. Izembia |
| 27. Izimbik | 66. Izembaek |
| 28. Izembeu | 67. Izenbed |
| 29. 12 Enbek | 68. Izembel |
| 30. Iyembek | 69. Izemhek |
| 31. Igembek | 70. Zembech |
| 32. Zembek | 71. Ilemkbek |
| 33. Inzembek | 72. I 2 Ember |
| 34. Zember | 73. Izembell |
| 35. Uzembek | 74. Izemler |
| 36. Tsembek | 75. Ivenbec |
| 37. Izemmbek | 76. Eizenbek |
| 38. Izembez | 77. Zembex |
| 39. Izemek | 78. Icembeck |
| | 79. Lizembeck |

Since the Izembek refuge was established in 1960 we have been misspelled at least 79 different ways.

PERSONNEL

Robin West, Refuge Manager, PFT, GS-485-12	9/12/88-Present
John Sarvis, Refuge Manager, PFT, GS-485-12	6/23/74-4/15/88
Michael D. Blenden, Assistant Refuge Manager, PFT, GS-485-11	8/26/84-Present
Christian P. Dau, Wildlife Biologist, PFT, GS-485-11	1/30/81-Present
Frank Dunn, Maintenance Worker, PFT, WG-4749-8	11/86-10/18/88
Shirley Simpson, Refuge Secretary, PFT, GS-318-4	2/18/88-Present
Rachael Fey, YCC Enrollee	6/7/88-8/29/88
Gary Thrift, YCC Enrollee	6/7/88-8/9/88

REVIEW AND APPROVALS

<u>Robin L. West</u> Refuge Manager	<u>3-10-89</u> Date
<u>ET Hauer Jr</u> Acting Associate Manager, Refuges and Wildlife Review	<u>4-4-89</u> Date
<u>John P. Rogers</u> Regional Office Approval	<u>4-7-89</u> Date





Robin West, Refuge Manager



Michael Blenden,
Assistant Refuge Manager.



Christian Dau,
Wildlife Biologist

Shirley Simpson,
Secretary



Frank Dunn,
Maintenance



YCC Enrollees,
Fey and Thrift



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INTRODUCTION

The Izembek National Wildlife Range was established in 1960 (Public Land Order 2216) with a boundary encompassing 415,300 acres dominated by wet and upland tundra. Within this area are approximately 95,000 acres of tide lands and lagoons owned by the State of Alaska. These areas have been identified as critical habitat by the state and are largely the basis for the identification and establishment of the refuge. Some of the largest eelgrass beds in the world are in these shallow lagoons and this resource, in addition to those in adjacent fresh water and terrestrial habitats, supports the large numbers of migratory waterfowl which characterize the area in fall through spring. Brown bear and barren ground caribou, both impressive resident game species, occur commonly in the area as well.

The Izembek National Wildlife Range became the Izembek National Wildlife Refuge on December 2, 1980, with signing of the Alaska National Interest Lands Conservation Act (P.L. 96-487) by President Carter (Figure 1). Under this act, 16 refuges were either established, redesignated (such as our name change), or enlarged, adding 53,720,000 acres to the National Wildlife Refuge system for a total of 76.1 million acres of refuges in Alaska. The purposes for which each of these 16 refuges are to be managed were also changed and/or defined. In addition, 13 refuge Wilderness areas were established, totalling 18,560,000 acres. A Wilderness area of 300,000 acres was designated from Izembek's total of 320,893.

The Izembek National Wildlife Refuge lies near the western terminus of the Alaska Peninsula, approximately 650 miles southwest of Anchorage. The refuge headquarters is in Cold Bay, Alaska, a largely federal and state government town of approximately 200 people. The Cold Bay office also has responsibility for the administration of part of the Aleutian Islands Unit of the Alaska Maritime National Wildlife Refuge (989,000 acres on Unimak Island) and the 1.5 million acre Pavlof Unit of the Alaska Peninsula National Wildlife Refuge. These areas support some of the largest seabird colonies in Alaska with a wide variety of species present. In addition, Unimak Island and the Pavlof Unit support important populations of brown bear, caribou, furbearers and a resident population of tundra swans. Adjacent coastal areas support rich and diversified populations of migratory waterfowl, marine birds and mammals, and fin and shellfish. Several fishery stocks exist in commercial quantities and activities associated with these resources increase on a seasonal basis. This report on Izembek National Wildlife Refuge integrates information from the Pavlof Unit and Unimak Island Unit.


The Aleutian Islands National Wildlife Refuge was created from public lands in 1913 by Executive Order 1733. The refuge is administratively divided at Unimak Pass. Unimak Island (989,000

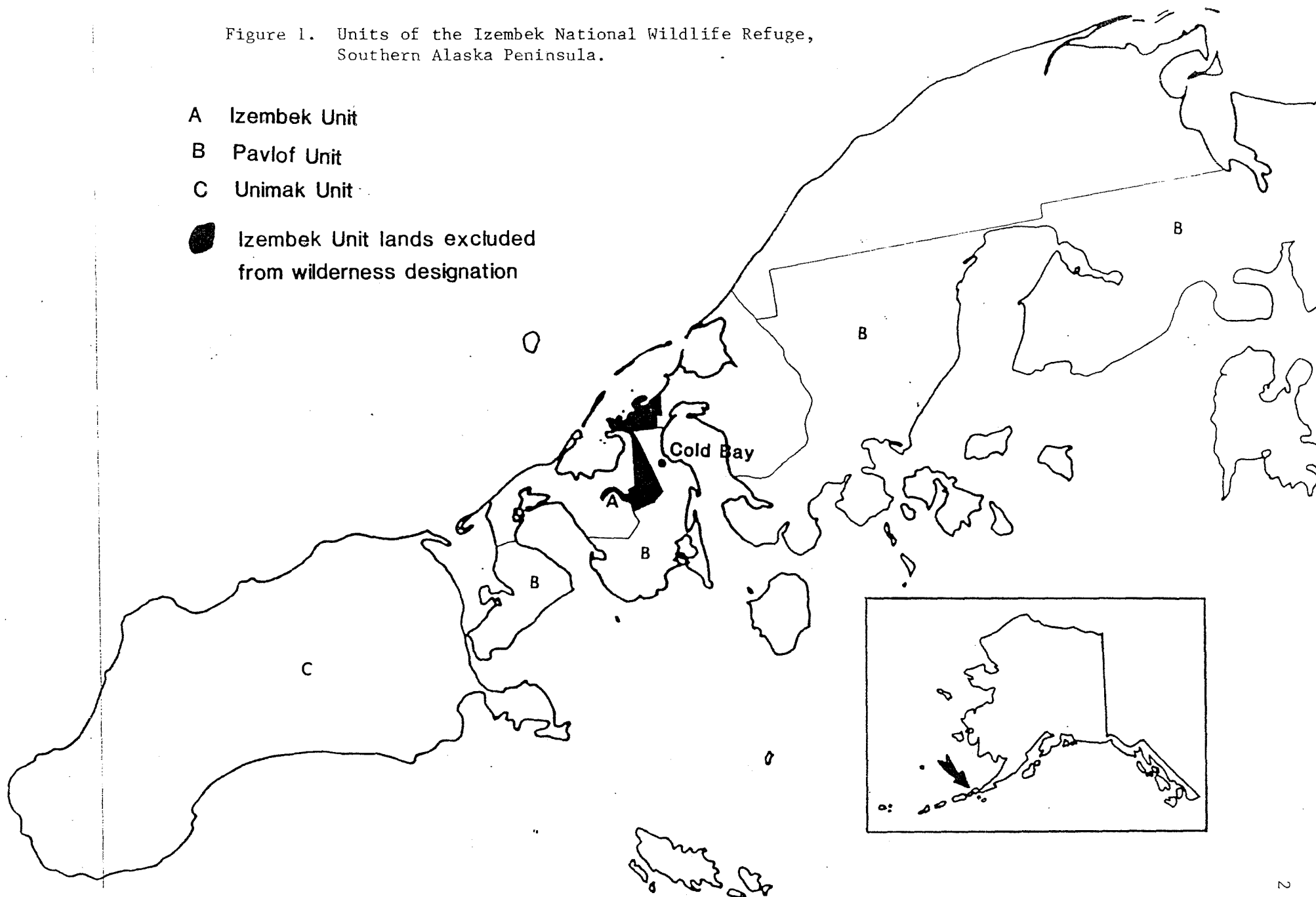
Figure 1. Units of the Izembek National Wildlife Refuge,
Southern Alaska Peninsula.

A Izembek Unit

B Pavlof Unit

C Unimak Unit

 Izembek Unit lands excluded
from wilderness designation



acres) is managed out of the Cold Bay office for logistical and biological reasons. The split conforms to natural boundaries, Unimak Pass forming a distinct and extremely important 'biological' divide before the unique Aleutian flora and fauna of the central and western islands. With passage of the Alaska National Interest Lands Conservation Act, came the establishment of the Alaska Maritime National Wildlife Refuge with an Aleutian Islands Unit, which included the islands that formerly comprised the Aleutian Islands National Wildlife Refuge.

Unimak Island's habitat closely resembles that of the Alaska Peninsula, although it is somewhat impoverished. Cover, such as alder and willow shrubs, are quite restricted in distribution, and there are fairly extensive, bare or nearly bare, ash and lava flows of varying ages. Especially in the western portion, salmon runs are small or non-existent, due partly to steep terrain and bluffs which make upstream negotiation impossible.

Since 1982, management responsibilities for the Pavlof Unit of the Alaska Peninsula National Wildlife Refuge have been assigned to the staff of Izembek National Wildlife Refuge. The Cold Bay office is more centrally located and hence, logistically able to adequately perform the required management functions.

The Pavlof Unit encompasses approximately 1.5 million acres of which well over half is native-selected or conveyed. This patchwork of land ownership may cause problems with management of the refuge, in particular, since the native corporations have selected the coastal areas which are also the most important lands to wildlife.

The Aleutian Range runs the length of the Pavlof Unit and provides some of the most spectacular scenery in Alaska. Pavlof Volcano, the highest peak at 8,261 feet, is an active volcano that has erupted several times in recent years. The northern portion of the unit is characterized by lowland meadows interspersed with numerous ponds and lakes and areas of upland tundra. The southern portion is mountainous with steep-sided valleys drained by alder-lined streams supporting large salmon runs.

Maintenance of refuge habitats in their present pristine condition is the goal of the refuge staff. In view of land status changes resulting from the Alaska National Interest Lands Conservation Act and the potential leasing and subsequent development of offshore petroleum rich basins in the Bering Sea, this chore will be no small one. Ongoing research, such as the effects of disturbances on black brant and other waterfowl and movements and population dynamics of brown bear and caribou, will provide support of our goal of protecting wildlife and its habitats.

A. HIGHLIGHTS

1. CHANGE OF COMMAND: John Sarvis leaves Izembek after 14 years and Robin West arrives to begin his term.
2. Demolition and burial of Grant Point Air Force radar site completed.
3. Electrical switching and feeder line problems evaluated and corrected by contractor and refuge staff.
4. Preliminary water quality sampling begun on six refuge lakes.
5. Biologist Dau receives flight authorization from the Department of the Interior.
6. Intensified, cooperative work on the Southern Alaska Peninsula Caribou herd undertaken.
7. Research project designed to access disturbance factors to waterfowl on Izembek Lagoon completed.
8. Eighth annual spring emperor goose survey completed in cooperation with Migratory Bird Management North with a count of 53,784 (+4% from 1987).
9. Brant and emperor goose productivity counts were conducted for the 26th and 22nd consecutive years, respectively. Juveniles made up 19.3 and 24.2 percent of the respective populations.
10. Fifty-one tundra swans were captured during banding/neck collaring operations on the Izembek Unit.
11. Sixth year of productive and safe Youth Conservation Corps programs completed.
12. Refuge goes on own water well system.

B. CLIMATIC CONDITIONS

Cold Bay and the Izembek refuge's typically exciting climate was just that in 1988 (Table 1). Average weather for the lower Alaska Peninsula means about 16 mile per hour (mph) of wind per day and an average blow of 62 mph at least once a month. The old adage of "battening-down-the-hatches" came into use in September when sustained winds of 80 mph (peaks of 95 mph) transferred property without the required paperwork. So much for the winds and yes, these are typical conditions.

Table 1. Summary of Weather Data, Cold Bay, Alaska, 1988

Month	Av. Temp. (°F)	Departure from Av.	Precip.	Departure from Av.	Wind Speed (Av. mph)	Peak (mph)
January	31.2	2.9	3.70	1.00	15.6	68
February	30.2	2.7	2.91	0.64	17.1	60
March	26.1	-2.5	0.89	-1.42	15.8	59
April	31.1	-1.9	1.81	-0.14	18.4	54
May	40.3	0.8	2.70	0.23	16.3	69
June	46.0	0.6	1.69	-0.47	16.1	54
July	51.0	0.7	1.12	-1.38	14.4	44
August	51.1	-0.1	3.03	-0.67	15.1	54
September	46.9	-0.6	3.90	0.13	16.9	95
October	40.5	1.0	3.25	-1.04	15.8	40
November	32.5	-1.8	3.98	-0.06	18.5	46
December	30.9	1.4	6.37	3.52	22.4	56
1988 Average	38.2	0.3	35.4 (1988 Total)	0.03	16.9	58

Data reported by the National Weather Service, Cold Bay, Alaska

This figure is the fastest mile (i.e. it is the peak sustained wind for a one-minute period). Actual peak gusts (less than one minute duration) are much higher.

The average monthly temperature in Cold Bay is less than 40 degrees (F), hence the name. It does warm into the 60's in July and August briefly. Vegetation must grow fast during a short period of time. The flora of the area is lush and well adapted to the short growing season. Primary crops include crowberries, salmonberries and blueberries and for the geese, eelgrass. These species all fared well in 1988 and consumers were well fattened by the bountiful harvest.

The high and gusty winds discussed earlier are generated each fall and winter as a continuous series of cyclonic low pressure systems sent to us from our Japanese and Soviet neighbors. The sequence of events in such systems are as follows: southerly winds and driving rains pelt the area, then calm as the "eye" of the storm passes, then northerly winds and blowing snow prevail as the "backside" of the low passes. There are the occasional nice days between systems, events which we "Aleuts by choice" enjoy so much.

Birds and mammals, which call the lower Alaska Peninsula home for all or a part of the year, thrive at varying levels of abundance. Adaptations have provided them the characteristics and behavior to prosper in conditions modern man views as inhospitable. Pacific brant and Taverner's Canada geese, our two primary fall migrants, make important survival-related use of the cyclonic lows we hide from. From 22 October to 2 November these species picked storms of suitable intensity to give them supportive tail-winds along portions of their flight to Mexico and Oregon, respectively. Other species exhibit similar, albeit less dramatic, behavioral adaptations with respect to migration (or annual leave) all of which is largely dictated by climate.

C. LAND ACQUISITION

Native conveyed lands (22g-Alaska Native Claims Settlement Act) within the Izembek National Wildlife Refuge and conveyed and selected lands adjacent to the Pavlof Unit of the Alaska Peninsula National Wildlife Refuge vary in resource value. The village corporations of King Cove, False Pass and Pauloff Harbor have suggested they are interested in land exchanges and the Realty Division prepared Land Exchange Ascertainment Reports for lands belonging to each of these three Native Corporations. These reports were distributed in December of 1986 allowing further negotiations to proceed.

Preliminary responses by the Native Corporations to appraised land values presented in the Realty Division ascertainment reports were not encouraging. Their trade lands, largely marsh, exposed coastline and areas adjacent to shallow estuaries, were evaluated at a quite low dollar/acre figure. Proposed United States Fish and Wildlife Service trade lands adjacent to the Cold Bay road system were, on the other hand, valued quite high due to their economic development potential. It will be necessary to negotiate

a reasonable compromise if any land exchanges are to be consummated. Progress toward an exchange in 1988 was essentially nil as the Native corporations were digesting the Service proposal and formulating responses of their own.

The Alaska Peninsula National Wildlife Refuge Comprehensive Conservation Plan and the Bristol Bay Cooperative Management Plan suggest the potential for land exchanges involving the Fish and Wildlife Service. Our potential trade lands are those areas of the Pavlof Unit of the Alaska Peninsula refuge adjacent to the town of Cold Bay.

The possible land exchange in the southern Alaska Peninsula area would add valuable wildlife habitat to the refuge while at the same time provide the private sector with commercially valuable land.

D. PLANNING

1. Master Plan and 2. Management Plan

The Izembek National Wildlife Refuge Comprehensive Conservation Plan mandated by the Alaska National Interest Lands Conservation Act in 1980, was finalized in 1985. We are currently operating under that plan.

In general, this plan restated the Fish and Wildlife Service's desire to continue management of Izembek refuge as has been done since it was established in 1960. The Service selected a management alternative that will continue to manage 300,000 acres (95% of the refuge) as wilderness. The remaining 15,000 acres (5% of the refuge) consist of refuge land adjoining the city of Cold Bay and the associated road system. This land was not designated as wilderness in 1980, due to the extensive system of roads and disturbance from military habitation during World War II. Under the Service's preferred management alternative, this land will not be recommended for wilderness designation, but is designated as a Minimal Management Area in which development and vehicular access would be kept at current levels.

4. Compliance with Environmental Mandates

In accordance with the Alaska Coastal Zone Management Act, the Aleutians East Coastal Resource Service Area was formed. The Izembek refuge falls within the boundaries of the Aleutians East Coastal Resource Service Area. In addition to this administrative designation, the Aleutians East Area voted in 1987 to become a borough of the State of Alaska. The borough went into effect in 1988. Plans call for establishment of a borough government and elected school board for the area as a whole rather than the village by village approach previously maintained. Implications of a borough government on individual residents of the area are

unfolding. We hope the basic goals for which the borough was established can be manifested in long-term strategies.

5. Research and Investigation

Refuge Personnel

Fall Composition Counts and Population Indices of Brown Bear on the Izembek Refuge

Survey areas of important brown bear habitat within the Izembek and Unimak Units of the Izembek refuge were flown in 1988 after a four year lapse. These animal surveys will provide trend data important for management of brown bears on the lower Alaska Peninsula. See Section G.8, Game Mammals, Brown Bear.

Seasonal Movements, Distribution and Productivity of Caribou on the Izembek Refuge

Census efforts, begun in 1979, were continued along with continued ground productivity appraisals. Use of radio telemetry equipment was begun in 1986 and expanded through 1988 in coordination with the Alaska Department of Fish and Game. See Section G. 8., Game Mammals, Caribou.

Caribou Winter Range Survey

Vegetative composition of three general habitat types within the wintering area of the southern Alaska Peninsula caribou herd are being evaluated to provide baseline data on species composition, distribution and abundance. These data will be compared to patterns of caribou distribution and forage consumption. Analysis of fecal deposits will quantify selected versus available forage species. See Section G. 8., Game mammals, Caribou.

Caribou Age and Condition Index

A large sample of hunter harvested animals were involved in this aspect of caribou research being performed by the refuge staff. Aging of individual animals will be assessed by both degree of tooth wear and by sectioning of incisors. The Game Division laboratory of the Alaska Department of Fish and Game is performing the tooth sectioning. In addition, other anatomical indices will be used to address general fitness, reproductive rate and food preferences. See Section G.8., Game Mammals, Caribou.

Population Size and Productivity of Pacific Brant

This continuing program receives a high degree of emphasis during the fall staging period to ensure accurate assessments for management of the species throughout the Pacific Flyway, per the Pacific Flyway Black Brant Management Plan. This work in 1988 is summarized in Section G.3., Waterfowl, Black Brant.

Population Size and Productivity of Emperor Geese

Emperor geese winter in the Aleutian Islands and the Alaska Peninsula and use the Izembek refuge extensively during spring and fall migration. Fall productivity surveys and periodic inventories aid in implementing the Pacific Flyway Emperor Goose Management Plan. The 1988 project results are summarized in Section G 3., Waterfowl, Emperor Goose.

Water Quality Sampling in Lakes on the Izembek Refuge

Fertile freshwater lakes with tributaries to the sea are important habitats for fish, aquatic mammals and water birds. Aquatic vegetation is an important component in the biological make-up of these water bodies. This project involves the collection of baseline data on water chemistry. Characteristics such as size and depth of each water body evaluated will also be determined.

Seasonal Movements and Population Dynamics of the Resident Tundra Swan Population

Aerial surveys of nesting tundra swans on all the Izembek Unit and portions of the Pavlof Unit were completed. Brood surveys were also flown to access productivity in this semi-resident population. Forty-seven new birds and 4 previously banded birds were captured. See Section G. 3., Waterfowl, Tundra Swan.

Other Personnel

Behavior and Energetics of Pacific Black Brant and other Geese in Response to Aircraft Overflights at Izembek Lagoon

Research Division personnel from the Alaska Fish and Wildlife Research Center completed their analysis of disturbance factors affecting spring and fall staging geese of the Izembek refuge. See Section G. 3., Waterfowl, Black Brant.

E. ADMINISTRATION

1. Personnel

Refuge Manager John Sarvis left the Izembek refuge in April after 14 years at the station. He took a composite position in the Anchorage Regional Office that includes duties such as Regional Aircraft Manager, biological project reviewer and assistant to the Refuge Supervisor. Johns predecessor, Robert D. "Sea Otter" Jones, was the first Izembek manager, a position he held for 28 years. A trend may be appearing, only time will tell if it is cyclic or otherwise. Robin West was selected as Izembek's third



A preliminary sampling of Izembek refuge lakes adjacent to the road system was begun in 1988 with the Youth Conservation Corp enrollees.

manager and was welcomed on board along with his wife Shannon on 12 September 1988.

Maintenance Worker Frank Dunn was selected for a similar position at the Alamosa/Monte Vista Refuge in Colorado departing Cold Bay on 18 October. The Maintenance Worker position was advertised and Thomas Morey was selected in mid-December.

Shirley Simpson was hired to fill the vacant Refuge Secretary position on 22 February 1988. Shirley was hired as a temporary clerk and extended a month through April 22, 1988. She was then re-hired as a permanent Clerk/Typist on May 18, 1988. This is Shirley's first experience working for the Government and it was a bit over-whelming at the start. Now, after attending a Small Purchase Seminar and Administrative Workshop in Anchorage she has a much better understanding of what is involved in the operation of a refuge. After several months of tackling finances and administrative duties Shirley has been promoted to Secretary GS-4/1, effective January 1, 1989.

No other changes of permanent personnel were made in 1988. (Table 2).

2. Funding

Shown in Table 3.

3. Safety

No lost time accidents involving refuge personnel or cooperators occurred during 1988. Safety related materials received from the Regional Office were read and discussed by the staff during safety meetings or irregularly as various needs arose.

A full day was devoted to orientation of our two Youth Conservation Corps enrollees. A large percentage of the discussion and materials related to safety during their field and headquarters work schedule.

A long-standing and dangerous electrical nightmare was dealt with in May and June of 1988. Distribution of power beyond the local utilities distribution box to our four residences, bunkhouse and office/shop complex has caused recurring problems. Internal surgery and external face-lift has put us back into safe operations. See Section I. Equipment and Facilities, 2. Rehabilitation.

Biologist Dau attended the annual Office of Aircraft Services ground school from 6-8 December. Numerous safety related topics were discussed and specific training in fuel handling and cold water survival was provided.

All members of the Izembek staff received briefing or refresher on safety aspects of wheel/ski and float plane operations. Several

Table 2. Staffing pattern, Izembek Refuge

Fiscal Year	Full Time	Part Time	Temporary	Youth Conservation Corp.
1977	3	1	1	-
1978	4	1	1	-
1979	4	1	1	-
1980 ^{/1}	3	3	1	-
1981 ^{/2}	3	2	-	-
1982	5	-	-	-
1983	5	-	-	2
1984	5	-	-	2
1985	5	-	-	2
1986	5	-	-	2
1987	5	-	-	2
1988	5	-	-	2
1989	5	-	-	2(tent.)

/1 Includes 1 full-time and 1 permanent part-time ceiling and funding for Cape Sarichef field station.

/2 One full-time ceiling and 1 permanent part-time ceiling vacated due to closing of Cape Sarichef field station. One full-time ceiling filled at Izembek.

Table 3. Funding for Izembek Refuge (in thousands of dollars)

Fiscal Year	1210	1220	1240	1260	1360	1500	Total
1977	93 ^{/1}	17				5	115
1978	122 ^{/2}	25 ^{/3}	20 ^{/4}				167 ^{/5}
1979	128	35	15				178
1980	169	40	16				225
1981	160	75	13				248
1982	207	96	10				313
1983	208 ^{/6}	100 ^{/7}	10				318
1984				500	10		510 ^{/8}
1985				401	15		416
1986				385			385
1987	3			432			435
1988							442
1989							430

/1 Includes \$3,000 for rehabilitation of Grant Point building.

/2 Includes \$9,000 cyclic maintenance.

/3 Includes \$10,000 Alaska Native Claims Settlement Act

/4 Includes \$15,000 cyclic maintenance.

/5 Includes funding for 3 months' operation and salaries at Cape Sarichef, Unimak Island.

/6 Includes \$15,000 for management of Pavlof Unit.

/7 Includes \$5,000 for management of Pavlof Unit.

/8 Includes \$135,000 for ARMM projects, of which \$120,000 was for construction of aircraft hangar.

safety related items of clothing such as nomex clothing, float coats, survival suits and exposure suits were ordered during the year.

Biologist Dau, Youth Conservation Corps enrollees Rachael Fey and Gary Thrift all completed the Red Cross First Aid Training and Cardiopulmonary Resuscitation classes on July 6, 1988.

4. Technical Assistance

Alaska Department of Fish and Game (ADF&G) Area Biologist Dick Sellers and his assistant Dave Johnson performed evaluation of the Southern Alaska Peninsula caribou herd with assistance from the refuge staff on 27-28 June. Capture operations and population composition surveys were performed from 12 to 14 October by Dave Johnson and Ken Prichard (ADF&G, Anchorage) in cooperation with the refuge staff. These capture and survey operations aid our respective agencies in fulfilling their management responsibilities.

The Izembek staff assisted personnel from the Alaska Fish and Wildlife Research Center (Anchorage, Regional Office) with aerial reconnaissance and ground logistics during their evaluation of disturbance factors affecting migratory waterfowl.

Archeologists with the Bureau of Indian Affairs worked on the Izembek refuge from 14 June to 17 August. The crew of four, sometimes five, archeologists were surveying 14(h)1 sites as identified in the Alaska Native Claims Settlement Act. Survey of these sites is necessary prior to their transfer to the Aleut Corporation. Lodging, gear storage, vehicular transportation and occasional air drops of mail or supplies were supplied by the refuge.

In total, 16 selected historical sites were visited by the Bureau of Indian Affairs crew in 1988. A minimum of one feature or house type was examined at each site along with mapping of the entire site. No surficial remains were collected however their position was mapped and photographs were taken. A combination of subsurface analysis techniques were used during the field project. These ranged from test excavations to soil probes. Remains discovered using subsurface techniques were collected for further analysis and in some cases, dating. These remains will be temporarily deposited at the Anchorage Museum of History and Fine Arts until conveyance decisions are finalized.

Vandalism was found to have had a small impact on 2 to 3 of the sites visited some of which may have occurred as long ago as World War II, other cases were much more recent. At some sites brown bears had caused damage due to digging of day bed or foraging for arctic ground squirrels. Burrowing by squirrels impacted all sites visited but to various degrees. One site was especially

avored by a large number of squirrels and the adverse impact was extensive. Several of the sites visited in 1988 had been tested by archeologists in the early 1970's so new data will add to past evaluations of the historic significance of sites on the Izembek refuge.

Izembek staff assisted the Bureau of Land Management in their effort to confirm public easements on Native corporation's interim conveyances in the area. Assistance included advice on public use patterns along coastal areas and suggestions on easement sites.

Wayne Crayton from the Anchorage Fish and Wildlife Enhancement field station was in Cold Bay from 4 to 7 June to collect soil samples at the Grant Point Air Force site and at the dump area used prior to demolition of this facility. Wayne also prepared the Sample Catalog for this contaminant analysis and will submit the samples to the appropriate laboratory. His assistance was greatly appreciated.

5. Other Items

Special Use Permits

Thirty-six special use permits were issued for 13 different activities on refuge lands during 1988. Of the total 14 were for trapping; 8 were to commercial hunting guides; 3 to air taxi operators; 2 for archeological investigations; and 1 each for on site inspection of military debris, gravel removal, maintenance of seismic stations, commercial filming, placement of markers for aerial photography, volcanic research, geologic survey, maintenance of a set net site, and an aerial survey.

F. HABITAT MANAGEMENT

1. General

Protection of habitat integrity has historically been the goal of the Izembek refuge staff. Until the 1980's threats due to various types of development were not eminent. Far-sighted managers however implemented a series of special refuge regulations during this period to prepare for some potential development. Also proposed was the inclusion of 300,000 (95%) of the Izembek Unit and 910,000 (98%) of the Unimak Unit in the Wilderness Preservation System. This important designation was accomplished with the passage of the Alaska National Interest Lands Conservation Act in 1980. However this Act also abolished all existing special refuge regulations. Starts and re-starts by the Izembek staff in 1982, 1985, 1986 and 1987 with support from the Regional Office have not succeeded in gaining the necessary support from the Washington office and the Alaska Congressional delegation. And now eight years later with a continual mounting of pressure from such special interest groups as the petroleum



Wayne Crayton collected and prepared soil samples as part of our contaminant evaluation of the Grant Point U.S. Air Force facility.

industry, mining companies, regional and village Native corporations and commercial fishing and big game interests, we find ourselves less able to maintain habitat integrity than before the Alaska National Interest Lands Conservation Act was passed. We still await some response from Washington, hopefully positive and helpful in our management of the Izembek Refuge.

The Izembek refuge boundary encompasses approximately 100,000 acres of lagoon systems which provide habitats essential to the wildlife of the area. These areas are tidelands owned by the State of Alaska. One, Izembek Lagoon, has been afforded protection by the state as a State Wildlife Refuge (114 State Land Act 1960, Chapter 20, Article 1) (Figure 2). Izembek refuge and the Izembek State Game Refuge received special recognition in 1986 as "Wetlands of International Importance". This designation was in accordance with the 1971 RAMSAR convention of the International Union for the Conservation of Nature. Izembek was one of the first four sites in the United States to be so identified.

The thoughtful planning process leading to the establishment of the Izembek refuge resulted in a refuge characterized by diverse habitats all within the boundary of a single watershed - Izembek Lagoon. Headwaters of the major tributaries on the refuge originate in mountainous areas in the center of the Alaska Peninsula. Drainage from glaciers around 4,800 foot Mt. Dutton and the Aghileen Pinnacles give rise to the Joshua Green River, the largest drainage on the Izembek Unit. Frosty Creek and several smaller streams originate from snowpack and glaciers on 6,000-foot Frosty Peak, west of Cold Bay.

The majority of the refuge is below 1,000 feet in elevation. This undulating coastal plain is derived from glacial outwash and deposition, which supports a mixture of low shrub/ericaceous and graminoid tundra. Characteristic species are arctic willow and other Salix spp., crowberry (Empetrum nigrum), mountain cranberry (Vaccinium vitis-idaea), bluejoint grass (Calamagrostis canadensis), white cotton grass (Eriophorum Scheuchzeri), and reindeer moss (Cladonia spp.). Along many watercourses and at intermediate elevations on mountain slopes, dense bands of Sitka alders (Alnus crispa) are found.

The conveyance of 17,800 acres of Izembek refuge lands to adjacent village corporations has posed potential management problems as the regulations relating to these section 22(g) (Alaska Native Claims Settlement Act) lands may be more liberal than those presently in force. When the Alaska National Interest Land Conservation Act was first passed, we assumed that refuge rules and regulations would remain in effect, as this was the direction that Native corporations were given in Alaska Native Claims Settlement Act, in an effort to discourage them from selecting lands from existing refuges. However, in 1983, it was the solicitors opinion that those regulations do not apply and that new regulations would have to be promulgated. This was certainly a bad resource decision and will probably result in further

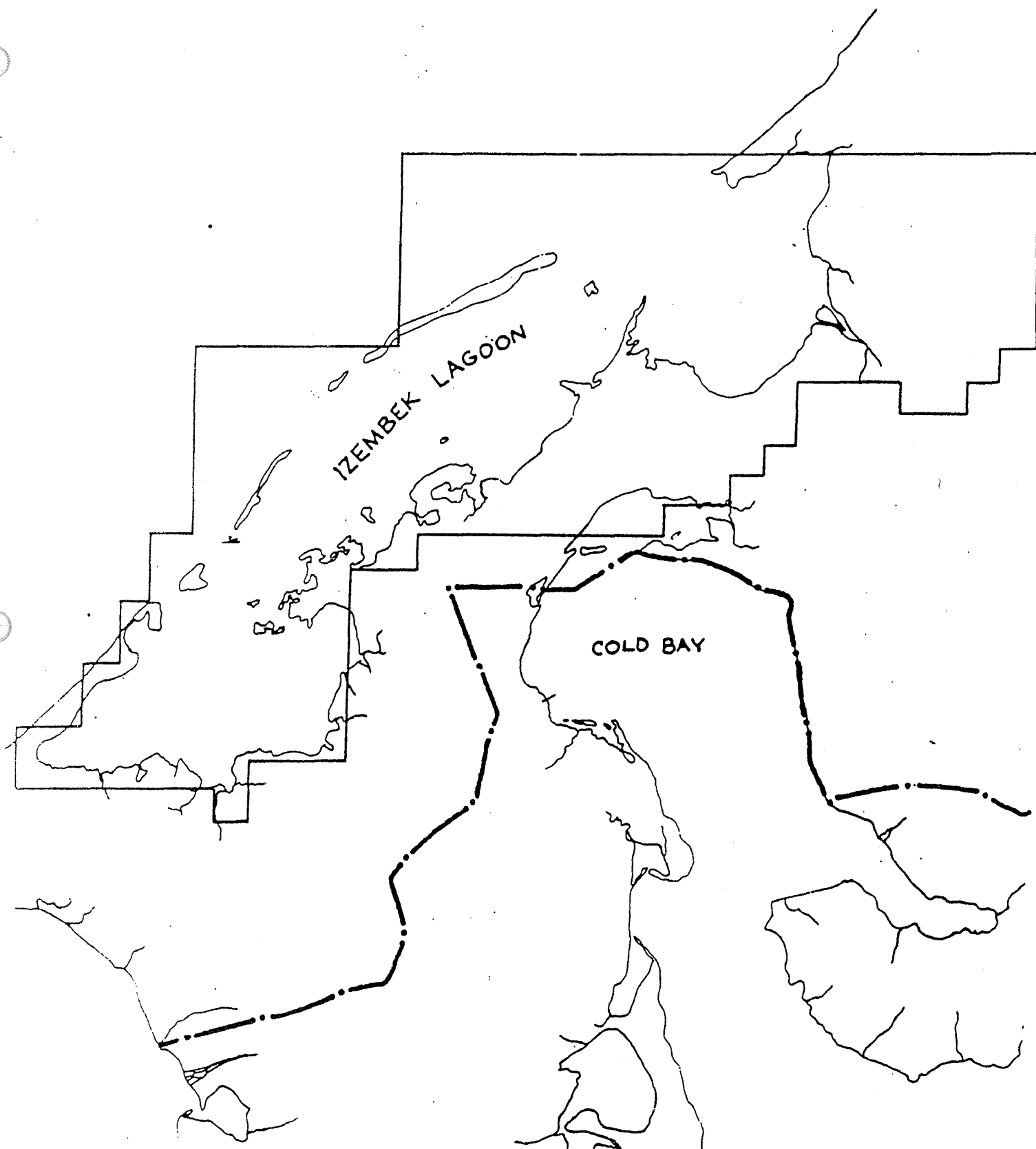


Figure 2. Boundary of Izembek State Game Refuge (—) in relation to Izembek NWR (- - -).



19,000 yards of gravel were made available to the State of Alaska during their runway re-surfacing project. The area surrounding the removal site was re-vegetated by the contractor upon completion of the project.



Gravel necessary to resurface the runway was exchanged for asphalt paving of the refuge headquarters.

degradation of lands that are supposed to be protected, as well as greatly decrease the potential trade value of these lands. A regional task force continues to work on the development of new regulations.

The specific land development plans of the village and regional Native corporations are unknown at present, but center on economic return for the shareholders. Roads, hunting lodges, small boat harbors, gravel mining and thermal and hydroelectric development have been mentioned as potentials. The Cold Bay and Izembek refuge area promises to be a hub for activities associated with offshore petroleum exploration in the Bering Sea, as well as for an expanding fishing industry. These activities, and changing land use patterns, will be closely monitored in an attempt to maintain the integrity of refuge habitats and wildlife resources. The present status of land conveyances under Alaska National Interest Lands Conservation Act is summarized in Table 4.

2. Wetlands

Approximately 87% of Izembek refuge is characterized as true wetlands. Nearly 200,000 acres of upland tundra (61%), 22,400 acres of wet sedge/grass marsh (7%) and 60,000 acres of pond, lake and riverine areas (19%) make up this total. Most of these areas are covered under wilderness designation and all are important to the continued stability of fish and wildlife populations on the refuge.

The nearly 100,000 acres of state-owned lagoon within the Izembek refuge are essential wetland habitat for up to 250,000 migratory waterfowl in the fall. Eelgrass is the most important food item for migratory waterfowl using the lagoon complex and is essential year-round habitat for numerous fish and invertebrate species. Izembek Lagoon covers an area of approximately 84,220 acres (132 sq. mi.). Of this area, 78% (65,692 acres) is tide flat and of that area, 44,671 acres are covered by eelgrass beds (i.e. 53% of the total lagoon area).

6. Other Habitats

A milestone of habitat restoration was achieved in 1988. In February, demolition and burial on-site of the obsolete Grant Point Air Force radar site was completed. A crew of heavy equipment operators and demolition experts from Elmendorf Air Force Base in Anchorage performed the work which began in fall of 1987. The area was leveled and/or re-surfaced and supposedly seeded; however, no re-vegetation appeared during the 1988 growing season.

The Izembek refuge staff and Regional Office pressured the Air Force and Corps of Engineers for five years to see that they complied with their Special Use Permit stipulations relating to the removal of this facility. All that remains now is the



Pavlof Volcano (8261 feet) and Pavlof Sister (7028 feet), prominent peaks in the Pavlof Unit.



Waterfowl of numerous species and spectacular scenery greet the fall visitor the the Izembek refuge.

TABLE 4. Native Selection of Land Within the Izembek NWR per the Alaska Native Claims Settlement Act

Village	Refuge Lands Conveyed (acres)	Refuge Lands Remaining for Conveyance (acres)	Total (acres)	Remarks
King Cove	9,695	5,760	15,455	22g land
False Pass	8,105	1,264	9,369	22g land
Pauloff Harbor	-	-	approx. 320	22g land
Aleut Corp.	-	-	96,030	14 (h) (8) ¹
Aleut. Corp.	-	-	152	14 (h) (1)

¹In January, 1983, a verbal decision by the Regional Office was made that all 14(h) (8) selections on Izembek are invalid.

official relinquishing of their 91 acre military withdrawal and return of these lands to the Izembek refuge.

9. Fire Management

The lower Alaska Peninsula has very little history of range fires. Wet tundra and continually moist air are effective natural fire suppressants. For this reason, we petitioned for and were granted, an exemption from preparation of a Refuge Fire Management Plan.

12. Wilderness and Special Areas

On December 2, 1980, 300,000 acres of the Izembek Refuge were officially designated Wilderness by Alaska National Interest Lands Conservation Act. Preservation of the striking geographic features and conservation of the internationally important fish and wildlife values of the area have always been the primary goals of the refuge so this designation did not greatly alter our program direction.

Volcanos form the backbone of the Wilderness Area of Unimak Island, from Roundtop in the East to Faris-Westdahl in the West. Perpetual snow fields and glaciers surround the five most prominent peaks; Roundtop, Isanotski, Shishaldin, Pogromni and Faris-Westdahl. At 9,372 feet, Shishaldin is the highest peak on the island, and also the most spectacular, being a near-perfect volcanic cone. This mountain is a National Historic Landmark because it has served as a navigational aid for seamen at least since the days of Russian exploration and was undoubtedly used by the Aleuts well before that. Active volcanos include Shishaldin, Pogromni and Faris-Westdahl. Steam and/or smoke rising from the vent of Shishaldin occurs continually. A huge lake, Fisher Caldera, lies in west-central Unimak in the crater of a volcano.

Extensive lava flows of varying ages are found below Shishaldin, Isanotski, Roundtop, Faris-Westdahl and Pogromni. Some of those on the north side of Shishaldin have re-vegetated, although so sparsely that the nature of the substrate is obvious from the air. Several rivers, among them North Creek, Coal Oil Creek and others unnamed, flow partly through wide ash flats. To the southeast of Roundtop, Isanotski and Shishaldin, are areas several thousand acres in size overlaid with virtually bare lava and ash. These are also drained by sizeable streams.

Cliffs ranging from steep bluffs to spectacular wave-cut promontories and sea stacks occur along the coast, except at Unimak Bight and along the north side of the island from St. Catherine's Cove to Uria Bay, where more gentle beaches and dunes are found. The more inaccessible bluffs and cliffs support some seabird nests, but are most important for bald eagles. Because of its large size and unique features, Unimak was proposed as a separate unit for Wilderness in 1972. Designation was held

up pending resolution of the D-2 lands issue by Congress resulting from passage of the Alaska Native Claims Settlement Act. Finally, a Wilderness area of 910,000 acres was established on December 2, 1980, with passage of Alaska National Interest Lands Conservation Act. Management approaches on the Unimak Unit will change little as it also has been historically managed as a wilderness.

The loss of special refuge regulations for the Izembek and Unimak Units and the less restrictive approach mandated for management of "Alaska Wilderness" represent important concerns to the refuge staff. Both factors adversely affect our ability to maintain the integrity of wildlife habitats and populations within our area of responsibility. Hopefully our continuing work, with Regional Office support, towards the re-establishment of our special refuge regulations will relieve some of these concerns.

G. WILDLIFE

1. Wildlife Diversity

Approximately 142 species of birds and 23 species of mammals have been reported as residents and/or migrants on Izembek refuge. Four species of Pacific Salmon (chum, pink, red and silver), two varieties of trout (dolly varden and arctic char) and stickelbacks are the primary fish species in fresh-water habitats on the refuge. King salmon may occur in very low numbers in the Moffett Bay area. A minimum of 23 species of saltwater fish have been reported in Izembek Lagoon.

2. Endangered Species

The presence of an Aleutian Canada goose (Branta canadensis leucopareia) on the Izembek refuge was documented in October of 1987 when a single tarsal banded bird was observed. Canada geese are monitored closely by observers making waterfowl composition counts and hunter bag checks in the Izembek Lagoon area. The fact that the Aleutian subspecies has been encountered only once when such a large number are individually marked suggests they are very rare stragglers to the lower Alaska Peninsula.

Arctic and American races of the peregrine falcon (Falco peregrinus tundrius and F.p. anatum, respectively) may occur in the Izembek area during migration however such use has yet to be documented. The non-endangered Peales' race of the peregrine falcon (F.p. pealei) is a fairly common resident of the area.

Evaluations of the population and taxonomic status of the Amak Song sparrow (Melospiza melodia amaka) and Amak tundra vole (Microtus oeconomus amakensis) both of which occur only on Amak Island, 20 miles northwest of Cold Bay, are as yet undetermined. Field work undertaken in 1987 was inconclusive and additional research may be required.

3. Waterfowl

Tundra Swan

Tundra swan, an important nesting waterfowl species at Izembek, utilize the entire refuge and typically remain on refuge lands all year. Therefore, a knowledge of their habitat needs and population parameters is useful to managing and protecting refuge ecological units. In order to fulfill one of our mandates of protecting the essentially pristine wilderness nature of the refuge, knowledge is necessary of species such as the tundra swan which require wilderness conditions in order to reproduce.

The winter season of 1987/88 was characterized by a dramatic departure from the normal routine in our essentially non-migratory population which nests on the Izembek and Unimak Units. Twenty four (24) different marked individuals were observed from Calgary, Alberta, Canada to Ensenada, Baja California, Mexico. In the previous 9 winters only 16 neck collared birds from this population (8 in one family) had been seen in the Pacific Northwest as far south as California. The normal winter haunt for the 500-600 swans in this population is the Peterson Lagoon area of the Unimak Unit. Sixteen tundra swans captured on the Pavlof Unit were also encountered during the winter of 1987/88 (Figure 3).

The causative factors involved in such an abnormal emigration are speculative. Fall and early winter climatic conditions at Cold Bay showed typical levels of variation. Likewise wintering conditions at Peterson Lagoon were not significantly different than in other years. Unknowns such as winter food availability, behavioral responses to crowding or disturbance factors may play some part. Whatever the cause, the result in wintering distribution was remarkable.

Spring nesting surveys of the Izembek Unit were no less remarkable (Tables 5 and 6). Total birds and nesting pairs observed were down 48 and 53 percent, respectively from the previous 9 year average. Biologist Dau flew these surveys for the first time, however he participated on similar efforts from 1981 to 1987 hence the area and intensity of coverage in 1988 is comparable to previous years. The dramatic decrease in the overall density of swans on the Izembek Unit in 1988 (.29 birds/sq. mi.) versus the preceding 9 year average of .55 birds/sq. mi. is alarming. Further evidence of a population decline or emigration is the fact that highly preferred nesting territories such as Bluebill Lake, the Y Lakes and Mortensen Marsh were not used by

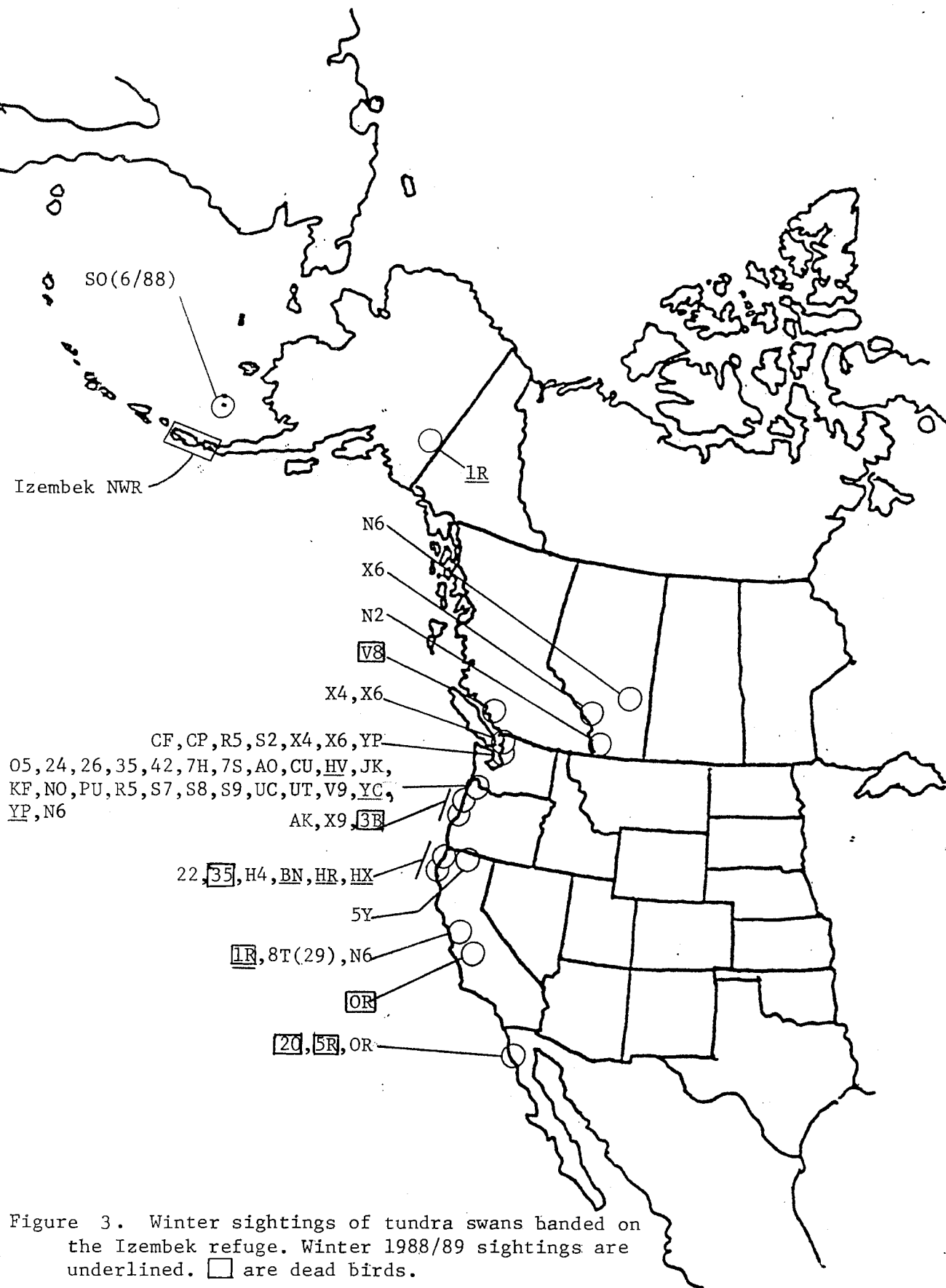


Table 5. Spring Nesting Survey of Tundra Swan, 1988.

Date	No. of Swans Observed (%)				Total	Area Cov. (sq. mi.)	Density (Sq. mi.)
	Singles	Nesting Pairs	Non-nesting Pairs	In Groups			
18-19 May	7(6)	28(24)	42(36)	41(35)	118	413.9	.29
Average	10.8 \pm 4.6	59.6 \pm 16.7	75.8 \pm 20.0	79.1 \pm 29.5	225.2 \pm 20.0	413.9	.55 \pm .05
1979-87 (range)	(5-20)	(24-78)	(50-96)	(29-140)	(197-266)		(48-64)
% Change in 1988 versus 9 year average	-35	-53	-45	-48	-48		-47

¹ Survey area: Izembek Unit, Pavlof Unit south of Cold Bay and Izembek Unit north to Cathedral River.

Table 6. Spring Nesting Surveys of Tundra Swans on the Izembek and Pavlof Units, 1978-1988.

	Singles	No. of Swans Observed (% of Total)			Total	Area Cov. (sq. mi.)	Density (sq. mi.)	No. of Collared Swans Seen
		Swans (nesting pairs)	Swans (other pairs)	In Groups				
5/8/78 ¹	6 (8%)	18 (23%)	26 (33%)	28 (36%)	78	315.5	.25	N/A
4/25,28/79 ²	10 (5%)	24 (12%)	96 (47%)	75 (36%)	205	413.9	.50	12
5/14-15/80	9 (4%)	60 (26%)	84 (36%)	80 (34%)	233	413.9	.56	1
5/13,15/81	16 (8%)	58 (29%)	94 (48%)	29 (15%)	197	413.9	.48	21
6/2,6/82 ³	11 (5%)	68 (30%)	92 (41%)	55 (24%)	226	413.9	.55	23
5/31-6/1/83 ³	8 (4%)	48 (21%)	94 (41%)	77 (34%)	227	413.9	.55	37
6/7-8/84 ³	5 (2%)	78 (35%)	54 (25%)	85 (38%)	222	413.9	.54	42
5/28,30,6/1/85	20 (7%)	54 (20%)	52 (20%)	140 (53%)	266	413.9	.64	32
5/20/86	11 (5%)	70 (29%)	66 (28%)	90 (38%)	237	413.9	.57	24
5/19/87	7 (3%)	76 (36%)	50 (23%)	81 (38%)	214	413.9	.52	30
5/18-19/88	7 (6%)	28 (24%)	42 (36%)	41 (35%)	118	413.9	.29	7
Avg. 1979-1987	11 (5%)	60 (27%)	76 (34%)	79 (35%)	225	413.9	.55	23

¹ Cathedral lakes, lakes south of Mortensen's Lagoon and west side of Morzhovoi Bay areas not covered, Other areas not covered thoroughly.

² Survey done too early to include peak of nesting.

³ Survey late for peak of nesting.

nesting pairs for the first time since observations began in 1978.

Weather conditions did not permit a 1987/88 winter survey of swans while congregated at Peterson Lagoon on Unimak Island. This will be a high priority effort this winter due to our perceived need to assess total numbers within the "non-migratory" segment of the population. Since 1978 four swans captured on the Izembek Unit have wintered both here and in the Pacific Northwest. The tendency is uncommon but nevertheless intriguing. Only one of the 24 Izembek Unit migrants of 1987/88 was re-sighted at Izembek in 1988, and in this case recaptured in 1988 during the banding program. Of the remaining 23 birds, 6 are known to have perished over the winter, 1987/88.

Pavlof Unit nesting surveys were again conducted covering five 1:63,300 scale quadrangle maps north of Pavlof Bay (Table 7). From our banding information, swans from this area have been determined to be largely from the "migratory portion" of the lower Alaska Peninsula population. On the average in 1988, total numbers were up 25 percent while nests were down only 4 percent in comparison to the 1986-87 average. Aircraft crews were the same on these and the Izembek Unit surveys hence the alarmingly low numbers observed on Izembek are considered to be real and not just an anomaly.

Only one segment of the Pavlof Unit survey segments (D-5) was flown during the brood rearing/fledging period. Fifteen broods were present, remaining from the 17 nests observed on the May nesting survey (i.e. 88% nesting success). These data are indicative of good production on the Pavlof Unit. The total number of nests was comparable to previous years.

The number of nests found on the Izembek Unit was down 53 percent from the previous 9 year average. Hence, the 75 percent nesting success documented (i.e. 12^{of 16} nests^{with eggs} hatched one or more cygnets) does not alter the bleak productivity in 1988 (Table 8). Only 50 percent of the nests from which one or more cygnets hatched, had young successfully reach flight stage. This equated to a maximum of only 21 juveniles in 1988. Overwinter survival of cygnets belonging to the non-migratory segment of the population is routinely quite poor hence recruitment in 1988 is expected to be exceeded by natural mortality.

Cygnet production and survival was good in 1987 and 46% (n=19) of the new banded birds captured in 1988 were in their second-year (SY), that is they were cygnets produced in 1987. The primary goal of our banding program is to monitor the dynamics of the non-migratory population. With respect to banding, this is best accomplished by marking known-age birds. Progress was made in this area in 1988 not only with



Jim Savery, Acting Refuge Manager, and Ed Bailey and Kurt Schmidt, biologists with the Alaska Maritime refuge, assist on the capture of tundra swans near Mortensen Lagoon.



The refuge staff captured a total of 51 tundra swans during neck collaring operations in July and August.

Table 7. Tundra Swan survey of the Pavlof Unit, Alaska Peninsula NWR, 1988

Date	PML Maps	Single	Single w/nest	Pair w/nest	Pair w/brood	Pair w/o nest	Birds in Flocks	Total Swans	Area Covered (sq. mi.)	Density (sq. mi.)
NESTING										
23 May	D-4	18	6	11	0	32	117	227	175.8	1.29
23/27 May	D-5	26	8	9	0	31	39	153	177.1	.86
19 May	D-6	7	1	3	0	9	33	65	104.5	.62
20 May	C-5	11	1	9	0	17	91	155	110.7	1.40
27 May	C-6	4	1	3	0	18	7	34	110.5	.31
1988 Total		66	17	35	0	97	287	634	678.6	.93
Average 1986-87 (+ 1SD)		47.0 (1.4)	16.0 (2.8)	38.0 (0)	0	90.5 (2.1)	189.0 (9.9)	509.0 (4.2)	678.6	.745 (.01)
% Change in 1988		+40	+6	-8	0	+7	+52	+25		+24
BROOD REARING										
8 Sept	D-5	0	0	0	15	37	259 ¹	402 ¹	177.1	2.27

¹ One flock of 202 birds included.

Table 8. Summary of 1988 successful Tundra Swan nests.

Nest No.	/1 Collar Status	Est. Clutch Size	Est. Hatching Date	Brood Size	
				First Observe	Last Observe
2		≥ 4	6/20	4	1
3	DCP	≥ 1	6/15	1	1
6		6	6/10	3	3
7		≥ 4	6/10	4	3
8		≥ 4	6/15	4	4
9		≥ 2	6/15	2	2
11		≥ 5	6/5	5	5
12		Unk.	6/5	0	0
13		Unk.	6/5	0	0
14		≥ 5	6/1	5	5
15		≥ 1	6/15	1	1
16		≥ 1	6/5	1	1
Totals (N=12)		≥ 33		30	26
(\bar{x})		(3.3)		(2.5)	(2.2)

/1 DCP-Double neck-collared pair

respect to second-year birds but also locals (i.e. cygnets produced in 1988) as we were able to capture young from two of the six available families.

Banding operations in 1988 were conducted from 20 July to 12 August. A total of 51 birds including four recaptures were processed during nine separate capture operations. A summary of the 1988 banding effort by specific capture location is presented in Table 9. A summary of historical banding data on the Izembek refuge is presented in Table 10.

The Izembek refuge has collected a large amount of valuable biological data on tundra swans since the project began in 1977. Previous refuge manager John Sarvis initiated the project and supervised it as principal investigator through 1987. Although now stationed in the Regional Office he hopes to summarize much of the available data for publication. An ideal opportunity and forum will be the Third International Swan Symposium to be held from 9-13 December 1989 in Oxford, England. Such gatherings have occurred once a decade and Izembek refuge hopes the Service sees the merit of an Alaska representative.

The Izembek refuge will continue to monitor the tundra swan population and their productivity on the lower Alaska Peninsula as part of the protocol established by the Migratory Bird Management division.

Table 9. Summary of Tundra Swans banded, neck-collared or recaptured in 1988, Izembek and Pavlof Units./1

Date	Location	ASY		SY		Local		Neck Collar Codes
		M	F	M	F	M	F	
20 July	VOR Lake	3	1	3	4			OV, 6V, 8V, 2X, 4X, 5X, 3Z, 5Z, 7Z, BH, BS
21 July	Rescue Lake		2 (1)	1	1			2Z, 4Z, BB, HB, (26)
25 July	Thinpoint Lake	1	(1)	5	3			BN, BR, BV, HN, HR, HS, HV, HX, HZ, (V6)
27 July	Hatchery Lake	2	4					NB, BX, BZ, (BB), (05), (26)
28 July	Shuttle Lake (Lake # 114)	2						NN, NR
29 July	Bug Lake (Lake # 113)	1	2	2				NV, NX, NZ, RH, 2N ^{/2}
5 Aug.	Lake #115	2 (1)	1					RN, RR, RV, 5Y ^{/3}
12 Aug.	Paul Hanson Lk	1				3	1	RS, RX, SB, SR, SS
12 Aug.	Lake # 63	(1)				1	1	SV, SX, (81)
Totals		12 (2)	10 (2)	11	8	4	2	

/1 Recaptures in parenthesis

/2 2N remarked RB

/3 5Y remarked RZ

Table 10. Summary of Tundra Swans neck-collared on the Izembek National Wildlife Refuge.

Year	Adult (After Second Year)		Sub-adult (Second Year)		Juvenile (Hatch Year)		Total ^{/1}
	Male	Female	Male	Female	Male	Female	
1978	9	7	2	1	5	3	27
1979	3	7	3	3	0	0	16(2)
1980	9	12	4	4	3	5	37(6)
1981	15	18	3	9	6	6	57(10)
1982	15	20	2	2	11	2	52(14)
1983	15	19	2	1	13	26	76(14)
1984	2	1	1	1	3	5	13(6)
1985 ^{/2}	41	40	14	23	10	11	139(7)
1986	23	14	4	6	8	13	68(15)
1987	17	16	16	11	12	12	84(18)
1988	12	10	11	8	4	2	47(4)
Totals	161	164	62	69	75	85	616(96)

/1 Additional birds captured that had previously been marked shown in parenthesis.

/2 Includes twenty-eight birds marked with standard bands only (i.e. ASY-M 13; ASY-F 7; SY-M 4; SY-F 1; L-M 1; L-F 2).

Black Brant

The Pacific Flyway (PF) population of black brant breeds primarily on the Yukon-Kuskokwim Delta and along the arctic coast and islands of the Chukotka Peninsula in the Soviet Union, the North Slope of Alaska and the Northwest and Yukon Territories of Canada. Currently this population numbers about 140,000 birds and essentially all of these make the Izembek refuge area home for up to three weeks in the spring and six to eight weeks in the fall. Surveys and research on brant and their primary attractant, the eelgrass beds of Izembek Lagoon, are conducted annually by refuge personnel and cooperators. Continuing and primary commitments are toward collection of production and family group size data during fall and providing of facility, logistic and manpower assistance to the Division of Research during their spring and fall analysis of waterfowl disturbances.

The Izembek refuge staff continued to provide assistance to Migratory Birds-Waterfowl Investigations personnel in Juneau by monitoring the numbers of black brant over-wintering in Izembek and adjacent lagoons. These data are important in assessing the distribution and abundance of brant, flyway wide, as determined from the annual mid-winter surveys conducted in January. Approximately 8,400 brant were found over-wintering at Izembek in January of 1988. Inventories in the winter of 1988/89 again showed high numbers of over-wintering brant. On 29 November 9,150 were counted with numbers declining to 7,053 on 12 December. The January 17 survey flight in coordination with the mid-winter inventory in Mexico showed that approximately 3,910 brant remained at Izembek.

Brant productivity and family group counts conducted at Izembek in 1988 marked the 26th consecutive year such appraisals have been made. Brant were first seen arriving on the lagoon on 18 August in 1988. The modal arrival date for first migrants at Izembek for 17 years for which we have data is the same (i.e. 18 August). Production counts were obtained from 29 August to 14 October with a total of 19,985 individual brant classified to age. Juveniles comprised 3,847 (19.3%) of this total in comparison to the long-term average of 23.3% (Table 11). Productivity of the PF brant population, based on observations from Izembek, has been below average in six of the past eight years, however, overall population size, determined from mid-winter surveys, is relatively stable. Average production has occurred only four times in the past 12 years possibly resulting from the dwindling sub-arctic Yukon Delta populations and the growing, less productive, arctic populations.

Family group size data were collected concurrently with productivity counts. A total of 263 individual families were observed giving an average of 2.4 juveniles/family (Table 12). Based on our family group counts, survival of young was below

Table 11. Annual black brant production counts, Izembek Refuge, 1970-1988.

Year	Adults	Juveniles	Total	% Juveniles
1970	12,104	6,256	18,360	34.1
1971	4,820	1,953	6,773	28.8
1972	6,599	3,698	10,297	35.9
1973	12,025	4,999	17,024	29.4
1974	13,118	632	13,750	4.6
1975	9,396	5,452	14,848	36.7
1976	7,962	4,340	12,302	35.3
1977	8,856	4,092	12,948	31.6
1978	10,696	1,842	12,538	14.7
1979	13,674	2,349	16,023	14.7
1980	9,618	3,341	12,959	25.8
1981	4,109	936	5,045	18.6
1982	11,509	1,213	12,722	9.5
1983	6,149	1,947	8,096	24.1
1984	9,451	1,499	10,950	13.7
1985	12,032	1,915	13,947	13.7
1986	15,621	2,823	18,444	15.3
1987	17,411	7,882	25,293	31.2
1988	16,138	3,847	19,985	19.3
26_Yr. X	11,264	3,415	14,680	23.3

Table 12. Black brant family group counts at Izembek Refuge, 1980-1988.

Year	<u>Frequency by Family Group Size</u>								No. Families	No. Juveniles	\bar{X} Juv/Family
	1	2	3	4	5	6	7	8			
1980	26	47	57	39	7	0	1	0	177	489	2.76
1981	34	38	36	27	10	8	1	0	154	431	2.80
1982	18	22	25	20	4	0	0	0	89	237	2.66
1983	25	40	55	26	21	6	0	0	173	515	2.98
1984	19	49	70	39	10	4	1	0	192	564	2.94
1985	125	223	173	73	24	6	0	0	624	1538	2.46
1986	23	46	43	19	4	2	0	0	137	352	2.57
1987	168	263	267	171	66	13	0	0	948	2587	2.73
1988	62	91	65	35	6	4	0	0	263	633	2.41
<u>23 Yr</u> <u>X</u>	43	76	70	41	14	3	<1	<1	248	663	2.68

average (i.e. down 0.27 juveniles/family in comparison to the 23 year average). Research being conducted on the Tutakoke River, Yukon-Kuskokwim Delta, suggests that a considerable amount of brood mingling occurs among brant even before fall migration begins. As yet, data are insufficient to identify the extent of this phenomenon or its implications on family group size data from Izembek. Other goose species maintain family bonds through fall and winter and even into the following spring.

Productivity appraisals of brant conducted during the fall of 1988 were a joint effort of the Research Division and the Izembek refuge staffs. The substantial contributions of Research personnel the past four years are very much appreciated. We will miss their help, comments and contributions.

Nesting success for brant on the Yukon-Kuskokwim Delta was 69 percent versus the 90 percent recorded in 1987. Likewise the mean clutch size during incubation was 3.7 eggs/nest this summer, down from 4.1 in 1987. Researchers with the Division of Research and the University of Alaska working with brant on the Yukon-Kuskokwim Delta report brood sizes post-hatch of 2.8 young/brood. Compared with the average 2.4 juveniles/family seen at Izembek, these data suggest a 14 percent reduction in brood size.

The fall population of brant at Izembek Lagoon includes birds from Alaska, the western Canadian Arctic and Wrangel Island in the Soviet Arctic. It was hypothesized that these birds mix throughout the lagoon and hence our counts are representative of the whole PF population. Radio marking of brant from various breeding areas in 1987 to address this mixing in Izembek Lagoon among other questions, proved very interesting. A total of 33 backpack radio transmitters were placed on 16 Alaskan birds from the Tutakoke colony on the Yukon-Kuskokwim Delta and 17 Canadian birds from 4 breeding colonies: Mackenzie River Delta (4), Mellville Island (8), Prince Patrick Island (2), and Victoria Island (3). Radio telemetry data collected from brant marked in the Canadian Arctic in 1987 suggested that some of these birds preferred the Moffet Bay area of Izembek Lagoon. Three efforts were made in 1988 to observe brant from shore locations on Moffet Bay to see if light-bellied brant could be distinguished. Light-bellied and intermediate color phases predominate in the Canadian Arctic population. No light-bellied birds were observed and productivity (i.e. 16.9% juveniles) was only moderately lower than for the Izembek area as a whole (Table 13). Very low production predicted for the Canadian Arctic in 1988 by Canadian Wildlife Service Biologists suggests that possible segregation of population components at Izembek needs further analysis.

In 1988 forty brant from three Alaskan locations were marked (Table 14). Additional marking was planned for the Canadian High Arctic, however apparent poor productivity and logistics problems prevented any birds from being captured. Hopefully future efforts to mark Canadian, and possibly Soviet nesting brant, will



Goose production counts are performed by the refuge staff and cooperators from points such as this in the Moffet Bay area.

Table 13. Brant production counts conducted at Moffet Bay, Izembek
Refuge, 1988.

Date	No. Adults	No. Juveniles	Percent Juveniles	Total Birds	Observer
22 Sept.	497	171	25.6	668	L. Tibbitts M. North
5 Oct.	1516	289	16.0	1805	M. Blenden C. Dau
20 Oct.	3548	674	16.0	4222	R. West M. Blenden C. Dau
Totals	5561	1134	16.9	6695	

Table 14. Arrival and departure times at Izembek Lagoon of Black Brant originating from different nesting areas.

	Breeding Location		
	Y-K Delta	Island Lake, Teshekpuk	East Long Lake, Teshekpuk
number of transmitters	26	4	10
number detected at Izembek	24	3	6
first/last dates of arrival	8/31-10/23	9/2-9/7	unk.
number (% of arrivals) departing Izembek ^{/1}	≥22 (92%)	3 (100%)	5 (83%) ^{/2}
first/last dates of departure	10/20-11/2	11/1	10/3-10/28

^{/1} Possible over-wintering birds 164.291;598

^{/2} Possible over-wintering birds 151.382

successfully provide the data necessary to answer several important questions about the populations use of Izembek Lagoon.

The radio-tracking effort at Izembek Lagoon involved several techniques including aerial tracking and the use of directional antenna systems at fixed locations. Aerial tracking of radio-equipped brant was used initially to determine dates and locations of arriving brant. After a majority of the radio-equipped brant had arrived, aerial tracking was concentrated on those birds that were absent or infrequently detected by ground tracking systems. Many times aerial tracking coincided with, and was secondary to, population surveys.

Six primary stations were used for radio tracking brant this fall. These were Baldy Mountain, Halfway Point, Outer Marker and Outpost #1 (OP1), Cape Glaznap, and Banding Island as shown in Figure 4. The Baldy Mountain station was unique due to it's 1000' elevation, proximity (2 miles) to Izembek Lagoon and subsequent long ranges (approx. 10 miles) of signal detection. This station allowed researchers to receive good, consistent signals from radio transmitters in all parts of Izembek Lagoon, except Moffet Bay and from Kinzarof Lagoon. On occasion it was possible to detect signals from radio-equipped brant using the Big or Middle Lagoons areas of Morzhovoi Bay.

Each radio-tracking station was equipped with either four-element or five-element stacked, dual Yagi antenna arrays with a null detection system. The quality of reception of a radio signal at a particular station depended on the individual transmitter, distance between the source and receiver, obstructions between source and receiver, elevation, and weather conditions (i.e. rain reduced reception of the signal). Attempts to locate radio-equipped birds from the 8 blinds occurred intermittently, from 1 to 5 days per week for up to 12 hours per day. Time and occupancy varied for each blind site depending on weather, use of the area by geese, and timing of experimental over-flights.. During a tracking session the start time, end time, and frequencies searched during each scan were recorded as well as the time, azimuth, null width, and signal strength for each frequency located.

Handheld "H" antennas were used for radio-tracking during mobile situations from boats or in areas not covered by permanent stations. This device had a very limited range of approximately 3 miles, line of sight.

Generally, the radio telemetry data suggested that, at least in 1987, brant from Canadian Arctic nesting areas arrived later than birds marked on the Yukon-Kuskokwim Delta. Although no Canadian brant were radio marked in 1988, migrants continued to arrive into October as suggested by aerial survey data (Table 15). Ultimately we have to determine the timing of arrivals for each primary breeding location. The possible preference of Canadian Arctic birds for the Moffet Bay area throughout most of the fall staging

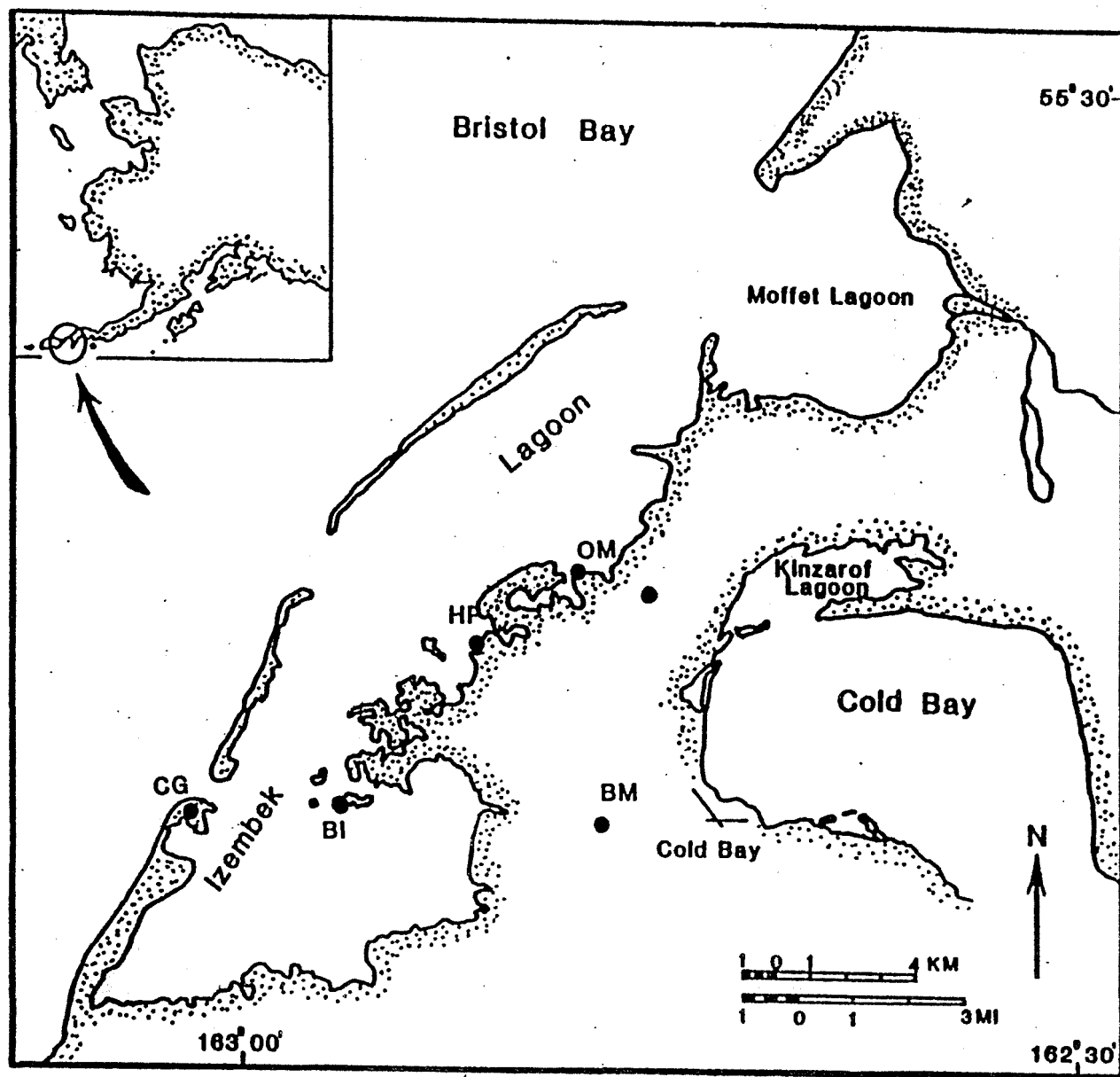


Figure 4. Black brant research observation points on or adjacent to Izembek Lagoon.

Table 15. Aerial surveys of goose populations on Izembek and adjacent Lagoons, 1988.

Date	Number of Birds			Observers
	Brant	Canada Goose	Emperor Goose	
25 August	9781	1823	0	Dau/R. Fey
1 September	65040	6774	951	Dau/B. Stehn
12 September	75902	18632	1215	Dau/D. Ward
26 September	106221	22066	2201	Dau/D. Ward
4 October	106435	40923	2846	Dau/D. Ward
11 October	142083	34800	3492	R. King B. Eldridge
18 October	135620	45321	3403	Dau/R. West
2 November	81726	32888	3132	Dau/D. Ward
4 November ^{/1}	47311	25314	1836	Dau/M. Blenden
29 November	9150	0	4008	Dau/D. Strom
12 December	7053	0	3790	Dau/R. West

^{/1} Izembek Lagoon only.

period requires further research. It does appear that Moffet Bay is important for this and other components when first arriving in the fall.

Canadian Arctic nesting brant show wide color variation from "typical" light-bellied (Atlantic Type) to dark phases approaching that characteristic of breeds on the Yukon-Kuskokwim Delta. In nearly 30 years of bag checking during the hunting season, refuge personnel have not documented the presence of light-bellied forms at Izembek. Likewise our preliminary observations of birds in flight at Moffet Bay were negative for light-bellied birds. Radio telemetry data, collected in 1987, showed that most of the light-bellied and intermediate phase brant marked in the Canadian Arctic stayed in the Moffet Bay area. This provided us with insight into why they have not appeared in hunters' bags. Moffet Bay is a remote, virtually un-hunted area at the north end of Izembek Lagoon.

In 1987, thirty-three radios were deployed on brant from various breeding areas. Twenty-six of these were received at Izembek Lagoon, however only one was received at the completion of the fall migration to wintering areas, and this only briefly. Six radioed brant either died or shed their radio harness while at Izembek. One bird which had shed its radio was shot in good condition by a hunter in the Puget Sound area. These data caused concern over the survival of marked birds so alterations were made in the radios and attachment harness prior to 1988 marking operations. None of the 26 radio marked brant encountered at Izembek this fall died or shed their equipment and to date two of these birds have been found at Baja de San Quintin, Baja California, Mexico.

The ongoing emphasis of biological investigations on Pacific Flyway brant in Alaska during 1988 came primarily from the Alaska Fish and Wildlife Research Center which intensified its appraisal of disturbance and behavior of brant at Izembek this fall. A seven-person team including David Ward, Bob Stehn, Lee Tibbitts, Karen Kincheloe and Mike North spent September, October, and early November on this important project.

The research effort took various approaches to quantify the types and effects of disturbances of fall staging geese, primarily black brant. Efforts to refine the methodology used by field workers to insure the compatibility of data collected and reduce observer bias as much as possible were intensified. Monitoring took the form of a more thorough and precise estimate of weather conditions, bird behavior, and distance of the disturbance factor from the geese during various phases of their reaction. These types of data are essential to a more complete understanding of the overall impact of various disturbances. When the disturbance is a fast moving aircraft, disturbance/birds distances and behavioral responses change rapidly necessitating the use of tape recorders by observers to describe the event. Data so collected



Brant normally depart the Izembek area during nocturnal hours on their way to Pacific coast wintering areas as far south as mainland Mexico. This is a rare photograph of a large flock departing in the early evening of 3 November.



Personnel from the Alaska Fish and Wildlife Research Center in the Regional Office tracked radio marked brant from observation blinds situated around Izembek Lagoon.

was later converted to numerical data and/or directly transferred to various data sheets.

Several parameters relating to various disturbance factors are important to the quantification of their effects on birds. Parameters such as altitude, speed, and distances of the disturbance from the subjects were estimated as precisely as possible for all uncontrolled events. To qualify observations of numerous important uncontrolled disturbances, experimental controlled disturbances were performed. In 1988 experimental over-flights were performed in a Hughes 500 helicopter and the Izembek refuge Super-Cub. An essential aspect of the research program is to obtain statistically acceptable sample sizes for the various types of aircraft used for experimental over-flights.

Quantification of the intensity and duration of auditory stimuli which occur from various types of aircraft was evaluated more thoroughly in 1988. Acoustics equipment was remotely placed on a tower erected over an eelgrass bed near Halfway Point. Data obtained during experimental and incidental over-flights should assess the disturbance at the brants' location more precisely.

All forms of waterfowl disturbance encountered by observers were analyzed including boat and foot traffic, various types of auditory stimulus and predator activities (primarily bald eagles). It is apparent that brant can undergo some level of disturbance without having adverse affects on their physical capabilities to assimilate nutrient reserves necessary to migrate or breed. Natural forms of disturbance such as activities of predators like bald eagles or gyrfalcons are largely uncontrollable, but must be viewed as a cumulative factor in the overall analysis of disturbance. Identification of an "acceptable level" of disturbance, and development of means to avoid exceeding that level, are critical to managing waterfowl and public use at Izembek.

Behavioral interactions and responses of disturbed and undisturbed brant, engaged in various activities, must be quantified in relation to a number of climatic and phenological factors. To obtain these types of data, Research crews viewed birds for several days from key areas of Izembek Lagoon throughout the fall. Time budget analyses were performed throughout diurnal periods to provide these baseline data. Such observations also will help to identify increases in migratory restlessness within the population.

The spring arrival of brant at Izembek occurred from 19 March to 14 May with a peak influx on 30 April and 1 May. The normal arrival usually occurs over about a 10 to 15 day period. Flocks of a few hundred up to a thousand are observed during daylight hours over Cold Bay. As these birds move north over Cold Bay, they gain altitude (i.e. approximately 1,500 feet AGL), cross the Alaska Peninsula and descend into Izembek Lagoon. Some of the spring influx occurs during nocturnal hours and may not be

detected at Cold Bay. A total of 56,035 brant were counted in the Izembek/Kinzarof Lagoon areas on 3 May. From 2 to 6 May the refuge coordinated with Migratory Bird Management-North in performing coastal waterfowl survey of southwestern Alaska with brant numbers totaling 73,404. Spring migration of brant from wintering areas to Izembek Lagoon is characterized by short, daily movements over roughly a two-month period. Nevertheless, brant have not historically arrived at Izembek over a month-long period as has occurred in the past three years.

Numbers and distribution of brant within Izembek and adjacent lagoons are determined each fall by aerial survey. The refuge staff performed ten surveys and Migratory Bird personnel from the Regional Office performed an additional count during the peak staging period in 1988 (Table 15). The average count from the peak staging period, resulting from these various efforts to enumerate the population was 138,852 brant. This figure was used to estimate the composition of the population with reference to age and breeding status (Table 16).

A total of 128,163 Pacific brant were reported during the mid-winter inventory with 107,721 of these in Mexico (Table 17). The peak fall count for southwestern Alaska was 142,083 brant. The Izembek refuge coordinated with personnel performing the mid-winter survey by performing an aerial count of brant in the Izembek area. A total of 3,910 brant were counted during this survey. Considering the minimum number of brant overwintering in Alaska, and that the bulk of hunting mortality in the lower 48 and Mexico had occurred by mid January, the peak fall Izembek counts and mid-winter censuses were in close agreement.

Table 16. Brant population composition, Izembek Refuge, 1988.

Parameters	Est. Number of birds	% Change from 1987
Total Count ^{/1}	138852	-7.7
Est. No. of Juveniles (i.e. 19.3% of total)	26798	-42.9
Est. No. of Families (i.e. Total juveniles 2.4 juv./fam.)	11166	-35.8
Est. No. of Breeding Adults (i.e. No. of families x 2)	22332	-35.8
Est. No. of Sub-adult and Non and Failed Breeding Adults (i.e. total count minus juveniles and breeding adults)	89722	+30.6

^{/1} Average of 135,620 and 142,083 peak counts.

Table 17. Black brant mid-winter survey data, Pacific flyway.

Year	Washington	Oregon	California	Mexico (West Coast)	Total	3 Year Running Avg.
1974/5	6,163	1,507	480	115,340	123,490	126,382
1975/6	7,540	1,769	680	112,056	122,045	125,395
1976/7	14,111	2,100	0	130,756	146,967	130,834
1977/8	18,100	1,110	560	143,117	162,887	143,966
1978/9	8,078	1,255	10	120,070	129,413	146,422
1979/80	7,665	1,015	135	137,550	146,365	146,222
1980/1	10,107	1,790	540	181,760	194,197	156,658
1981/2	6,451	706	485	113,402	121,044	153,869
1982/3	3,113	718	565	104,918	109,314	141,518
1983/4	7,097	930	700	124,703	133,430	121,262
1984/5	11,675	641	801	131,568	144,685	129,143
1985/6	12,026	1,113	706	114,725	128,570	135,562
1986/7	14,371	1,133	736	86,913	103,153	125,469
1987/8	19,831	1,104	947	116,696	138,578	133,317
1988/9	18,538	871	1,033	107,721	128,163	123,298

Calendar year prior to January mid-winter survey (i.e. 1988 data represents survey done in January 1989).

Canada Goose

Taverner's Canada geese are an important component in the fall waterfowl concentration on the Izembek refuge. The first fall arrivals were a flock of eight observed on 23 August. A single or a small flock was heard by local residents near Kinzarof Lagoon on 8 August. The influx of birds continued slowly through September. Greatest numbers are present in October each year and aerial survey efforts in the fall of 1988 placed the peak population at 45,321 birds (Table 15).

The Canada goose is the primary species in the hunter's bag at Izembek. Canada geese are of increasing importance due to the harvest restrictions or closures on other species. Canada geese made up 81.7% of the goose harvest and 52.9% of the total waterfowl take at Izembek in 1988 (Table 39 in Public Use section). Juveniles predominated slightly over adult Canada geese in the fall harvest based on our bag check data (Table 18a).

The fall departure of Canada geese from the Izembek area began on 22 October and peaked from 30 of October to 3 November. Canada geese initiate their migration with weather conditions similar to those used by brant, but Canadas leave during daylight hours. All Canada geese have usually departed the area by late November. The last sighting of departing birds in 1988 was on 8 November.

Very small numbers of cackling Canada geese occur among the masses of Taverner's Canada geese seen at Izembek each fall. Of the numerous cacklers banded on the Yukon-Kuskokwim Delta, none have been recovered by hunters here; however, this fall three collared cacklers were observed at Moffet Bay on 20 October (i.e. 34, K6 and K8). Considering the relatively large numbers of cacklers that have been standard banded or neck collared, these few occurrences at Izembek seem to confirm the "uncommon" status of this subspecies on the Southern Alaska Peninsula.

In 1988, 662 Canada geese were captured for banding on the Nushagak Peninsula by the staff of the Togiak Refuge. One of these birds was shot at Izembek. Cal Lensink with the Alaska Fish and Wildlife Research Center compared measurements of these geese with those made on the populations in western Alaska. Except for 5 cackling Canada geese all the birds captured on the Nushagak Peninsula were determined to be Taverner's Canada geese. However, slight differences in measurements and head/neck plumage suggests that these birds are probably from stocks other than those most abundant during fall at the Izembek Refuge.

Table 18a. Age ratio of Canada geese in hunters' bags, Izembek National Wildlife Refuge.

Year	Canada Geese Harvested		Total	Adult:Immature Ratio in Harvest
	Adults (%)	Immatures (%)		
1976	78 (38.6)	124 (61.4)	202	1.00:1.6
1977	32 (43.2)	42 (56.8)	74	1.00:1.3
1978	29 (37.7)	48 (62.3)	77	1.00:1.7
1979	98 (53.3)	86 (46.7)	184	1.10:1.0
1980	30 (43.5)	39 (56.5)	69	1.00:1.3
1981	113 (57.1)	85 (42.9)	198	1.30:1.0
1982	74 (50.7)	72 (49.3)	146	1.03:1.0
1983	51 (49.1)	53 (50.9)	104	1.00:1.04
1984	37 (41.6)	52 (58.4)	89	1.00:1.4
1985	23 (67.6)	11 (32.4)	34	2.09:1.0
1986	11 (50.0)	11 (50.0)	22	1.00:1.0
1987	17 (51.5)	16 (48.5)	33	1.06:1.0
1988	50 (48.5)	53 (51.5)	103	1.00:1.06
Total	643 (48.2)	692 (51.8)	1,335	1.00:1.08

Emperor Goose

The emperor goose population has responded to three years of near average or better productivity as indicated by both the spring and fall aerial censuses. The spring and fall inventories increased by 4.1 and 16.0 percent, respectively over the 1987 level (Table 18). Given favorable nesting conditions the emperor goose population has shown the potential for growth necessary to return to historic levels. The spring population size of 53,784 in 1988 is 61.3 percent below the historic, mid-1960's, level of 139,000 geese.

The Izembek refuge staff and Migratory Bird Management-North cooperated to perform the eighth annual aerial survey of emperor geese in coastal areas from the Yukon-Kuskokwim Delta to Unimak Island including the north and south sides of the Alaska Peninsula. The 1988 spring survey from 2 to 6 May, as with previous efforts, was initiated when essentially the entire population was believed to be staging in bays and lagoons within the survey area. A total of 53,784 emperor geese were observed in the survey area (Table 19). Climatological charts prepared by the National Weather Service and aerial reconnaissance by refuge personnel from the Yukon-Delta, Togiak and Alaska Peninsula/Becharof Refuges are essential indicators used to determine when to initiate the survey.

Coordination with Soviet biologists working on the Commander Islands and Kamchatka has provided information supportive of a spring migration of essentially the entire emperor goose population eastward through the Aleutian Islands and northward up the west coast of Alaska.

The concern that significant numbers of emperor geese may remain in the Aleutian Islands during spring surveys and hence go uncounted was largely dispelled by an aerial survey with the aid of a Grumman Goose in the spring of 1987. Slightly over one thousand birds were found west of the survey area during the count period. These were likely sub-adults or non-breeders.

Below average productivity in the emperor goose population in recent years is directly related to the alarming population decline observed through 1985. Management strategies had little if any effect in slowing this decline even though all hunting was theoretically stopped, beginning in 1986. It was gratifying to see the population respond to good nesting conditions in 1986, 1987 and 1988.

Negotiations among residents of the Yukon-Kuskokwim Delta (i.e. Waterfowl Conservation Committee of the Association of Village Council Presidents), the states of Alaska and California, sportsmen's groups and the Fish and Wildlife Service culminated in the 1985 Yukon Delta Goose Management Plan. According to this plan, if the spring emperor goose population falls below 60,000 birds, based on a 3-year moving average, all hunting must stop.

Table 18. Population size and productivity trends in Emperor geese.

Year	Spring Population Size (% change prev.year)	Production (% young in fall)	^{/1, /2} Family Group Size	Fall Population Size (% change prev.year)
1980	No survey	24.8	2.3	65,971
1981	91,267	31.7	3.2	63,156 (-4.3)
1982	100,643 (+10.3)	7.8	2.7	80,608 (+27.6)
1983	79,155 (-21.4)	27.1	3.2	72,551 (-10.0)
1984	71,217 (-10.0)	22.3	2.8	82,842 (+14.2)
1985	58,833 (-17.3)	17.4	2.8	59,792 (-27.8)
1986	42,228 (-28.2)	26.1	2.6	68,051 (+13.8)
1987	51,655 (+22.3)	33.6	3.1	65,663 (-3.5)
1988	53,784 (+4.1)	24.2	3.1	76,165 (+16.0)

/1 Data from Izembek National Wildlife Refuge, (1980-1984).

/2 Data from Izembek Refuge and other Alaska Peninsula areas (1985-88).

Table 19. Summary of emperor goose sightings by survey area,
2-6 May, 1988.

Date	Location	No. of Emperor Geese Observed
2 May	Hooper Bay to mouth of Kuskokwim River	126
"	Mouth of Kuskokwim River to Quinhagak	55
"	Quinhagak to Jacksmith Bay	4
"	Jacksmith Bay to Carter Bay	91
"	Carter Spit to Platinum	52
"	Platinum to Security Cove (incl. Chagvan Bay)	148
"	Security Cove to Cape Pierce (incl. Nanvak Bay)	409
"	Cape Pierce to Tongue Point	0
"	Tongue Point to Kulukak Point	0
"	Kulukak Point to Dillingham	75
"	Dillingham to Nakeen	0
"	Nakeen to Naknek	0
4 May	Naknek to Cape Chichagof	0
"	Cape Chichagof to Goose Point (incl. Egegik Bay)	507
"	Goose Point to Cape Menshikof (incl. Ugashik Bay)	605
"	Cape Menshikof to Port Heiden (incl. Cinder River estuary and Hook Lagoon)	8,006
"	Port Heiden to base of Stroganof Point (incl. Port Heiden)	20,300
"	Base of Stroganof Point to Ilnik (incl. Seal Islands lagoon)	6,115
"	Ilnik to Port Moller	0
"	Port Moller to Point Divide	0
"	Point Divide to Sapsuk River mouth (incl. Herendeen Bay, Nelson Lagoon, Mud Bay, and Kudobin, Deer and unnamed sand islands)	12,240
"	Sapsuk River mouth to Moffet Point	0
5 May	Moffet Point to Strawberry Point (incl. Moffet Bay)	2,143
"	Strawberry Point to Cape Krenitzin (incl. Izembek Lagoon and Applegate Cove)	218
"	Cape Krenitzin to Chunak Point (incl. Swanson Lagoon, Hook Bay, St. Catherine's Cove and Hot Springs Bay)	0
"	Boiler Point to Littlejohn Lagoon (incl. Little, Middle, Big and Littlejohn Lagoons)	70
"	Kenmore Head to Thinpoint	0
"	Thinpoint to Delta Point (incl. Old Man's Mortensen's and Nurse Lagoons)	0
6 May	Delta Point to Lenard Harbor (incl. Kinzarof Lagoon)	15
"	Belkofski Bay to Arch Point	5
"	Arch Point to Canoe Bay	125
"	Canoe Bay to Dorenoi Bay	15
"	Dorenoi Bay to Mitrofanina	885
"	Mitrofanina to Chignik Lagoon (mouth)	0
"	Chignik Lagoon to base of Cape Kumliun	117
"	Base of Cape Kumliun to Cape Kuyuyukak	311
"	Cape Kuyuyukak to Cape Kilokak	35
"	Cape Kilokak to Hartman Island	130
"	Hartman Island to Coal Point	988
"	Coal Point to Cape Kekurnoi	0
2-6 May		Total
		53,784

With the 1988 survey total of 53,784 geese, this average continued to fall to 49,222 (Figure 5). Restricted hunting of emperor geese may be allowed again when the spring population reaches 80,000 geese again based on a 3-year moving average.

An action plan and a draft Pacific Flyway Management Plan for emperor geese identify a population goal of 150,000 birds. This goal is comparable to historic levels and should be maintained. It seems, to the Izembek refuge staff, that the difficulty in reaching and maintaining a population of 150,000 emperor geese is greatly increased by allowing hunting when only 80,000 individuals are present. We would suggest that hunting be prohibited if the population falls to 25% below the identified goal (i.e. when fewer than 110,000-115,000 geese are present). (Figure 6)

Emperor geese began their fall influx into the Izembek refuge on 23 August when five birds were seen at Grant Point on Izembek Lagoon. Peak numbers were present beginning in October as determined from seven aerial surveys (Table 15 in brant section). The aerial survey conducted by Rod King and Bill Eldridge, Migratory Bird Management, was part of the annual fall survey of emperor geese in southwestern Alaska. The total of 76,165 geese counted from 8-12 October 1988 was used to estimate the composition of the fall population (Table 20).

Emperor goose productivity counts in 1988 were performed by the Izembek refuge staff and personnel from the Research and Migratory Bird Management Divisions in the Regional Office. Observations were made from 31 August to 29 October. Emperor goose productivity as determined from Izembek counts was based on 7 and 24 September and 3 October aerial photographic surveys and by conventional ground counts at other times using spotting scopes. Aerial surveys by the Izembek staff resulted in samples totaling 1,944 geese from the Nelson Lagoon to Moffet Bay area. This sampling effort gave a weighted average of 25.7 percent juveniles in the population. Combined aerial and ground productivity counts through October resulted in 5,126 emperor geese classified to age with 1,242 (24.2%) of these being juveniles (Table 21).

Izembek information was combined with similar counts made at other bays and estuaries along the north side of the Alaska Peninsula from 7 to 30 September (Table 22). The proportion of young in the population based on all sampling (11,200 geese) in 1988 was 25.3 percent.

The estimate of percent young in the emperor goose population from specific locations and times (Table 23) varied again this year. This corroborates previous years data that indicated production estimates from aerial photographs taken from one area and time may not be representative. Comparison of the proportion of young present in each area during the first week of the survey (Table 24) suggest there may be a difference in the age composition of emperor geese using each lagoon. These results may indicate that

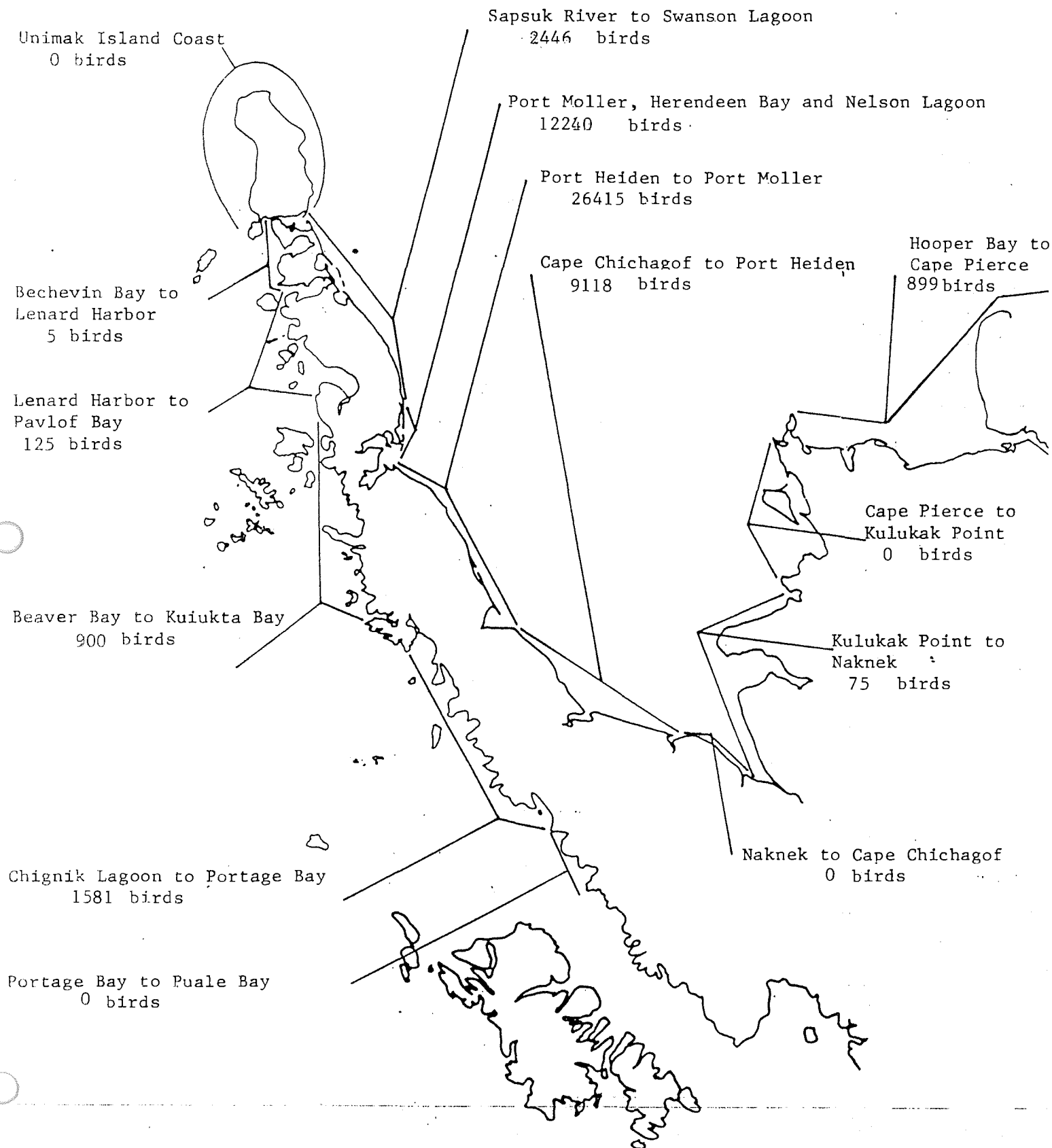


Taverner's Canada geese are abundant in the fall and are favorites of consumptive and non-consumptive users alike.



The emperor goose population has begun to respond to moderately good production and hunting closures since 1986. The fall population numbers over 75,000 birds.

Figure 5. Percentage distribution of emperor geese by survey area, 2-6 May 1988.



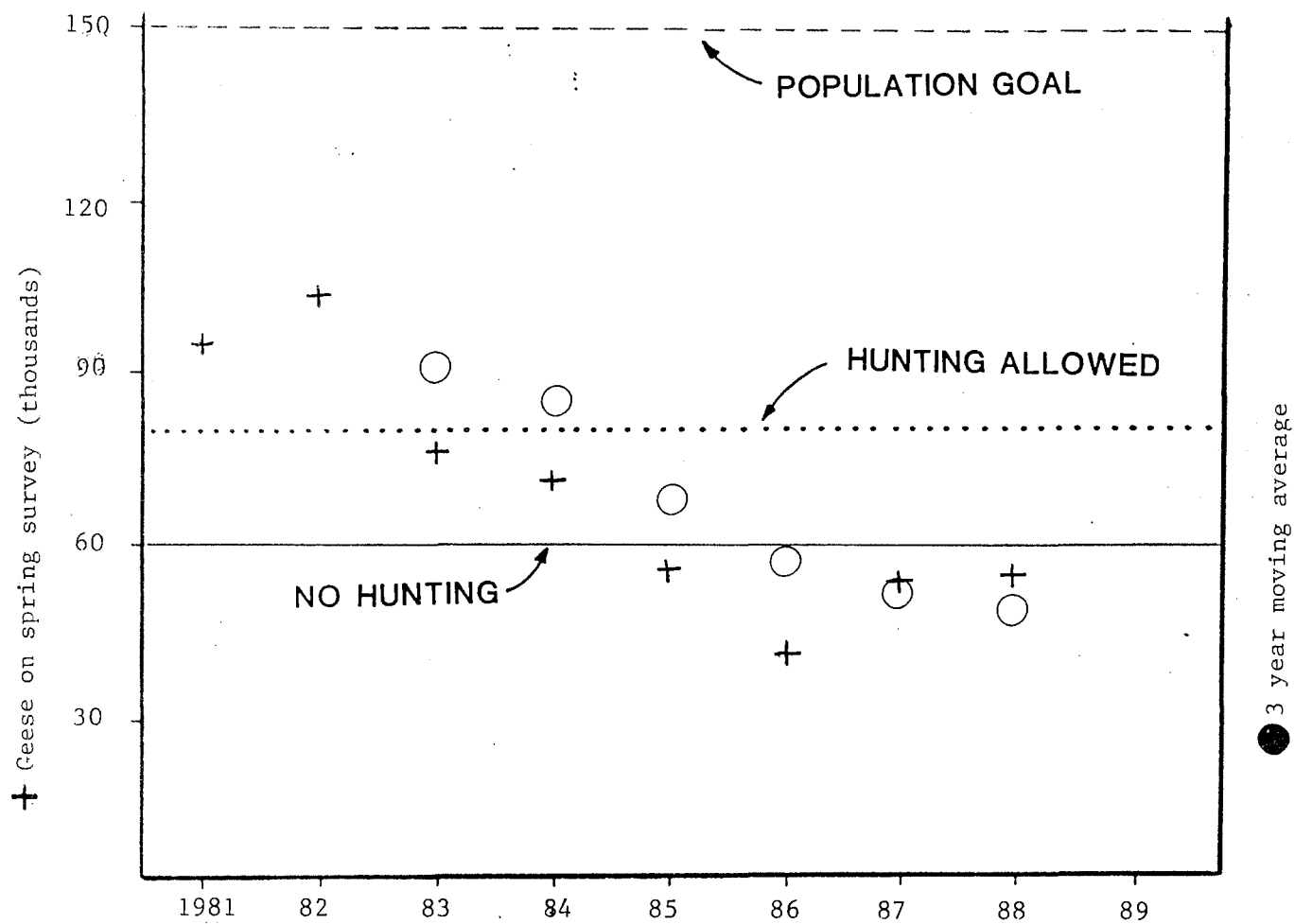


Figure 6. Emperor goose spring population size in relation to management thresholds.

Table 20. Composition of the emperor goose population based on fall surveys in southwestern Alaska.

	Number of Birds			
	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>
Fall Peak Count	59,792	68,051	65,663	76,165
Est. number of juvenile birds (percent young x total)	10,404	17,761	22,063	18,432
Est. number of families (number HY + Avg. family group size)	3,716	8,881	7,117	5,946
Est. maximum number of breeding adults with young (number of families x 2)	7,432	17,762	14,234	11,892
Est. total number of sub-adults non and/or failed breeding adults (total count minus juveniles and breeding adults)	41,956 (70.2%)	32,528 (47.8%)	29,366 (44.7%)	45,841 (60.2%)

Table 21. Emperor goose productivity counts, Izembek NWR, 1970-1988.

Year	Adults	Juveniles	Total	% Juveniles	No. of Families	Family Group Size
1970	9,722	4,933	14,655	33.7	383	2.9
1971	8,142	3,458	11,600	29.8	480	2.7
1972	4,680	2,270	6,950	32.7	210	3.1
1973	-	-	-	-	-	-
1974	2,025	377	2,402	15.7	50	2.6
1975	744	405	1,149	35.2	51	2.9
1976	1,023	324	2,247	14.4	207	2.7
1977	996	683	1,679	40.7	108	2.8
1978	1,395	495	1,890	26.2	62	3.0
1979	841	113	954	11.8	53	3.3
1980	1,777	586	2,363	24.8	40	2.3
1981	1,067	495	1,562	31.7	181	3.2
1982	1,653	140	1,793	7.8	32	2.7
1983	1,058	393	1,451	27.1	192	3.2
1984	2,753	795	3,548	22.4	79	2.8
1985	2,245	503	2,748	18.3	125	2.8
1986	3,283	1,381	4,664	29.6	266	2.6
1987	2,989	1,523	4,512	33.8	186	3.1
1988	3,884	1,242	5,126	24.2	200	3.1
22_Yr. X	2,907	1,158	4,078	28.4	150	2.9

Table 22. Annual emperor goose productivity estimates from photographs taken on the northside of the Alaska Peninsula, 1985-1988.

Year	Adults	Juveniles	Total	Percent Juveniles
1985	2657	536	3193	16.8
1986	4721	1659	6380	26.0
1987	7760	2417	10178	23.7
1988	8367	2833	11200	25.3
Total	23505	7445	30951	24.0

/1 Data compiled by Bill Butler, Office of Migratory Bird Management, Anchorage including observations collected by the Izembek staff.

Table 23. Percent juveniles observed in photographic samples of emperor geese from four locations on the northside of the Alaska Peninsula, fall 1988.

Location			
Cinder River	Port Heiden	Seal Islands	Nelson Lagoon
27.3(3000) ^{/1}	28.7(2205)	19.8(1303)	24.9(3850)

/1 The number of emperor geese classified from photographs taken at each location are in parentheses.

Table 24. Estimates of percent juvenile emperor geese from aerial photographs on the Alaska Peninsula, fall 1988.

Date	Location						
	Egegik	Ugashik	Cinder River	Port Heiden	Seal Islands	Nelson Lagoon	Izembek Lagoon
7 Sept.						20.8(629) ^{/1}	
21 Sept.						26.8(760)	
25 Sept.	25.3(166)	17.3(52)	20.4(1068)	34.0(633)	15.2(374)	26.6(173)	12.2(98)
26 Sept.		16.5(249)	32.4(1622)	24.8(1264)	17.7(507)	22.2(397)	24.7(243)
27 Sept.						21.7(576)	
30 Sept.			24.2(310)	33.7(308)	26.3(422)	33.8(260)	3.0(34)
3 Oct.						29.9(555)	

^{/1} The number of emperor geese classified from photographs at each location are in parentheses.

discrete sub-populations use specific lagoons for extended periods during fall migration.

Family group sizes of emperor geese observed in the Izembek area averaged 3.1 young per family (n=200 families) over the period 31 August to 29 October (Table 25). Average Class I and Class II sizes for emperor geese at one study site on the Yukon-Kuskokwim Delta were 4.1 and 3.4, respectively (Craig Ely, Research, Anchorage). These data suggest an attrition rate of 24.4% for young emperor geese from hatch into the fall migration period. This rate of mortality, as evidenced by size of family groups, is 6.4 percent higher than the average for the historical period 1969-1980, suggesting below average survival of young in 1988 (Table 26).

Neck collaring of emperor geese at research study sites on the Yukon-Kuskokwim Delta continued in 1988. A total of 800 birds, 400 adults and 400 juveniles, were fitted with yellow neck collars with black number/letter combinations. In addition, eleven emperor geese were fitted with radio packages, five of which were solar powered units attached to the neck collar. The remaining six birds carried conventional back-pack harnesses.

The Alaska Fish and Wildlife Research Center placed a camp at Cinder River Lagoon, 240 miles northeast of Izembek Lagoon, from which emperor goose observations were made. Over twenty percent (20.8) of the neck collared geese were observed from this camp. Seventy percent of the collared emperor geese were seen an average of 9 times during a 7 week period, suggesting that some individuals show a high degree of fidelity for certain staging areas. Tracking of radio marked geese confirmed these data in that four of the six signals received were from quite sedentary birds while two others spent only brief periods in a particular lagoon.

Two radio marked emperor geese were located as far south as Nelson Lagoon during aerial surveys conducted by both Migratory Bird Management and Research personnel and the Izembek refuge. One radioed bird (6C5: frequency 167.560) was last present on a 19 October survey of Nelson Lagoon. Refuge tracking flights in the area from Nelson Lagoon to Unimak Island on 29 November and 12 and 16 December did not turn up either bird suggesting they had moved into the Aleutian Islands. Emperor 6C5 was received on Adak Island in December and January. Four neck collared emperors (ie. 5T1 and three unreadable codes) were observed this fall during ground production counts at Izembek.

4. Marsh and water birds

Common loons and red-necked grebes nest regularly in the area, but in low numbers. Both species appear to use remote areas of the refuge, however, a pair of common loons did continue to nest on Blinn Lake where we operate our float plane. The nest was unsuccessful in 1988.

Table 25. Emperor goose productivity counts, Izembek NWR, 1970-1988.

Year	Adults	Juveniles	Total	% Juveniles	No. of Families	Family Group Size
1970	9,722	4,933	14,655	33.7	383	2.9
1971	8,142	3,458	11,600	29.8	480	2.7
1972	4,680	2,270	6,950	32.7	210	3.1
1973	-	-	-	-	-	-
1974	2,025	377	2,402	15.7	50	2.6
1975	744	405	1,149	35.2	51	2.9
1976	1,023	324	2,247	14.4	207	2.7
1977	996	683	1,679	40.7	108	2.8
1978	1,395	495	1,890	26.2	62	3.0
1979	841	113	954	11.8	53	3.3
1980	1,777	586	2,363	24.8	40	2.3
1981	1,067	495	1,562	31.7	181	3.2
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1986	3,283	1,381	4,664	29.6	266	2.6
1987	2,989	1,523	4,512	33.8	186	3.1
1988	3,884	1,242	5,126	24.2	200	3.1
22 Yr. X	2,907	1,158	4,078	28.4	150	2.9

Table 26. Juvenile mortality of emperor geese during summer and fall, 1969-1980¹

	\bar{X} Clutch Size (n)	\bar{X} Class I Brood Size (n)	\bar{X} Class III/F Brood Size (n)	\bar{X} Fall Family Group Size (n)
1969-1980	5.0 \pm 0.3 (806)	4.1 \pm 0.4 (517)	3.5 \pm 0.6 (497)	2.9 \pm 0.3 (1,805)
Estimated mortality from preceeding age classification		18%	15%	17%
Estimated mortality in relation to fall family group size	42%	29%	17%	

¹Summer data from Yukon-Kuskokwim Delta study areas; fall data from Izembek NWR

5. Shorebirds, Gulls, Terns and Allied Species

Rock sandpipers and semipalmated plovers are two of the most common shorebird species nesting on the refuge. The first rock sandpipers observed displaying on the tundra were on 18 April. First arrival for semipalmated sandpipers was on 8 May, their numbers appeared lower in 1988.

Gull migration in 1988 was approximately one week late with flocks of glaucous-winged gulls moving north most noticeably 16-17 April. First mew gulls arrived on 30 April.

Other noteworthy shorebird and gull observations made largely by Research personnel follow:

Lesser Sandhill Crane: First arrival on 30 April.

Black-bellied Plover: Uncommonly seen on the Izembek refuge usually in association with lesser golden plovers. Six and 5 were seen on 13 and 18 October, respectively.

Black Turnstone: Prior to 1988 only one individual of this species had been observed in the Izembek refuge area. This year a single bird was observed on 26 August and an unconfirmed sighting of a flock of 15 was made on 20 September.

Whimbrel: This uncommon fall migrant was observed on 30 August (2), 31 August (12) and on 2 September (5).

Wandering Tattler: Four birds were observed on 30 August and single birds were observed on 19 September and 8 October.

Yellowlegs sp: Greater yellowlegs were uncommon but seen regularly from 23 August to 27 September with the latest sighting being 2 birds on 12 October. Lesser yellowlegs are rare, with individual birds being seen on 25 August and 17 September.

Semipalmated Sandpiper: A first record of this species at Izembek was a single bird seen with western sandpipers on 26 August.

Sharp-tailed Sandpiper: Eighty-six birds in varying sized groups up to 21 individuals were seen from 2 September to 14 November.

Marbled Godwit: Another first sighting for the Izembek refuge. A single bird was seen by three observers at close range on 25 August.

Red Phalarope: Individuals seen on 4 and 18 September and on 5 October.

Red-necked Phalarope: Observed single birds on 26 August, 1 and 17 September and 2 birds on 4 and 13 September.

Glaucous Gull: Rarely identified at Izembek; individuals were seen on 3 and 14 November.

Red-legged Kittiwake: A single immature was seen on 11 September.

6. Raptors

A single osprey was observed on 21 October. This is only the third sighting for the Izembek refuge. Golden eagles are uncommon and single immatures were seen on 20 May and 1 October while a single adult was seen on 12 October. Merlins are rare in the area however three sightings were made in 1988 on 3, 6, and 24 October.

Single nest sites of bald eagles, rough-legged hawks and gyrfalcons occur on or near the refuge however only the eagle aerie was active producing two young. Both young were captured for banding on 26 July.

Gyrfalcons, northern harriers and short-eared owls are all common fall migrants. First spring sightings of northern harriers and short eared owls were on 9 and 3 March, respectively.

7. Other Migratory Birds

A chronology of routine and unusual sightings of 'other' migratory birds follows:

Greater white-fronted goose: Usually rare in the fall, more stragglers than normal occurred in 1988. A single adult was seen on 22 September and a single and group of 3 adults were seen on 22 October. Juvenile birds were seen on 13 October (4) and 24 October (2) and two birds of unknown age were seen on 2 November.

Lesser snow goose: Uncommon in fall however 1988 numbers were slightly higher than normal. Two adults were observed on 12 September and a single adult was seen on several occasions from 8-27 October. A flock of 15 was seen on 15 October and a single juvenile was observed on 4 November.

Eurasian Wigeon: This species has been found to be an uncommon but regular fall resident in the Outer Marker area of Izembek Lagoon. Twenty-five were seen on 27 September, 20 on 13 October, 1 to 3 on 20 October and 2 on 24 October.

Horned Lark: A first record for the Izembek area was of a single bird seen on 21 October.

Thrush sp: Single Hermit, gray-cheeked and Swainson's thrush were observed on 16, 12 and 10 September, respectively.

American Robin: A first record for the Izembek area. Single robins were seen on 14 and 22 May and a pair was observed on 18 May.

Water Pipit: First spring arrival on 1 May 1988.

Yellow Wagtail: An unconfirmed sighting on 12 October would be a first record for the Izembek refuge.

Tree Swallow: First spring arrival on 18 May 1988.

Savannah Sparrow: First spring arrival on 11 May 1988.

Lapland Longspur: First spring arrival on 30 April 1988.

Refuge personnel performed the annual Breeding Bird Survey organized nationwide by the Migratory Bird Management Office. The 6 June survey marked our sixth year of participation in the program. This is a vehicle survey with 30 stops and one-half mile intervals. A total of 351 individuals of 19 species were encountered (Table 27).

Refuge personnel performed the 22nd Audubon Christmas Bird Count in the Cold Bay/Izembek area on 22 December. A total of 27 species and 3,381 individuals were observed (Table 28).

8. Game Mammals

Brown Bear

Intensive brown bear capture and radio marking activities began in 1984 in the eastern portion of the Izembek Unit. This study was designed to evaluate the importance of the remote Right and Left-hand Valley area to brown bears of the lower Alaska Peninsula. Moderate to high densities of bears observed in this area suggested to the refuge staff that the area may be important as a core denning area for bears from surrounding areas of the Pavlof Unit and non-refuge lands. In addition it was apparent that bears accumulate in this area again during late summer and fall salmon spawning periods. A total of fifty-nine (59) bears of various age and sex classes were captured during the three year study and thirty-five (35) of these bears were fitted with radio collars. Aerial tracking of these animals through the spring of 1988 fulfilled our goals of delineating denning areas not only categorizing the types of sites used but also identifying individual preferences by sex, age and reproductive status. Seasonal use of the study area and surrounding habitats during the non-denning period was also quantified. These and additional data are being summarized in a final report.

Fall aerial brown bear surveys were re-initiated in 1988 on the eastern portion of the Izembek Unit and the northeast and southeast portions of the Unimak Unit. Bear surveys were last performed in these areas in 1985, 1983 and 1981 respectively. These crepuscular surveys are scheduled to coincide with the peak runs of salmon to spawning streams and are only general indices of population trends and productivity. Bears are categorized as

Table 27. Results of spring breeding bird surveys conducted on the Izembek Refuge, 1982-1988. /1

Species	1982		1983		1984		1985		1987		1988	
	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop	Bird/Stop
Common Loon	2	2	1	1			2	2	1	1	2	1
R-t. Loon	1	1			1	1			3	2		
Tundra Swans	3	3	2	2	2	2	3	2	14	8	7	3
Mallard	4	3			9	4			3	2	1	1
N. Pintail			3	2	2	2	3	2	1	1		
Greater Scaup	2	1	2	2	12	4	5	3	16	5	10	3
Black Scoter	8	4	5	4	13	4	5	3	18	6	16	5
Common Merganser					18	1						
W. Ptarmigan	3	3	9	6	33	17	30	16	67	27	58	24
Bald Eagle					1	1						
L. Sandhill Crane	1	1									2	1
Semipalmated Plover	1	1	2	2	4	4	5	5			8	6
Lesser Yellowlegs									1	1		
Least Sandpiper	10	1	2	1	1	1			3	2	4	2
Rock Sandpiper	52	23	93	27	69	26	65	26	97	29	70	27
Dunlin							1	1			1	1
Common Snipe	4	3	7	5	8	7	8	8	20	14	1	1
Mew Gull	8	5	21	13	14	9	4	3	9	7	11	8
G-w. Gull	1	1	16	9	34	15	15	6	80	15	73	14
Arctic Tern					2	1						
Tree Swallow			1	1								
Common Raven	8	1					2	1	3	2		
B-b. Magpie			5	1								
Water Pipit	7	6	24	17	12	11	18	11	23	17	10	8
Savannah Sparrow	3	2	41	20	35	20	30	18	16	12	13	9
G-c. Sparrow	3	3	7	5	11	9	14	8	7	6	3	3
G-c. Rosyfinch					1	1						
Song Sparrow					1	1						
Lapland Longspur	56	22	55	25	48	22	40	22	64	26	53	28
Common Redpoll	4	4	7	6			2	2			8	2
Total Species	20		19		21		18		20		19	

/1 This is an automobile survey with thirty (30) three minute stops at half mile intervals. Birds: is the total heard or seen for the survey; stops: is the number of stops on which the species was encountered.

Table 28. Results of Christmas Bird Count, Cold Bay, Alaska
22 December 1988.

Species ^{/1}	1988	Average No. Seen ^{/2} (No. Years Seen)	% Change From Avg.
Red-necked Grebe	3	3 (10)	0
Horned Grebe	9	13 (12)	-31
Pelagic Cormorant	6	13 (21)	-54
Black Brant	1400	1479 (15)	- 5
Emperor Goose	956	1149 (23)	-17
Mallard	31	36 (15)	-14
Green-winged Teal	5	7 (8)	-29
Common Goldeneye	53	112 (22)	-53
Bufflehead	1	9 (15)	-89
Oldsquaw	31	232 (23)	-87
Harlequin Duck	33	30 (22)	+10
Steller's Eider	593	1091 (23)	-46
Common Eider	8	46 (18)	-83
White-winged Scoter	26	19 (19)	+37
Black Scoter	36	156 (20)	-77
Common Merganser	30	13 (11)	+132
Red-breasted Merganser	17	124 (21)	-86
Bald Eagle	9 (5A:4J)	11 (23)	-18
Glaucous-winged Gull	32	161 (23)	-80
Pigeon Guillemot	2	6 (14)	-67
Belted Kingfisher	2	1 (5)	+100
Black-billed Magpie	8	3 (15)	+167
Common Raven	47	90 (23)	-48
Northern Shrike	2	1 (16)	+100
Gray-crowned Rosyfinch	16	57 (23)	-72
Snow Bunting	24	40 (23)	-40
Repoll sp.	1	13 (7)	-92

Total number of Species 227
Total number of individuals 3381

Number of observers: 1 (Chris Dau)
Observation time: 8 hours (2.5 on foot; 5.5 by car)
Distance covered: 61 miles (3 on foot; 58 by car)

^{/1} A total of 58 species have been observed in 23 years.

^{/2} Average for year during which species was observed during the 23 years of participation in the Christmas Bird Count.

small, medium or large single animals or as family groups of cubs-of-the-year, yearlings or 2-1/2 year olds. Data from the Moffet Bay/Left and Right-hand Valley area suggested a possible dramatic decline in fall usage by bears (Table 29). Unimak Unit counts in the northeast segment were comparable to previous efforts while the southeast segment showed possibly greater use.

Fall aerial surveys over selected sample units will continue to be our primary means of monitoring the status of brown bear populations on the Izembek refuge. More accurate means of accurately assessing total population size, involving intensive radio marking, is being evaluated by the Alaska Department of Fish and Game near Black Lake, 200 miles northeast of Cold Bay. These data may help qualify survey efforts elsewhere on the Alaska Peninsula.

The Alaska Peninsula (Game Management Unit 9) was open to brown bear hunting during the 10 to 25 May season in 1988. The fall season extends from 1 to 21 October but was closed in 1988. Consecutive spring and fall seasons are open every other regulatory year hence the next opening will be in the fall of 1989. The Izembek staff seals bear skulls and hides for the Alaska Department of Fish and Game on a designee basis. Hence, many of the bears harvested on the lower Alaska Peninsula and Unimak Island are sealed by Izembek refuge personnel. A total of twenty-five (25) brown bears were sealed in the spring of 1988 including two taken on the Unimak Unit (Game Management Unit 10) and one from Game Management Unit 9E. Brown bear hunting on the Unimak Unit is open annually by drawing permit with seven and eight permits issued for spring and fall seasons, respectively (Table 30). The spring hunting season extends from 10 to 25 May and in 1988 five of the seven permittees participated in the hunt. Three bears, all male, were taken during the season. Hunters were in the field for an average of eight days and saw an average of six bears each.

The fall hunt on Unimak Island was from 1 to 21 October with 2 of the eight permittees participating. Two bears were taken (one male and one female). Hunters were in the field for one day each.

Brown bear hunting on Unit 9D of the Alaska Peninsula in the spring of 1988 was generally successful based on interviews with guides and hunters. Cold spring weather retards snow-melt and holds bears in or near their den sites often until late May. Hunter access to higher elevations is more difficult than for lowland areas hence cold springs generally equate to a reduced harvest. The spring of 1988 was climatically near average as was hunter access and subjectively the overall harvest. Larger males make up a greater proportion of the harvest in mild springs as they are more likely to occur at lower elevations frequented by hunters. Seven (41%) of 17 bears sealed in the spring of 1988 were large animals with skulls measuring 26 inches or greater. This is a greater than normal proportion of large males further suggesting climatic conditions were moderate.



Sealing of bear hides and skulls is done both in the field at guide camps and in Cold Bay prior to shipment.



Brown bears are sealed by the refuge staff in support of the Alaska Department of Fish and Game.

Table . Fall aerial brown bear counts on units of the Izembek refuge, 1988.

Unit	Date	Single Bears			Sows with ^{/1}			Total Females	Total Bears	Previous Counts ^{/2}	
		Sm.	Med.	Lg.	COY	Yrl.	2 ⁺			No. females	Total Bears
Izembek(E)	23 August	9	10	1	4w/6	4w/8	1w/2	9	45	19	109
Unimak(NE)	24 August	2	32	3	3w/7	5w/9	1w/3	9	65	11	68
Unimak(SE)	25 August		9		3w/7	2w/4	2w/3	7	30	1	8

/1 Total sows and young in each age class.

/2 Izembek (E) 1981-85; Unimak (NE) 1981-83; Unimak (SE) 1981

Table 30. Brown Bear Hunter Numbers and Success Unimak Island, 1975-1988.

	Permits Issued	Hunters Active	Bears Known Taken
CY 1975	20	9	6
CY 1976	18	10 ^{/1}	4
CY 1977	15	10 ^{/1}	7
CY 1978	15	3 ^{/1}	1
CY 1979	15	8 ^{/2}	7
CY 1980	15	6	3
CY 1981	15	5	3
CY 1982	15	7 ^{/1}	4
CY 1983	15	10 ^{/1}	6
CY 1984	15	4	1
Spring 1985	7	3	2
Fall 1985 ^{/3}	6	6	5
Spring 1986 ^{/3}	2	2	2
Fall 1986	8	5	3
Spring 1987	7	5	3
Fall 1987	8	6	5
Spring 1988	7	5	3
Fall 1988	8	2	2

/1 One permittee failed to return questionnaire, unknown if active.

/2 Three permittees failed to return questionnaires, unknown if active. One additional hunter was lost at sea on his return flight to Anchorage, not known if he took bear.

/3 Changed to a registration hunt with permits issued on a first-come-first served basis at the refuge office.



A bear guides base camp near Cold Bay. Weather ports have become popular remote facilities.

The Cold Bay road system area, an administrative unit identified by the Alaska Board of Game, was established to provide both spring and fall brown bear hunting opportunities. Over-hunting of the population in the early 1980's depleted the local population. In the fall of 1984 the Alaska State Board of Game agreed to only open this hunting area if a "nuisance" bear was present. The reduced size of the bear population and vigilance by Cold Bay residents has resulted in very few bear-people encounters and no nuisance bears.

Minor problems at one of the Federal Aviation Administration navigational aid facilities occurred in the fall and early winter of 1988. At least two different bears became attracted to thin sheets of foam insulation applied under metal siding on a building used to house electronics equipment. This siding was only recently applied to a concrete block building. The "attractant" insulation apparently caused bears to linger in the area which may have resulted further damage to electrical wiring at the navigation aid itself. This damage put the navigational aid out of service several times during the fall which could have caused potential aircraft safety problems. The Izembek staff was presented with the solution of this problem by the concerned agency. This involved removal of the bear or bears either by relocation or shooting. We, in response, suggested that something was attracting the animals and that identification and removal of the attractant should be the first step. Winter and the desire to den solved the immediate problem.

Subjectively it appears that the local bear population has begun to respond to closures begun in 1984. Historically, when bear numbers have begun to increase in the Cold Bay area there has been pressure to re-open the hunting season. When this has occurred with insufficient restraint the population was again reduced below acceptable levels. Early in 1989 the Alaska Board of Game will respond to public and Alaska Department of Fish and Game requests to again allow hunting. The Izembek staff believes that a restricted harvest would be compatible with other forms of public use and what remains is to agree upon such a level with the Alaska Department of Fish and Game.

Caribou

The lower Alaska Peninsula caribou herd ranges from Port Moller southwest to the tip of the Alaska Peninsula, occurring seasonally on Izembek refuge (Figure 7). The rugged terrain between Port Moller and the Pacific Ocean is thought to effectively impede most interchange between the northern and southern Alaska Peninsula herd, enough so to warrant their separate management.

The primary calving ground for the lower Alaska Peninsula herd is on State owned land near the Black Hills area, 40 miles northeast of Cold Bay. Arrival on the calving ground occurs in mid May. After calving in early June, a large portion of the herd moves toward wintering areas southwest of the Cathedral River during the latter part of July. They typically arrive in the Cold Bay area with the first snows of the year in mid to late October and use the area from two to four months before returning to lowlands adjoining the Black Hills area.

It is here, around Cold Bay that what is thought to be a large portion of the sport and subsistence harvest occurs. The popularity of caribou hunting increased substantially until 1987, especially among military and airline employees with travel benefits who can economically travel from Anchorage to Cold Bay for a caribou hunt. Good accessibility afforded by refuge roads and liberal bag limits for resident hunters appealed to many.

Population surveys of this caribou herd have been sporadically conducted since 1949. Refuge staff initiated systematic survey attempts in 1978. Management of the herd has been shared by the Alaska Department of Fish and Game and Izembek refuge. State hunting regulations have been set with consideration given to data and recommendations provided by refuge staff.

Since 1978, efforts have been directed toward obtaining herd composition and total population estimates (Figure 8).

Post-calving surveys conducted in mid-June through early July provide an estimate of the year's calf crop and in some years an idea of the total population size. Herds are spotted from the air, and after landing near accessible groups, observers hike to suitable observation points to count and classify the animals. Fall composition data have been obtained by ground observation of groups as they cross the Cold Bay road system. Winter population estimates have only been accomplished sporadically during past years because of the

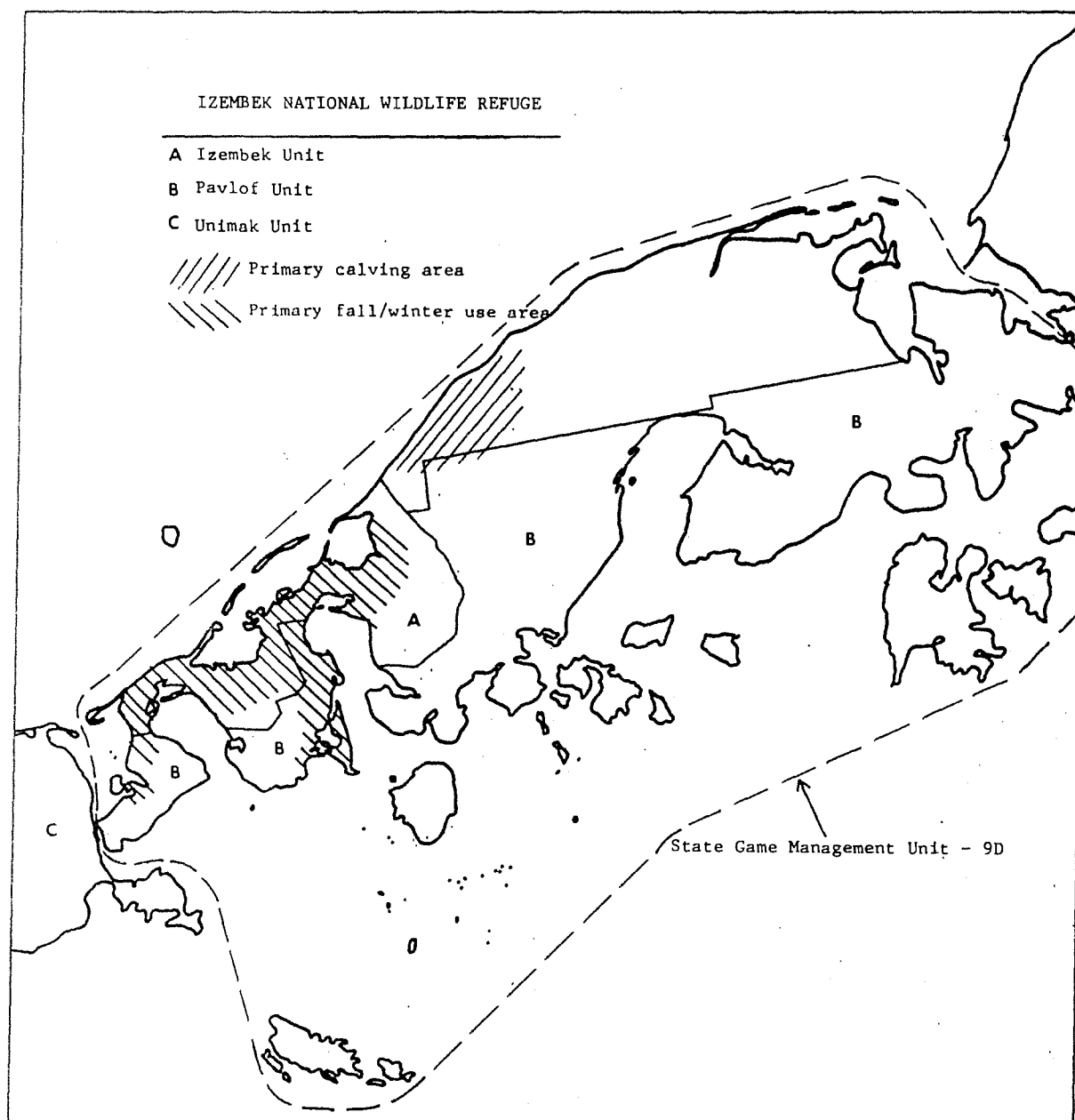


Figure 7. Seasonal distribution of the southern Alaska Peninsula caribou herd, Game Management Unit 9D.

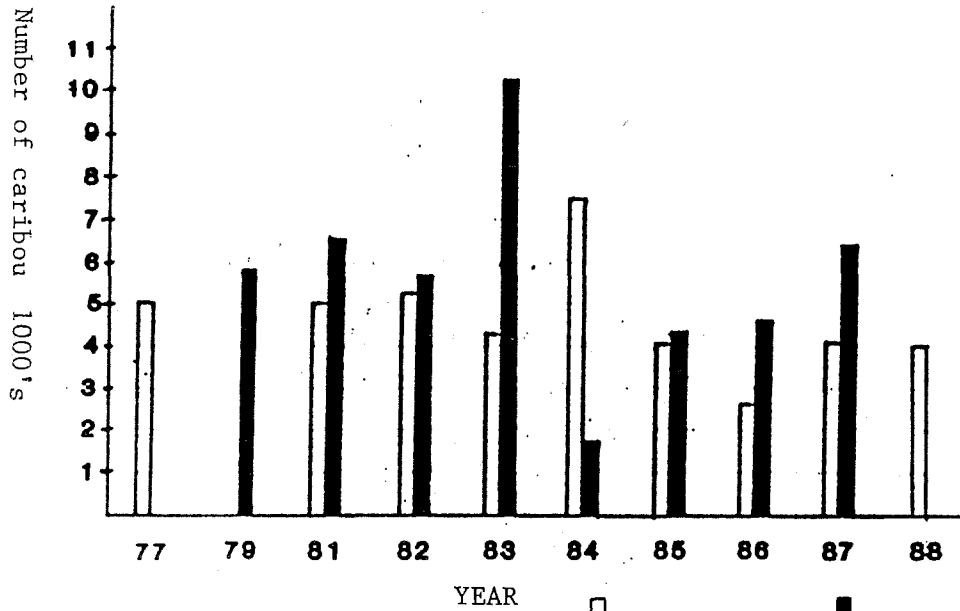




Figure 8. Results of post-calving  and post-rut  surveys of the southern Alaska Peninsula caribou herd.

successful attempts a combination of caribou counted from 35mm photos and with the unaided eye has proven effective in obtaining an estimate of total numbers.

In an effort to expedite location of caribou concentrations and provide an index for population size estimates radio telemetry techniques have been used. The refuge has worked with Alaska Department of Fish and Game since 1986 to maintain radio collars on at least 20 adult females. Up until this year's marking project animals were immobilized via helicopter with an injection of Carfentanil administered using a dart gun. Following the success experienced during the caribou transplant on Togiak National Wildlife Refuge in 1988 we enlisted the help of Soloy Helioperations and their Hughes 500 helicopter with a strut mounted net gun. Ten caribou were captured and marked in approximately three hours, using this technique, none were injured. The fact that no immobilization drugs are necessary for routine handling of caribou is a safety bonus of using this method. At year's end we had a total 36 cows marked with radio collars.

Refuge staff assisted Alaska Department of Fish and Game biologists Ken Pitcher from Anchorage and Dave Johnson from King Salmon on 13 and 14 October in this fall's capture project. The 10 cows caught this year were not only instrumented with radios but, were also weighed, and the following measurements taken; mandible length, chest girth, and metatarsal length. Blood samples were also collected from these animals. Although the sample is small it indicates these cows are very small, possibly the smallest in the State. This may be a reflection of diet and hence poor range condition.

Refuge staff have collected mandibles from caribou killed by hunters during seasons starting in 1986 and 1987. These were sent to Alaska Department of Fish and Game in Anchorage where age to size ratios were estimated for cows. Age was determined by counting incisor annuli. Size was estimated through correlation with mandible length.

Alaska Department of Fish and Game personnel Dick Sellers and David Johnson performed a post-calving production survey on 28 June in the Black Hills area. By locating radio collared animals calving concentrations were quickly located. Of the 1,162 animals classified 186 (16%) were calves. Although this is an increase over the 11.9% calf crop estimated in 1987 it is still considered minimal production and likely insufficient to maintain the herd size. Also during this survey the number of caribou on the calving area was estimated at 4008 essentially the same as last year's estimate (Table 31).



Caribou of the southern Alaska Peninsula herd occur in the Cold Bay road system from October through March. Local hunters are allowed two animals each.



Fecal samples from caribou were collected by the refuge staff as part of a program to assess winter food habits and range quality.

Table 31. June and July productivity surveys of the southern Alaska Peninsula caribou herd.

Year	Method	N	% Calves
1981	ground	2971	10.4
1983	aerial/ground	2125	17.9
1984	ground	2389	16.9
1985 *	aerial	2333	5.5
1986	ground	2594	17.2
1987	ground	1689	12.0
1988	aerial	1162	16.0

* Incomplete survey due to fog, results not used in \pm or SE calculations.

On 12 October State biologist Ken Pitcher and assistant area biologist Dave Johnson conducted a composition survey from a Hughes 500 helicopter. A total of 886 caribou were classified (Table 32). All values are very similar to those obtained during the 1987 fall composition survey.

The fall census was of caribou, using transects covering all lowland areas, was abandoned this year due to the untrustworthy results obtained during 1986 and 1987 (Izembek National Wildlife Refuge 1987 Annual Narrative Report). This decision was mutually agreed upon by Alaska Department of Fish and Game and refuge staff. In its place we agreed to attempt a winter census, a method used prior to 1986. We feel snow conditions during mid to late winter are such that no caribou will be found in upper elevations, a problem identified during previous fall lowland surveys.

The trade off is that consistent uninterrupted snow cover is required in the survey area during the three consecutive days suitable for flying. Past experience has shown these conditions do not occur every year. We are still waiting for a suitable survey opportunity as of February 1989.

The age structure of the herd as determined from animals harvested in the Cold Bay road system has shown that most animals harvested are at least six years old. Alaska Department of Fish and Game has pointed out that in other, growing herds in the State less than 20% of the harvest is comprised of animals 5 years old or more while in these samples 84% of the animals are in this age group (Table 33). Since it is unlikely that hunters are selecting against the two, three and four year old animals these data support our suspicions that little recruitment has occurred since 1982, hence few younger age animals are present in the herd.

In the continuing effort to better understand the dynamics of this population refuge staff will continue to monitor harvest in the Cold Bay area, conduct population and composition surveys, continue to assess the quality of winter range found on the refuge and participate in calving ground observations.

Vegetation information collected during 1987 is currently being compared with the diets of caribou wintering on the refuge. Dietary information was obtained by analysis of fecal samples collected during December, 1987. The objective of this project is to determine the relative abundance of favored forage plants.

In order to better determine the number of calves born each year and their survival during the first days of

Table 32. Fall composition survey results of the southern Alaska Peninsula caribou herd.

Date	N	% Calves	%Subadults & Cows	% Cows*	% Bulls	% Large Bulls
1982	1527	13.1	72.2	-	-	14.7
1983	1596	15.2	80.3	-	-	4.5
1984	1567	15.3	80.9	-	-	3.8
1985	1460	9.4	78.7	-	-	11.9
1986	2307	13.0	-	65.8	21.1	2.8
1987	1769	16.3	-	62.0	22.0	4.5
1988	886	12.0	-	62.4	25.6	1.0
\bar{X}	1587	13.5	78.0	63.4	22.9	6.2

* Data unavailable prior to 1986 when helicopter first used.

Table 33. Age distribution of caribou killed during the 1986-87 and 1987-88 hunting seasons.

	N	Age Class (yr)						
		Calves	1	2	3	4	5	6+
1986-87	81	2	2	1	1	9	19	47
1987-88	53	1	0	1	1	4	14	32
Total	134	3	2	2	2	13	33	79
%		(2.2)	(1.5)	(1.5)	(1.5)	(9.7)	(24.6)	(59.0)

life, refuge staff are planning to work with State biologists on the Black Hills calving ground during June, 1989. A combination of techniques including udder counts, frequent locations of radio instrumented cows and predator observations will be used.

By our estimate the 1987-88 harvest was conservative. Based on field checks conducted by Izembek refuge staff approximately 116 caribou were harvested, very similar to previous seasons estimated harvest of 108 animals (Table 34). Prior to the 1986-87 season the average harvest was estimated by the Alaska Department of Fish and Game to be 487 animals. Other than the obvious reduction in overall harvest during the last two seasons these data indicate approximately equal numbers of bulls and cows were taken. However twice as many bulls were taken during the less restrictive seasons prior to 1986. This may indicate fewer trophy hunters have participated in the last two hunts, possibly because of bag limit reduction or their ineligibility due to residency. Also, larger size bulls have made up a small component of the population in recent years and are hence less available.



Aerial radio tracking occurs year-round for caribou of the southern Alaska Peninsula herd. These flights are being conducted in the North Creek/Aghileen Pinnacles area.



Table 34. Caribou harvest reports for Game Management Unit 9D.

Season	No. Successful Hunters	Caribou Harvest				No. Caribou/ Hunter	Total Harvest ^a
		Male	Female	Unknown	Total		
1981-82	187	298	130	4	432	2.3	575
1982-83	180	300	110	0	410	2.3	545
1983-84	100	168	81	5	254	2.1	338
1984-85	174	279	109	0	388	2.2	516
1985-86	151	180	162	3	345	2.3	459
1986-87 ^b	81	27	32	22	81	1.0	108
1987-88 ^c	55	39	37	11	87	1.6	116
X	132.6	184	94.4		271.0	2.0	379.6
(+SE)	(+52.2)	(+1165)	(+47.7)		(+147.1)	(+0.5)	(+198.1)

a. Corrected for 75% reporting rate.

b. Bag limit reduced to one per hunter, residents only.

c. Bag limit two per resident hunter, one for nonresident during shortened season.

9. Marine Mammals and 10. Other Resident Wildlife

Sea otters in three pods of approximately 200 animals each were observed on 29 November and 12 December aerial bird surveys over the Izembek refuge. These animals were at Cape Krenitzin, Cape Glaznap and at the north end of Neumann Island. Individual animals totaling less than 100 were seen elsewhere in the survey area.

Numbers and distribution of various species of marine mammals in the Izembek refuge area have been determined opportunistically during spring waterfowl surveys since 1981. Data presented in Table 35 were collected on 6 May, 1988 during a coastal survey for emperor geese. This survey took place as peak numbers of gray whales were migrating to the Chuckchi and Beaufort Seas as indicated by the large numbers seen around the periphery of Unimak Island.

Wolves were seen in the Frosty Road area throughout June and July. These sightings are indicative of a den in the area as two of the sightings were of up to three large pups. As the caribou began their fall influx into the area wolves were again observed. A single was seen on 20 September and a pack of 11 (one light colored animal) was seen on 12 December. This is the largest pack ever documented by the refuge staff. Red fox and land otters were present in good numbers with family groups of three to six observed in the area of the Cold Bay road system.

Spring emergence of Arctic ground squirrels (or parky squirrels) was a month later than in 1987 with a single animal reported on 12 April. Many were seen out of their burrows on 14 April, from which time on they were abundant. Fall denning usually occurs in mid to late October.

11. Fisheries Resources

The Izembek refuge staff provided support and logistics for a baseline fisheries inventory by the King Salmon Fisheries Resources field office in 1985 and 1986. These investigations were designed not only to fill information voids but also to impart local knowledge to Service fisheries biologists so that they could aid the Izembek staff in the preparation of a refuge fishery management plan. Data analysis and the drafting of our management plan began in 1987, and as 1988 drew to a close, the plan was undergoing final review in the Regional Office. Fishery management plan goals listed below are broad statements corresponding to those found in the Izembek Comprehensive Conservation Plan:

Goal A: To conserve refuge fish populations and habitats in their natural diversity.



Red foxes are the predominant furbearers on the Izembek, Pavlof and Unimak Units.

Table 35. Marine mammals observed along the southern Alaska Peninsula shoreline, 5 May, 1988.

Area	Species			
	Gray Whale	Sea Lion	Harbor Seal	Sea Otter
Izembek Lagoon	2	-	160	188
Kinzarof Lagoon	-	-	-	4
Bechevin Bay	-	3	28	124
Ikatan Bay to Cold Bay	-	2	3	384
Totals	2	5	191	700

Sub-Goal A.1; Administer the refuge fishery program.

Sub-Goal A.2; Manage anadromous fish population.

Sub-Goal A.3; Manage resident fish population.

Goal B: To fulfill international treaty obligations..

Goal C: To provide for the opportunity of continued subsistence with respect to Goals A and B.

Sub-Goal C.1; Manage and maintain subsistence harvests.

Goal D: To ensure water quality and quantity to meet Goal A.

Sub-Goal D.1; Manage and maintain refuge water quality and quantity.

Salmon runs in various streams on Izembek and Pavlof Units are annually monitored by Alaska Department of Fish and Game biologists of the Commercial Fish Division. Commercial catch and escapement data for these areas are presented in Tables 36 and 37.

The Fisheries Rehabilitation and Enhancement Division of the Alaska Department of Fish and Game constructed the \$4 million Russell Creek Hatchery near Cold Bay in 1979. At full capacity, the facility should be able to rear up to 50 million salmon annually. The facility has experienced annual budgeting and construction problems which have combined to reduce the facilities effectiveness (Table 38). The Division has been plagued by recent legislative uncertainties with respect to funding which has left the future for personnel and facilities in doubt.

The hatchery employed a new "state-of-the-art" weir in 1988. Eight State and Federal fisheries biologists from Boise, Idaho led by Ed Createau, with the Service, visited this site from 18-20 August.

14. Scientific Collections

Several specimens were salvaged during the year including two tundra swans, one bald eagle, one whimbrel and one eurasian wigeon. The bald eagle was sent to the National Wildlife Health Laboratory to determine the cause of death. The other specimens will be prepared for the refuge collection or for display purposes.

Collection of jaws from caribou harvested in the Cold Bay area continued in 1988. Additional other parts were collected to generally assess the fitness of harvested animals.

16. Marking and Banding

Mammals

Table 36. Commercial salmon catch and escapement, vicinity of Izembek Refuge, 1969-1988. /1

Pink (Humpy) salmon (in thousands)				
Year	Cold Bay Area & Morzhovoi*		Izembek & Moffet	
	Catch	Escape	Catch	Escape
1969	0.2	20.3	0	2.3
1970	1.5	43.9	0	0
1971	3.6	4.5	0	0.1
1972	0	5.7	0	0
1973	0	4.6	0	0
1974	0	9.9	0	0
1975	0	8.3	0	0.1
1976	0.8	55.8	0.1	0
1977	0	21.7	0	0.2
1978	6.0	157.7	2.2	0
1979	0.03	19.2	0.01	0
1980	126.1	127.1	0	0
1981	8.5	17.5	0	0
1982 /2	136.9	319.7	0	0.2
1983	13.8	31.2	0	0
1984	139.7	236.7	0.1	0
1985	5.3	15.6	0	0
1986	48.2	84.4	0	0
1987	0.1	17.4	0	0
1988	90.6	111.1	1.2	1.8

* Much of the Cold Bay/Morzhovoi runs occur off refuge.

/1 Data supplied by Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

/2 Includes inner Cold Bay, Lenard Harbor, Sandy Cove-Mortensen's Lagoon, Morzhovoi Bay.

Table 36 continued.

Chum (Dog) salmon (in thousands)				
Year	Cold Bay Area & Morzhovoi*		Izembek & Moffet	
	Catch	Escape	Catch	Escape
1969	0	24.6	4.5	94.4
1970	1.8	43.5	10.0	53.4
1971	0.5	54.3	36.3	54.8
1972	0	51.0	57.9	72.7
1973	0.7	30.4	96.6	70.3
1974	0	30.9	11.2	70.6
1975	0	17.7	3.4	77.6
1976	2.9	38.7	40.8	123.3
1977	0	139.1	20.3	368.3
1978	5.9	102.2	81.4	119.0
1979	4.6	27.4	17.8	178.0
1980	43.3	64.4	282.6	365.2
1981	27.0	48.5	296.4	235.0
1982 ^{/2}	102.6	103.6	57.5	166.4
1983	58.9	62.5	154.8	173.3
1984	145.5	123.4	102.7	427.5
1985	87.4	94.4	126.6	194.7
1986	134.5	157.9	69.1	142.4
1987	2.9	163.8	148.6	286.0
1988	186.4	129.5	112.2	304.4

* Much of the Cold Bay/Morzhovoi runs occur off refuge.

/1 Data supplied by Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

/2. Includes inner Cold Bay, Lenard Harbor, Sandy Cove-Mortensen's Lagoon, Morzhovoi Bay.

Table 36 continued.

Coho (Silver) salmon (in thousands)**		
	Cold Bay Area & Morzhorvoi*	Izembek & Moffet
Year	Catch	Catch
1969	0	0
1970	0	0
1971	0	0
1972	0	0
1973	0	0.2
1974	0	0
1975	0	0
1976	0	0
1977	0	0
1978	1.3	0
1979	7.0	0
1980	16.4	0
1981	13.1	0
1982 ^{/1}	1.4	0
1983	0.7	0
1984	0.6	0
1985	1.9	0
1986	2.5	0
1987	6.7	2.9
1988	11.4	3.0

* Much of the Cold Bay-Morzhovoi runs occur off refuge

** Coho escapement data is incomplete. Some surveys are done, but they are rarely peak counts. Fishing effort is usually very light on Alaska Peninsula coho (Arnold R. Shaul, Alaska Department of Fish and Game, Commercial Fish Division, Kodiak).

/1 Includes inner Cold Bay, Lenard Harbor, Sandy Cove-Mortensen's Lagoon, Thin Point Cove from 1982 on.

Table 36 continued.

Red (Sockeye) salmon (in thousands)				
Year	Cold Bay Area & Morzhovoi*		Izembek & Moffet	
	Catch	Escape	Catch	Escape
1969	2.2	7.5	6.1	14.0
1970	1.0	3.3	3.1	7.5
1971	1.1	2.3	6.9	3.5
1972	0	2.5	0.8	4.8
1973	0.2	3.3	1.2	2.0
1974	0	27.3	4.7	3.7
1975	0.5	15.6	1.5	13.6
1976	1.4	27.3	20.4	15.3
1977	12.5	28.7	3.1	26.1
1978	1.0	24.7	15.5	23.0
1979	0	8.5	10.8	8.4
1980	15.6	6.1	34.2	11.2
1981	8.9	7.0	30.9	12.0
1982 ²	19.8	17.0	24.5	21.2
1983	13.8	18.2	15.2	18.5
1984	59.3	14.1	4.7	19.1
1985	30.8	7.1	6.2	17.2
1986	42.5	19.7	19.1	15.7
1987	1.5	23.5	6.5	13.6
1988	6.6	40.4	11.5	17.3

* Much of the Cold Bay/Morzhovoi runs occur off refuge.

/1 Data supplied by Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

/2 Includes inner Cold Bay, Lenard Harbor, Sandy Cove-Mortensen's Lagoon, Morzhovoi Bay.

Table 36 continued.

King (Chinook) salmon (in thousands)				
Year	Cold Bay Area & Morzhovoi*		Izembek & Moffet	
	Catch	Escape	Catch	Escape
1969	0	0	0	6.9
1970	0	0	0	2.1
1971	0	0	0	0.2
1972	0	0	0	0.2
1973	0	0	0	0.7
1974	0	0	0	0
1975	0	0	0	0
1976	0	0	0	0
1977	0	0	0	0
1978	0	0	0	0
1979	0.002	0	0	0
1980	0	0	0	0
1981	0	0	0	0
1982 ^{/2}	0	0	0	0
1983	0	0	0	0
1984	0	0	0	0
1985	0	0	0	0
1986	0	0	0	0
1987	0	0	0.1	0
1988	0	0	0	0.1

* Much of the Cold Bay/Morzhovoi runs occur off refuge.

/1 Data supplied by Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak.

/2 Includes inner Cold Bay, Lenard Harbor, Sandy Cove-Mortensen's Lagoon, Morzhovoi Bay.

Table 37. Catch and escapement data for salmon in the Hoodoo (Sapsuk) Lake/Caribou River Drainage.

(Data supplied by Arnold Shaul, Commercial Fisheries Division, Alaska Department of Fish and Game, Kodiak, Alaska).

		Species					
Year		Red	Silver	Chum	King	Pink	Total
1983	Catch	192,900	64,000	14,000	12,100	0	283,000
	Escapement	128,800	13,000 ¹	14,000	12,500	0	168,300
1984	Catch	118,800	113,300	78,400	7,800	100	318,400
	Escapement	251,000	41,000 ¹	49,000	6,300	-	338,300
1985	Catch	706,300	88,200	6,600	10,900	0	812,000
	Escapement	318,500	18,100 ¹	13,000	3,200	0	352,800
1986	Catch	178,400	99,300	3,600	4,800	100	286,200
	Escapement	117,900	23,000 ¹	1,800	1,800	0	144,500
1987	Catch	128,500	83,700	6,700	5,800	0	224,700
	Escapement	155,700	27,500 ¹	5,200	4,100	0	192,500
1988	Catch	185,800	95,400	13,400	6,500	100	301,200
	Escapement	142,500	17,000	11,000	3,300	0	173,800

¹ Sapsuk River Only.

Table 38. Management Data, Russell Creek Hatchery, 1984-1988 (data supplied by Arnold Shaul, fisheries biologist, Commercial Fisheries Division, Alaska Department of Fish and Game, Kodiak, Alaska)

	SPECIES									
	Chum Salmon					Pink Salmon				
	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988
No. adults taken for eggging	9,700	-	-	-	-	-	-	-	-	-
Aerial assessment of stream pop. (i.e. escapement)	55,000	64,800	94,100	66,400	87,900	94,000	Trace	18,900	300	15,700
Estimated commercial harvest	25,655	42,600	26,500	900	160,700	20,144	4,000	4,900	-	26,700
No. fish fin clipped	-	-	-	-	-	-	-	-	-	-
Total run (approx.)	-	n/a	121,000	-	248,600	-	n/a	25,000	-	42,400

See Section G. WILDLIFE 8. Game Mammals, Caribou for a discussion of marking activities in 1988.

Birds

Forty seven tundra swans and two bald eagles were banded under the Refuge Master Banding Permit #20826 in 1988. Refer to the appropriate sections in G. WILDLIFE, 3. Waterfowl, Tundra Swans, Black Brant and Emperor Goose for specific discussion of marking involved in these projects.

H. PUBLIC USE

1. General

The majority of public use for the refuge comes from residents of Cold Bay and visiting waterfowl and caribou hunters. Although residents of King Cove (20 miles southeast) and False Pass (35 miles west) villages do use the refuge, it is typically limited to a small amount of caribou and waterfowl hunting.

A total of approximately 180 people reside in Cold Bay and these people are the most common users of the Izembek refuge. Cold Bay is predominately a transient community of State and Federal government employees. Most other residents are associated with local air carriers. All residents make use of the refuge on a regular basis. Viewing, photography, hiking, berry picking, fishing, hunting and trapping are all popular pursuits.

The relatively low number of public users has historically allowed visitors to experience wilderness conditions in addition to other pursuits. We anticipate the likely potential for these experiences to be affected by future development. Petroleum development both on and off-shore, land exchanges near Cold Bay and establishment of a U.S. Coast Guard air station at Cold Bay all may occur in the near future. A broad array of effects, detrimental to wildlife, their habitats and the public use of them, could occur along with such development. Some or all of this potential development could more than double the adult population of Cold Bay.

Caribou and waterfowl hunting seasons are the refuges most intensive periods of public use. However, harvest limitations eliminated much of the non-local use. In alternate regulatory years, the Alaska Peninsula is open to brown bear hunting, so Izembek had a spring 1988 hunt only. A spring and fall permit bear hunt occurred on Unimak Island. Bear hunting significantly increases the number of visitors to the area and typically these users engage in other forms of outdoor, consumptive activities as well.

The Izembek staff has worked hard to improve the refuge interpretive program. At the refuge headquarters, visitors are provided with written and visual information on local geography as well as flora and fauna common to the area. The Cold Bay school has made use of our interpretive facilities each year and this and other local use will hopefully increase.

The long awaited interpretive displays for the airport terminal and U.S. Post Office are still not finalized. Interpretive panels for our Grant Point Observatory have gone through similar, though less prolonged delays. The construction materials for the Grant Point building are on hand and the structure is planned for completion in the summer of 1989.

6. Interpretive Exhibits/Demonstrations

The visitor displays in the lobby of refuge headquarters exhibit mounted specimens of several species of migratory waterfowl found on the refuge. Also displayed is information aiding public use and the results of ongoing waterfowl surveys on the refuge. A blackboard installed in the lobby, displays current information on production and population surveys being conducted by refuge staff and other divisions on black brant, Canada geese, emperor geese and tundra swans.

Our six by twelve foot relief map encompassing the Izembek, Pavlof and Unimak Units arrived on 9 April and was installed by the refuge staff. This map is the highlight of our office visitor displays. We hope our efforts to increase visitor awareness at the airport terminal and U.S. Post Office through maps and displays are equally well received. Our expansion of visitor contact efforts will hopefully reach a wide variety of area visitors to better inform them on the goals and work of the Service.

8. Hunting

Migratory waterfowl of numerous species occur on the Izembek refuge each fall and winter. These alluring resources draw many consumptive as well as non-consumptive users to the refuge. Consumptive use of waterfowl in the Izembek area has in recent years been primarily by local residents. Declining populations of arctic nesting geese have resulted in harvest restrictions and in the case of one species, the emperor goose, a closed season. Harvest restrictions and rising air fares to Cold Bay have resulted in a large decrease in numbers of non-local hunters. The refuge staff maintains high visibility during the waterfowl hunting season for law enforcement and bag checking. Waterfowl bag check data are summarized in Table 39.

The Alaska Peninsula was open to brown bear hunting in the spring of 1988 (10-25 May) and closed during the fall season (1-21 October). The Izembek refuge is in State Game Management Unit 9D which is open to brown bear hunting every other regulatory year,



A six by twelve foot relief map of the Lower Alaska Peninsula, recently added to the refuge reception area, has greatly aided geographical discussions with visitors.



Two programs covering both the work of the Service and wildlife career opportunities were conducted for students in the Cold Bay School.



A good retriever is a valuable asset to hunters visiting the Izembek refuge. Tidal waters preclude retrieving many birds by foot.



Waterfowl survey and production data are summarized and displayed in the refuge office for the benefit of refuge visitors.

Table 39. Summary of waterfowl bag check data, Izembek NWR, 1988

Species ^{/2}	(Harvest by age/sex)									Lost	Total ^{/1}	% of Harvest
	Adult			Immature			Unknown					
	M	F	U	M	F	U	M	F	U			
W-f. Goose				2	1					0	3	1.6
Black Brant	5	7	6	4	2	5		1			30	16.7
Tav. Canada	20	18	12	21	16	16		1	37	6	147	81.7
Goose Total	25	25	18	27	19	21		1	38	6	180	
Pintail	4	8		5	3	4		5	12	2	43	43.9
Mallard	9	3		3							15	15.3
Gadwall	2	1									3	3.1
G-W Teal	6	4	2	1	3			1	4	1	22	22.5
A. Wigeon				1							1	1.0
E. Wigeon				1							1	1.0
G. Scaup	1			1						1	3	3.1
Bufflehead										1	1	1.0
C. Goldeneye	1									1	2	2.0
Steller's Eider	1			1	2					1	4	4.1
Harlequin										3	3	3.1
Duck Total	23	17	2	13	8	4		6	16	11 ^{/5}	98	
Total Birds	48	42	20	40	27	25		7	54	17	278	
No. Hunter Contacts (Hours afield/hunter)				No. Ducks (Av./Hunter)			No. Canada Geese (Av./Hunter)			No. Brant (Av./Hunter)		
79				98			147			30		
(5.4/hunter)				(1.2)			(1.9)			(0.4)		
Species	Est. Bag ^{/3}			Est. Cripples(%) ^{/4}			Est. Ttl Harvest					
Ducks	98/.1=980			110 (11.2)			1090					
Canada Goose	147/.1=1470			60 (4.1)			1530					
Black Brant	30/.1=300			0 (0)			300					

^{/1} Excluding Cripples (lost)^{/2} No open season on emperor geese began in 1986^{/3} Estimate 10% of hunters contacted^{/4} Percent crippling rate per goose species and ducks as a group^{/5} Includes two unidentified ducks

hence it will be opened also during the fall of 1989. The refuge staff sealed brown bears during the spring of 1988 season in cooperation with the Alaska Department of Fish and Game. We sealed all bears harvested on Izembek refuge and only a portion of those taken in adjoining areas. Approximately 200 brown bears are annually harvested on the Alaska Peninsula.

Unimak Island, in State Game Management Unit 10, is open to brown bear hunting annually by drawing permit. Fifteen (15) permits are issued per year for spring (N=7 permits) and fall (N=8 permits) seasons. Only five hunters participated in the spring hunt and three took bears (all males). Two hunters took two bears (1 male; 1 female) during the fall hunt.

The Alaska Board of Game dealt with the Game Management Unit 9D caribou situation and established a harvest level of two animals per local hunter again with a restricted season length and a one animal bag limit for non-residents and non-local Alaskans. The caribou season is dealt with more fully in Section G. Wildlife, 8 Game Mammals, Caribou.

9. Fishing

Sport fishing is very popular during the summer and early fall. Primary species sought are silver, chum and pink salmon; and Dolly Varden and steelhead trout. Saltwater fishing is also popular with Pacific cod, starry flounder and halibut making up the majority of the harvest.

10. Trapping

Trapping is permitted under state regulations and a trapping permit is also issued by the refuge. Izembek and Unimak Island (Alaska Maritime refuge) were refuge lands specifically mentioned in the Alaska National Interest Lands Conservation Act for which trapping permits are required. Four trappers received permits in the 1988-89 season, two for Izembek and two for Unimak Island. Other local residents may have trapped in areas of the adjacent Pavlof Unit where trapping permits are not required. This years harvest data (for 1988/89 season) and the reported catches for the last seven seasons are shown in Table 40.

11. Wildlife Observation

Most wildlife observation on the refuge is incidental to other activities. There are rare days when the weather is good and most of the town turns out to drive refuge roads and view wildlife.

17. Law Enforcement

Refuge officers made many hunter contacts in the field during both waterfowl and caribou hunting seasons. Several tips of violations were investigated but none were actually substantiated.



Cal Lensink, a premier Alaska wildlife scientist who recently retired from the Service, visited the Izembek refuge in October.



A moderate population of steelhead is found in Russell Creek on the Pavlof Unit.

Table 40. Results of permit trapping program, Izembek National Wildlife Refuge.

	1982/83 (21)	1983/84 (17)	1984/85 (16)	1985/86 (11)	1986/87 (7)	1987/88 (11)	1987/88 (4)
Red Fox	74	82	51	29	16	29	34
Land Otter	18	25	3	5	7	5	12
Mink	6	32	34	15	12	5	22
Wolverine	1	1	0	0	0	0	0
Wolf	0	0	0	3	1	1	1

Number of trappers in parentheses.

In contrast to 1987's 43 cases only one Notice of Violation was issued during 1988. It was issued by Special Agents Roger Parker and Steve Tuttle to a local hunter having too many pintails. They were here during 7-10 October, a long weekend that is traditionally bustling with waterfowl hunters. However, since bag limits have been reduced on brant and the season closed for emperor geese the number of hunters has noticeably declined.

Refuge officers Sarvis, Blenden and Dunn attended the regional law enforcement refresher during February.

18. Youth Programs

This year Izembek refuge continued its Youth Conservation Corps program at the established level of two enrollees. Rachael Fey of Cold Bay and Gary Thrift of Birmingham, Alabama were on staff from 7 of June to 29 August assisting on numerous maintenance and biological projects.

I. EQUIPMENT AND FACILITIES

1. New Construction

Our new Grant Point Observatory/Interpretive Site was pre-fabricated in Anchorage by the contractor and later shipped to Cold Bay. Materials were on hand by fall however Engineering in the Regional Office suggested we shouldn't try to erect the structure ourselves. Because of an unnecessarily elaborate design construction costs were higher than planned and now further expense will be necessary to actually place the facility on-site. Plans are to finish this project in the summer of 1989.

The headquarters water well went into operation on 8 August. The facility has performed well and should be a considerable monetary savings in the routine operation of the headquarters complex.

The emergency generator building and new headquarters electrical switching equipment was completed in 1988. Buried lines were replaced or re-routed as necessary and contract electrician Virgil Banach, of Badger Electric in Eagle River, supervised the work by the refuge staff. Virgil worked on the project from 15 to 23 June leaving only minor landscaping to be done by the refuge.

Through an agreement with the State of Alaska Department of Transportation, the refuge received asphalt paving of part of the headquarters compound in exchange for gravel necessary to resurface the airport runway. The contractor performed work at the headquarters on 22 June. They ran out of material prior to completing all the paving agreed upon. Quality of the work was good and minimally adequate coverage was received.

2. Rehabilitation



The refuges Grant Point observatory/visitor contact station was prefabricated in Anchorage and dismantled for shipment to Cold Bay. Installation of this facility will take place in the summer of 1989.



The Grant Point observatory's octagonal design with large picture windows will allow all season panoramic viewing. Informational display panels will cover the interior work surfaces.



The Izembek headquarters received a face lift in 1988 with the addition of asphalt paving. Resurfacing of the runway brought the contractor to Cold Bay.



A 500 gallon, gravity feed, fueling system was installed at the refuge float plane facility on Blinn Lake. This system upgraded a system utilizing electrical pumping from 55 gallon drums. More adequate filtering and the elimination of the need of electricity, in this case 12 volt batteries, makes the entire operation safer and more efficient.

Residences 1, 2 and 3 were constructed in 1962. New roofs and siding was added in the early 1980's. A further need is to replace windows throughout these residences. The windows leak and several have been sealed making them difficult, if not impossible, to open. Steps were taken to remedy this situation via the purchase of new "Alaska" designed windows. These were received in several shipments in December of 1988 with air transportation from Anchorage kindly provided by the Federal Aviation Administration during their bi-weekly supply flights to Cold Bay. Window replacement will begin in the summer of 1989.

Maintenance Worker Dunn completed the installation of two new refuge entrance signs in May. These were located on the Grant Point and Frosty Roads. A "foot travel only" sign designating the end of the Pintail Loop Road was cemented in on 30 August. We have had recurrent problems with keeping this sign intact. Future major sign needs are planned to be routed through the Kenai National Wildlife Refuge sign shop.

George Ziots with the Engineering Division in the Regional Office was in Cold Bay on 9 and 10 June to perform Maintenance Management Systems function part of which included an evaluation of refuge roads and bridges. Acting Refuge Manager Savery and Maintenance Worker Dunn made a further evaluation of the roads and bridges on 26 July. Several areas, most importantly a collapsed culvert on the Pintail Lake Road and the 4th bridge on Frosty Road, were identified as in need of immediate attention. The culvert was replaced on 29 August and materials needs were assessed for the repair of 4th bridge.

J. OTHER ITEMS

1. Cooperative Programs

Alaska Department of Fish and Game:

The Izembek refuge staff worked closely with the Department on surveys and inventories of the Southern Alaska Peninsula caribou herd. Expenses and personnel were shared on all operations including census and composition counts as well as radio collaring operations.

Research (Alaska Fish and Wildlife Research Center):



Jim Savery, Acting Refuge Manager on loan from the Alaska Peninsula refuge, stepped off the plane and into the trenches. He pitched in on all refuge projects and was a great help.



Manicure of the headquarters electrical rehabilitation site was performed by the refuge Youth Conservation Corp crew.





An extensive trenching, wire re-routing job was necessary to put the new headquarters switching facilities on line. This project remedied several substantial safety concerns and ended recurrent problems with outages.





The refuge bobcat was busy throughout the electrical rehabilitation project. It was also necessary to replace the power line to the refuge bunkhouse.



The only road access to Izembek Lagoon from which small boats can be launched is at Grant Point.



The 4th bridge near the end of Frosty Road, south west of Cold Bay, was collapsed by a local resident driving to heavy a vehicle. Plans are being formulated to either replace this bridge or close the road to vehicular travel at that point.

Housing, general and aerial support, etc., were supplied by Izembek refuge staff in cooperative work to quantify disturbance factors, behavior and energetics of spring and fall staging geese, primarily black brant.

Migratory Bird Management-Alaska:

The Izembek refuge provided personnel and funding toward an ongoing effort to census emperor geese in southwestern Alaska during spring.

Migratory Bird Management Office-Patuxent:

The Izembek staff completed the annual Breeding Bird Survey within the Cold Bay road system. This survey was begun in 1982 to assess changes in numbers of local breeding birds.

National Audubon Society:

A Christmas bird count has been conducted by the refuge staff since 1963.

With a small staff in a rural area such as Izembek, it is essential to maintain a highly cooperative rapport with various types of agencies and groups. This is an important goal of the refuge which to date has resulted in comparatively high biological output in relation to manpower and funding.

4. Credits

Robin West reviewed and edited the report.

Mike Blenden wrote Sections G.8, Caribou, H. 17, Law Enforcement and reviewed and edited the remainder of the report.

Chris Dau wrote the remainder of the report.

Shirley Simpson handled word processing and final editing.

K. FEEDBACK

The Izembek refuge staff continued to monitor the level of additional paperwork responsibilities placed upon us from within as well as outside the Fish and Wildlife Service (Table 41). We began this annual analysis in 1983 by maintaining a reporting deadlines list on which all incoming requirements are logged in and out. The reporting requirements summarized are additional to identified responsibilities in the annual work plan, and those in other routine areas such as payroll, energy, activities and outputs. Reporting requirements in 1988 were nearly identical to 1987 level [i.e. 1987 n=57, 1988 n=56]. Our thanks goes out to those responsible in the Regional Office (Refuges) for reducing reporting requirements placed on the field by 50 Percent. Other

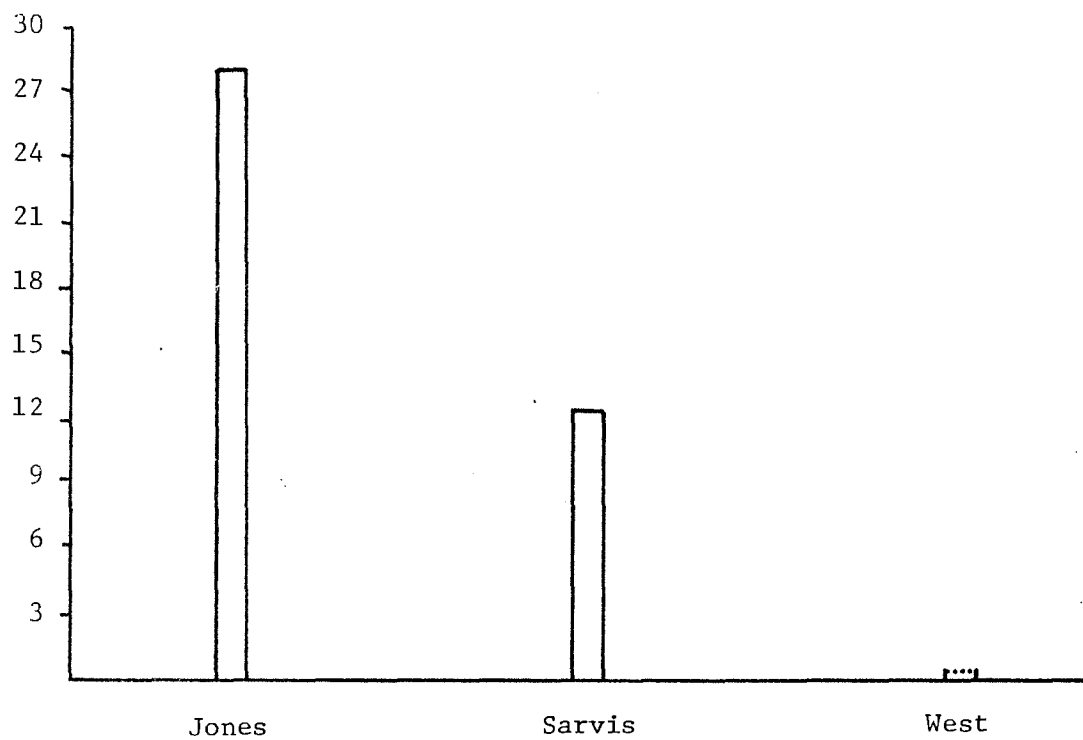
Table 41. Non-Annual Work Plan reporting responsibilities assigned to Izembek Refuge during 1988.¹

Requesting Office	No. Received (%)	\bar{X} Reporting Period (Days \pm 1SD)	\bar{X} Izembek Refuge Turnover Time (Days \pm 1SD)	\bar{X} Days Ahead of Deadline	Type of Report	
					Resource (%)	Non-Resource (%)
Refuges (RO)	11 (20)	25.7	12.1	9.2	15 (27)	41 (73)
Regional Office (other)	41 (73)					
Central Office	1 (2)					
Other Agency	3 (5)					
Total	56					

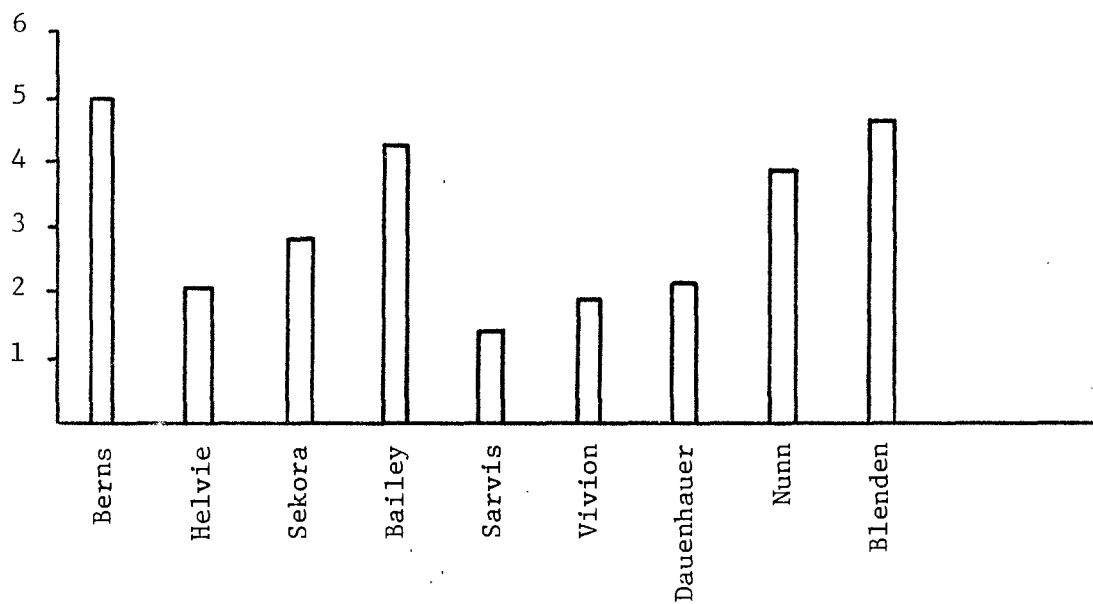
¹ Reporting with a deadline; many written and verbal requests are also received by the refuge staff with an estimated 75% of these also being non-resource oriented.

Regional Office divisions unfortunately picked up on the slack by increasing their requests by 24 percent.

Dramatic changes in staffing occurred at the Izembek refuge in 1988. The Cold Bay office was first established to administer the Aleutian Islands National Wildlife Refuge. The Izembek refuge also headquartered in Cold Bay was established in 1961. Robert D. "Sea Otter" Jones was the manager for 28 years. John Sarvis followed and was stationed in Cold Bay for 14 years. Both went to the Regional Office after leaving Cold Bay. Such fidelity presents a challenge for the new manager of six months Robin West. The pattern for assistant managers has shown a more typical pattern of turnover, however the average of 2.9 years per assistant (n=9) shows that Izembek is attractive to employees once they commit themselves to work in the "cradle-of-the-storms" (Figure 9).



REFUGE MANAGERS IN SEQUENCE



ASSISTANT REFUGE MANAGERS IN SEQUENCE

Figure 9. Managerial progression at the Izembek National Wildlife Refuge.