ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

STATE OF ALASKA
Jay S. Hammond, Governor

DEPARTMENT OF FISH AND GAME
Ronald O. Skoog, Commissioner

DIVISION OF GAME
Ronald J. Somerville, Director
Steven R. Peterson, Research Chief

ANNUAL REPORT OF SURVEY-INVENTORY ACTIVITIES

WATERFOWL

BY

Dan Timm

Volume XII
Project Progress Report
Federal Aid in Wildlife Restoration
Project W-19-2, Job No. 11.0

(Printed July 1982)

ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

STATE OF ALASKA
Jay S. Hammond, Governor

DEPARTMENT OF FISH AND GAME
Ronald O. Skoog, Commissioner

DIVISION OF GAME
Ronald J. Somerville, Director
Steven R. Peterson, Research Chief

ANNUAL REPORT OF SURVEY-INVENTORY ACTIVITIES

WATERFOWL

BY

Dan Timm

Volume XII
Project Progress Report
Federal Aid in Wildlife Restoration
Project W-19-2, Job No. 11.0

(Printed July 1982)

1980-81 ALASKA WATERFOWL REGULATIONS SUMMARY

Area	NORTHERN	GULF COAST	SOUTHEAST	ALEUTIANS	KODIAK
State Game Management Units	11-13 & 17-26	5-7, 9, 14-16 & Unimak Island	1-4	10 (except Unimak Is.)	8
Open Seasons	Sept. 1- Dec. 16	Sept. 1 - Dec. 16	Sept. 1 - Dec. 16	Oct. 8 - Jan. 22	Sept. 10- Oct. 9 &Nov. 5- Jan. 20

	LIMIT BAG	POSS.	LIMIT BAG	POSS.	LIMIT BAG	POSS.	LIMIT BAG	POSS.	LIMIT BAG	POSS.
Ducks	10	30	8	24	7	21	7	21	7	21
Sea Ducks* & Mergansers	15	30	15	30	15	30	15	30	15	30
Geese**	6	12	6	12	6	12***	6	12****	6	12
Emperor Geese	6	12	6	12	6	12	6	12	6	12
Brant	4	8	4	8	4	8	4	8	4	8
Snipe	8	16	8	16	8	16	8	16	8	16
Crane	2	4	2	4	2	4	2	4	2	4

* Sea Ducks: Eiders, Scoters, Old Squaw, Harlequin.
** No more than 4 daily, 8 in possession may be Canada and/or white-fronted geese.
*** Provided that Unit 1C is closed to the taking of snow geese.
**** The taking of Canada geese in the Aleutian Islands, except on Unimak, is illegal. (To protect the Aleutian Canada goose).

(a) WEAPONS: Waterfowl may be taken with a shotgun (not larger than 10 gauge) or bow and arrow, but not rifle or pistol.

(b) PLUGS: Shotguns must be plugged to a 3-shell capacity or less for waterfowl hunting.

(c) CONVEYANCES: Hunting is not permitted from an aircraft, motor driven vehicle, air boat, jet boat, or propellor driven boat which the motor of such has not been completely shut off and its progress therefrom has ceased.

(d) POSSESSION: No person may receive or possess any migratory game bird belonging to another unless such birds have a tag attached with the signature of the hunter, his address, the date and total number and kinds of birds taken.

(e) TRANSPORTATION: Waterfowl may be plucked in the field but one fully feathered wing or the head must remain attached while being transported.

(f) SHOOTING HOURS: One half hour before sunrise to sunset.

(g) STAMPS: No person 16 or more years of age may take waterfowl unless he carries a current validated Federal migratory bird hunting stamp (Duck Stamp) on his person.

SUMMARY OF FEDERAL REGULATIONS

In addition to State Regulations, these Federal rules apply to the taking, possession, transportation and storage of migratory game birds:

Restriction. No person shall take migratory game birds:
- From a live box (a low floating device, having a compression affording the hunter a means of concealment beneath the surface of the water).
- By the use or aid of live decoys.
- Using records or tapes of migratory bird calls, or sounds, or electrically amplified imitations of bird calls.
- By the aid of baiting (placing feed such as corn, wheat, salt, or other feed to constitute a lure or enticement). Hunters should be aware that a baited area is considered to be baited for 10 days after the removal of bait, and it is not necessary for the hunter to know an area is baited to be in violation.

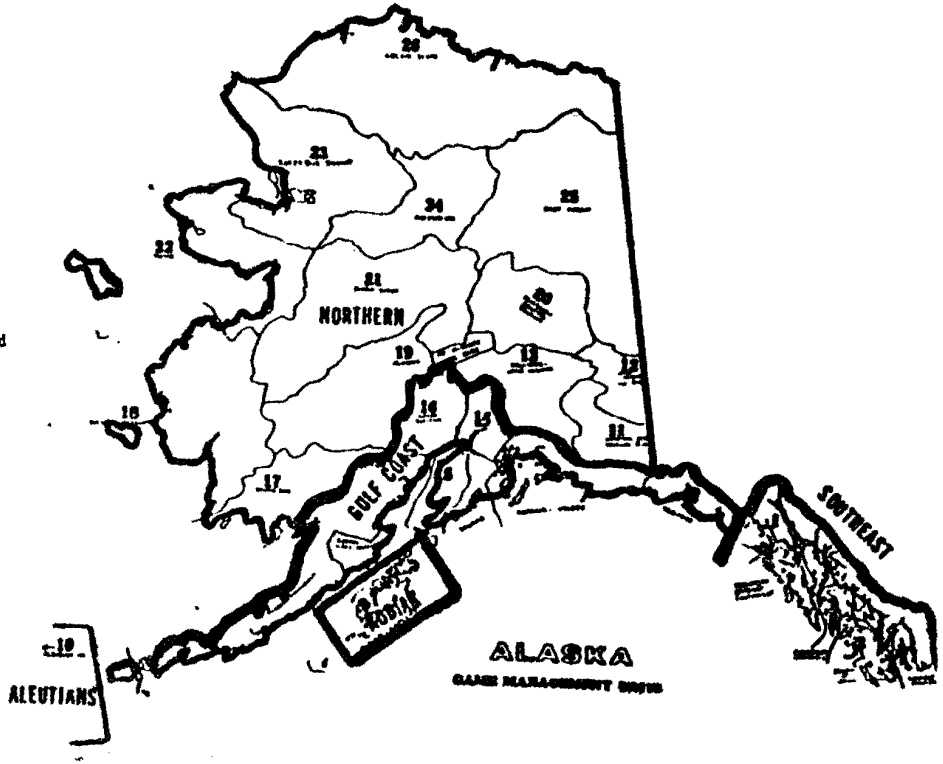
Field Possession Limit. No person shall possess more than one daily bag limit while in the field, or while returning from the field to one's car, hunting camp, etc.

Possession of Live Birds. Crippled birds must be immediately killed.

Importation. No person shall import during any one week beginning on Sunday more than (1) 25 doves and 10 pigeons from any foreign country, and (2) 10 ducks and 5 geese from any foreign country except Canada and Mexico. Importation of doves and waterfowl from Canada and Mexico may not exceed Canadian or Mexican export limits and these vary from province to province and from state to state. In addition, one fully feathered wing must remain attached to all migratory game birds being transported or shipped between a port of entry and one's home or to a migratory bird preservation facility. No person may import migratory birds belonging to another person.

Shipment. No person shall ship migratory game birds unless the package is marked on the outside with: (1) the name and address of the person sending the birds, (2) the name and address of the person to whom the birds are being sent, and (3) the number birds, by species, contained in the package.

CAUTION: More restrictive regulations may apply to National Wildlife Refuges open to hunting. For additional information on Federal regulations, contact Special Agent-in-Charge, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503. Telephone (907)276-3800.



CONTENTS

WATERFOWL HARVEST AND HUNTER ACTIVITY

This was the fourth year that the Department has utilized the United States Fish and Wildlife Service (FWS) mail questionnaire and parts collection surveys to estimate harvest and hunter activity. Timm (1978) described the progression of events which led to discontinuing an annual State survey of waterfowl hunters. Data in this report are from Carney et al. (1981).

The FWS categorizes data from their parts collection surveys according to codes listed in Table 1. Data are coded to either specific locations within 11 harvest areas (Fig. 1), or, if birds were not taken at the specific locations listed in Table 1, then the general harvest area code is assigned. For example, a duck shot at Palmer Hay Flats would be coded 1123; a duck shot on the Kasilof Flats would be coded 1103. Timm (1978) provided a more detailed description of the coding system.

RESULTS

Hunter Activity

There were 17,260 duck stamps sold in Alaska during 1980. After corrections for people buying two stamps, there were a projected 16,951 potential hunters in Alaska. During the 1980-81 season 12,425 (73.3%) hunted waterfowl, compared to 13,065 active hunters a year ago (Table 2). The FWS survey does not allow for a breakdown of hunting effort by area.

Duck Harvest

Magnitude of the Harvest

Hunters reported taking an average of 7.7 ducks each (8.8 in 1979-80), after corrections for reporting bias were made (Table 2). Reported daily bag was 1.2.

Table 1. Summary of FWS codes used to assign harvest locations in Alaska.

Old Code	New Code	ADFG Region (R) and Place Names	Originial FWS "County" Name	Harvest Zone
0001	0000	Unknown	Unknown	Unknown
0011	0101	North Slope (R)	Arctic Slope	NW
0031	0301	Seward Peninsula (R)	Seward Peninsula	"
0051	0502	Yukon Valley (R)	Upper Yukon-Kuskokwim	Central
0051	0512	Yukon Flats	"	"
0071	0702	Central (R)	Fairbanks-Minto	"
0071	0712	Minto Flats	"	"
0071	0722	Eielson AFB	"	"
0071	0732	Salchaket Slough	"	"
0071	0742	Healy Lake	"	"
0071	0752	Delta Area	"	"
0071	0762	Tok-Northway	"	"
0091	0901	Yukon Delta (R)	Yukon-Kuskokwim Delta	NW
0111	1103	Cook Inlet (R)	Anchorage-Kenai	SE
0111	1113	Susitna Flats	"	"
0111	1123	Palmer-Hay Flats	"	"
0111	1133	Goose Bay	"	"
0111	1143	Potter Marsh	"	"
0111	1153	Chickaloon Flats	"	"
0111	1163	Portage	"	"
0111	1173	Trading Bay	"	"
0111	1183	Redoubt Bay	"	"
0111	1193	Kachemak Bay	"	"
0131	1303	Gulf Coast (R)	Cordova-Copper River	"
0131	1313	Copper River Delta	"	"
0131	1323	Yakutat Area	"	"
0131	1333	Prince William Sound	"	"
0151	1503	Southeast Coast (R)	Juneau-Sitka	"
0151	1513	Chilkat River	"	"
0151	1523	Blind Slough	"	"
0151	1533	Rocky Pass	"	"
0151	1543	Duncan Canal	"	"
0151	1553	St. James Bay	"	"
0151	1563	Mendenhall Wetlands	"	"
0151	1573	Farragut Bay	"	"
0151	1583	Stikine River Delta	"	"
0171	1704	Kodiak (R)	Kodiak Island	SW
0171	1714	Kalsin Bay	"	"
0191	1904	AK Peninsula (R)	Cold Bay-AK Peninsula	"
0191	1914	Cold Bay	"	"
0191	1924	Pilot Point	"	"
0191	1934	Port Moller	"	"
0191	1944	Port Heiden	"	"
0211	2104	Aleutian Chain (R)	Aleutians-Pribilofs	"

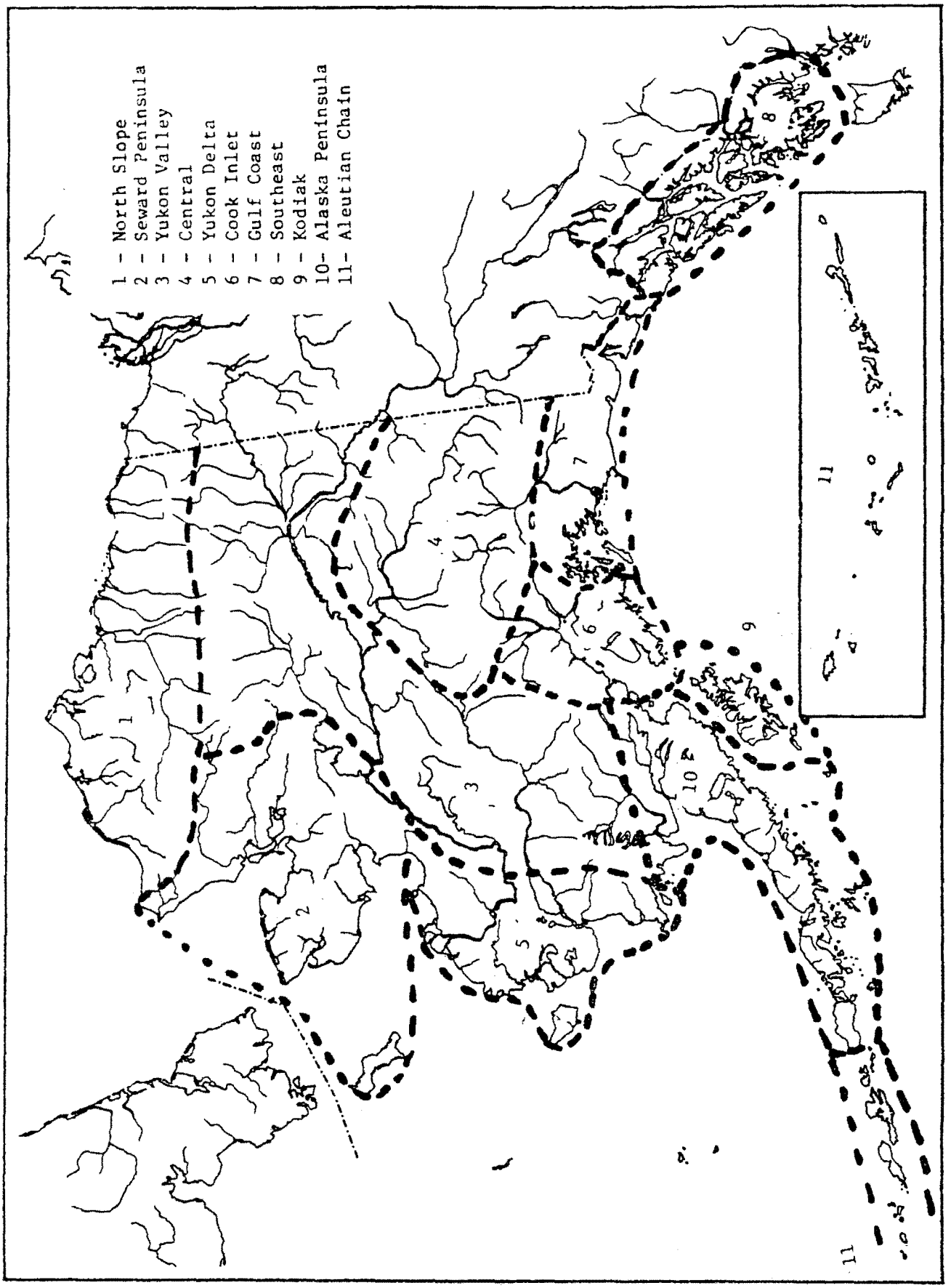


Figure 1. Harvest areas used in data analysis.

Table 2. Summary of waterfowl hunter success and activity, 1980-81 season (after Carney et al. 1981).

Number of duck stamps sold	17,260 (16,951 potential hunters)
Number of mail questionnaires	1,412
Number of duck wings received	1,688
Number of goose tails	209
Number of active hunters	12,425 (73.3%)

Calculated statewide harvests:

Ducks: 93,714, Sea ducks and mergansers 2,403, Total 96,117

Geese: Canada 9,477; Emperor 2,306; White-fronted 249; Brant 873; Snow 125; Total 13,030

Ducks per active adult hunter 7.7

Percent successful hunters 61.4 (shot one or more duck)

Cranes: 1,049 (Sorensen 1981)

Calculated total hunter days 85,294 *

Days per active adult hunter 6.3

* Includes about 6,825 juvenile hunter days (hunters under 16 years of age).

The projected total statewide harvest was 96,117 ducks, of which 2,403 (2.5%) were sea ducks and mergansers.

Location of Harvest

According to the FWS survey, about 48 percent of the kill occurred in the Cook Inlet area (Table 3), while no birds were shot on the North Slope, Aleutian Chain, or in the Yukon Valley. These aberrant data are the result of small, or no samples, from these areas. For comparative purposes, the 1974-76, 3-year average distribution of harvest data, as obtained from State mail surveys, are also presented in Table 3. These data are believed to more accurately portray harvest by location than does the Federal survey.

Species Composition of Harvest

As in previous years, mallards, pintails, green-winged teal and wigeons comprised the bulk of the harvest (76.6%) (Table 4). Dabblers made up 85 percent of the total kill, divers 12.5 percent and sea ducks and mergansers 2.5 percent. Mallards comprised a large portion of the harvest in Southeastern and Cook Inlet harvest areas, while pintails were common on the Alaska Peninsula and in Cook Inlet. Relatively uncommon ducks (blue-winged teal, ring-necked ducks and redheads) occurred in scattered locations of the Central, Cook Inlet and Gulf Coast areas.

Goose Harvest

A breakdown by species and area of the 1980-81 statewide goose harvest of 13,030 birds is provided in Table 5. This represented a 13.8 percent decrease in harvest over last year. Canada, emperor, brant, white-fronted, and snow geese comprised 72.7 percent, 17.7 percent, 6.7 percent, 1.9 percent and 1.0 percent, respectively, of the statewide kill. According to the Federal survey, over 48 percent of the harvest occurred on the Alaska Peninsula, while no geese were killed on the North Slope, Yukon Valley, Aleutian Chain, or Kodiak Island. Only a few (0.5%) were shot along the Gulf Coast. These aberrant data resulted from the same biases described for the duck harvest. We believe that a more accurate picture of the goose harvest is portrayed by 3-year average data obtained from past State mail surveys (Table 6)

Crane Harvests

A retrieved take of 1,049 cranes (675 in 1979) was calculated by Sorensen (1981) for the 1980-81 season in Alaska. The locations of crane harvests and the numbers of successful hunters were not obtained from the FWS survey, but long term averages are available.

Table 3. A comparison between reported duck harvest from 1978-79, 1979-80, and 1980-81 U.S.F.W.S. parts collection survey and the A.D.F.&G. mail survey, 1974-76 3-year average.

Harvest area	Percent of Statewide Harvest ADFG 1974-76	USFWS 1978	USFWS 1979	USFWS 1980	USFWS 1978-80 avg.
North Slope	0.2	0	0	0	0
Seward Peninsula	1.4	0	0	0.8	0.3
Yukon Valley	2.5	0	0	0	0
Central	18.0	14.6	25.0	15.3	18.3
Y-K Delta	1.4	1.5	1.2	0.6	1.1
Cook Inlet	39.2	50.1	49.4	46.1	48.5
Gulf Coast	8.4	6.6	2.9	2.5	4.0
Southeast	20.6	14.6	11.5	25.1	17.1
Kodiak	2.7	3.6	7.3	4.7	5.2
Alaska Peninsula	5.1	9.0	2.7	4.9	5.5
Aleutian Chain	0.5	0	0	0	0
	100.0	100.0	100.0	100.0	100.0

Specific Location	Percent of Statewide Harvest ADFG 1974-76	USFWS 1978	USFWS 1979	USFWS 1980	USFWS 1978-80
Susitna Flats	10.6	13.3	11.5	8.3	11.0
Minto Flats	7.3	4.2	3.6	1.5[1]	3.1
Palmer-Hay Flats	7.3	10.9	1.1	0.8[1]	4.3
Copper River Delta	5.6	2.8[1]	2.3[1]	2.4[1]	2.5
Mendenhall	4.1	4.2	5.5	8.2	6.0
Stikine River Delta	3.6	8.0[1]	3.6	4.4	5.3
Kachemak Bay	2.6	0.4	2.9	1.1	1.5
Redoubt Bay	2.5	1.0	2.2	0	1.1
Trading Bay	2.1	2.5	3.1	1.2	2.3
Portage Flats	2.1	0.9	2.7	3.0	2.2
Pilot Point	1.8	1.0	2.0	2.3	1.8
Chickaloon Flats	1.3	0.1	0.2	1.0	0.4
Potter Marsh	1.2	0.5	0	0	0.2
Duncan Canal	1.1	0.0	0	0	0
Eagle River Flats (Cook Inlet)	1.1	not coded			
Kalsin Bay	1.1	0.0	0	0	0
Yakutat Area	1.0	1.3	0.2	0.2	0.6
Rocky Pass	0.9	0.0	0	0	0
Blind Slough	0.9	0.5[2]	0	6.3[1][2]	2.3[2]
Cold Bay Area	0.8	4.6	TR[1]	0.3	1.6
Eielson AFB	0.8	2.6	TR	1.1	1.2
Salchaket Slough	0.6	0.0	0	0	0
Healy Lake	0.5	0.0	2.7	0	0.9
Goose Bay	0.4	1.5	0.4	0.6	0.8
Farragut Bay	0.4	0.0	0	0.1	TR
St. James Bay	0.4	0.0	0	0	0
Chilkat River	0.2	0.0	0.4	0	0.1
Delta Area	0.2	1.6	1.0	0.1	0.9
Tok-Northway Area	TR	4.3[1]	13.2[1]	7.0[1]	8.2[1]
Prince William Sound	0	2.4	0.4	0	0.9
	62.3	68.6	59.0	49.9	59.2

1/ Besides the location where "no" ducks were apparently shot, these estimates are unreasonably large or small; probably resulted from coding errors.

2/ Blind Slough has been closed to hunting since the 1978-79 season.

Table 4. Species composition of the duck harvest, 1980-81 waterfowl season.

Species	Seward Peninsula	Central	Y-K Delta	Cook Inlet	Gulf Coast	Southeast	Kodiak	Alaska Peninsula	Percent of Total Statewide 1/
Mallard	-	24.9	22.2	30.2	21.4	32.8	26.0	18.5	28.1
Pintail	30.8	19.8	55.6	25.0	11.9	17.1	2.6	23.5	21.3
Am. Wigeon	7.7	20.6	22.2	15.0	16.7	12.0	3.9	6.2	14.7
G-W. Teal	61.5	5.1	-	9.1	14.3	24.6	7.8	25.9	12.5
Shoveler	-	12.3	-	6.3	-	1.9	-	6.2	6.4
B-W Teal	-	2.4	-	0.5	-	1.4	-	-	1.1
Gadwall	-	-	-	0.6	2.4	-	6.5	6.2	0.9
Total Dabblers	100.0	85.1	100.0	86.7	66.7	89.8	46.8	86.5	85.0
Lesser Scaup	-	8.3	-	3.2	4.8	-	2.6	1.2	3.7
Greater Scaup	-	1.6	-	2.0	16.7	0.2	13.0	11.1	2.6
Bufflehead	-	1.9	-	1.4	7.1	1.4	10.4	-	2.0
Common Goldeneye	-	0.4	-	1.8	2.4	1.0	1.3	-	1.2
Barrow's Goldeneye	-	1.2	-	1.2	-	1.2	1.3	-	1.0
Ringneck	-	1.2	-	1.3	-	-	-	-	0.8
Canvasback	-	0.4	-	0.9	-	-	-	-	0.5
Redhead	-	-	-	0.4	2.4	-	-	-	0.2
Total Divers	-	15.0	-	12.2	33.4	3.8	28.6	12.3	12.5
W-W Scoter	-	-	-	0.9	-	1.2	1.3	-	0.6
Surf Scoter	-	-	-	-	-	2.4	-	-	0.5
Harlequin	-	-	-	-	-	1.2	6.5	-	0.5
Steller's Eider	-	-	-	-	-	0.2	7.8	-	0.4
Common Scoter	-	-	-	-	-	-	5.2	-	0.2
Common Merganser	-	-	-	-	-	0.7	2.6	1.2	0.2
Old Squaw	-	-	-	-	-	0.5	1.3	-	0.1
Hooded Merganser	-	-	-	-	-	0.2	-	-	TR
R-B Merganser	-	-	-	0.1	-	-	-	-	TR
Total Sea Ducks/ Mergansers	-	-	-	1.0	-	6.4	24.7	1.2	2.5
Sample Size	13	253	9	761	42	415	77	81	1,688

1/ Includes birds harvested in unknown locations.

Table 5. Species composition of the goose harvest, 1980-81 waterfowl season.

Species	Percent of Total Harvest by Area							
		Central	Y-K Delta	Cook Inlet	Gulf Coast	South-east	Alaska Peninsula	Percent of Total Statewide
Canada	100.0	66.7	66.7	97.9	100.0	91.4	45.5	72.7
Emperor	-	-	33.3	-	-	-	39.4	17.7
Brant	-	-	-	-	-	-	15.1	6.7
White-fronted	-	33.3	0	2.1	-	4.3	-	1.9
Snow	-	-	-	-	-	4.3	-	1.0
Sample Size	5	3	6	47	1	46	101	209

Table 6. A comparison between reported retrieved goose harvest from the 1979-80 and 1980-81 U.S.F.W.S. parts collection survey and the A.D.F.&G. mail survey, 1974-76 3-year average.

Harvest	Percent of Statewide Harvest			Specific Location	Percent of Statewide Harvest		
	ADFG	USFWS			ADFG	USFWS	
	1974-76	1980	1979		1974-76	1980	1979
North Slope	0.4	0.0	0.0	Izembek Lagoon	21.3	34.4	10.6
Seward Peninsula	4.4	2.4	0.0	Pilot Point	11.5	13.9	8.7
Yukon Valley	4.4	0.0	0.0	Copper River Delta	9.4	0.0	0.0
Central	8.1	1.4	7.7	Minto Flats	4.9	0.0	0.1
Y-K Delta	7.3	2.9	1.9	Chickaloon Flats	2.1	5.3	13.5
Cook Inlet	10.1	22.5	35.6	Susitna Flats	1.8	1.0	2.9
Gulf Coast	13.6	0.5	0.0	Delta Area	1.8	0.5	1.9
Southeast	13.1	22.0	23.1	Stikine River Delta	1.5	1.4	9.6
Kodiak	0.2	0.0	0.0	Redoubt Bay	1.5	0.0	0.0
Alaska Peninsula	38.2	48.3	31.7	Mendenhall Wetlands	1.1	2.4	7.7
Aleutian Chain	0.1	0.0	0.0	Duncan Canal	1.1	0.0	0.0
	99.9	100.0	100.0	P. Moeller & Nelson Lagoon	1.0	0.0	0.0
				Trading Bay	0.8	0.0	0.0
				Palmer-Hay Flats	0.8	7.7	0.0
				Kachemak Bay	0.8	1.0	0.0
				St. James Bay	0.8	0.0	0.0
				Portage Area	0.4	0.0	0.0
				Port Heiden	0.4	0.0	0.0
					63.0	67.6	55.0

DISCUSSION

The FWS samples more hunters in their mail questionnaire survey than were sampled by State mail surveys. Compared to most other states in the Pacific Flyway, sample size is proportionately greater in Alaska. However, a major weakness of the parts collection survey is that species composition of the harvest (particularly for geese), and harvest by area, are not accurately reflected. For example, perhaps 10 people from the Gulf Coast reported taking 25 geese in the mail questionnaire survey. However, if only one person from the Gulf Coast sent in one goose tail (which happened this year), a calculated 6.5 geese were taken in all of 1980-81.

When the State survey was dropped, the chief loss was annual estimates of harvest and hunter days by specific location (Timm 1978). However, it was believed that 3-year average estimates of these data, based on State surveys made during 1974-76, would be adequate until a need for more precise data arose. Requests for current and specific data continue to increase, and a State survey was planned for the 1981-82 season. However, higher priority tasks necessitated postponing the State survey until at least the 1982-83 season.

STUDIES ON THE COPPER RIVER DELTA (CRD)

Dusky Canada Goose Studies

Production and Fall Flight

Although snow and ice melt was early in 1980, it was cool and wet during incubation. Also, nest predation was again substantial, with 25 percent destroyed, 9 abandoned and 65 percent active nests (N = 231) recorded May 20 and 21, (about midway through incubation) by Dick Sellers and Dan Bynon. Clutch size averaged 5.4 (N = 152) eggs in 1980, compared to the previous 14-year average of 5.0 (range = 3.6 to 5.8).

On July 18, 1980, Timm and Sellers counted 7,500 geese from the air, and subsequently calculated 23.7 percent young in the population. Production during the preceding 9 years (1971-1979) averaged 26.8 percent young, and ranged from 10.6 to 51.4 percent.

A breeding population survey was not flown this year, because of unknown air/ground visibility rates and higher priority work on tule geese. However, Bob Jarvis of Oregon State University has apparently developed an aerial photographic technique to determine subspecies of geese. The results of his photography and ground estimates of subspecies composition, combined with aerial population surveys, indicated a 1980 post-season population of 22,000 duskys (unpubl. rept. to Pacific Flyway Waterfowl Study

Committee). That population and 23.7 percent young resulted in a calculated fall 1980 flight of 27,900 birds. The spring 1981 population was an estimated 23,000 geese (B. Jarvis, unpubl. rept.), indicating mortality of 4,900 geese (Table 7).

The Future of Dusky Geese

The rate of brush growth on the Copper River Delta has visibly increased the past 3 to 4 years. For example, alders by the Cut-off Research Cabin are now 8' to 10' tall; 10 years ago they were 1' tall and 3 years ago, 4' to 5' tall. This rapidly changing habitat has created conditions well suited to brown bears and other mammalian predators. For example, in 1979 (the last year when nesting studies were complete) nest success averaged about 7 percent. Although weather conditions in 1979, 1980, and 1981 should have resulted in slightly below to well above average production (26% young), young geese comprised 16, 24 and 18 percent of the population, respectively.

Concurrent with a decrease in nesting success has been a decrease in nest densities, at least on the study areas. Part of the decrease (Table 8) may have resulted from a greater difficulty in locating nests due to the brush growth. However, this factor could account for only a small portion of the decrease.

Less intensive nest searching in 1976, 1980, and 1981, resulted in underestimation of nest densities. In other years, plots were searched several times during the season; in 1976, 1980, and 1981 only one search was made. Regardless, a marked decrease in nest density is apparent.

Geese are now nesting in greater densities in other parts of the Delta, particularly on Castle Island in the Copper River, on Egg Island off the southwest corner of the Delta, and on the west end of the Delta in the Government Slough area. Production has generally been good in these areas, judging from July production surveys. Brush growth is retarded, particularly on the islands, compared to former high density nesting areas.

It was thought (perhaps hoped) that siltation and sedge growth on pre-earthquake submerged land would keep pace with brush growth on the upper delta, resulting in the amount of nesting habitat remaining constant. This has not been the case. It will be many years before the outer uplifted mud flats become suitable nesting habitat, at least at the present rate of succession.

However, the dusky's future is not all gloomy. For example, the post-season population since 1978 has remained fairly stable, despite poor production the in past 3 years (Table 7). If errors in survey techniques are ruled out, the reason for this stability lies with reduced harvest in Oregon.

Table 7. Summary of population data for dusky Canada geese, 1971-81.

Year	Mid-winter	Breeding Populations 2/	% Yg.	% non-prod. ad. 3/	No. Yg. Produced	Fall Flight	Harvest 4/
1971	20,850	20,065	16.2	79.7	3,880	23,945	5,995
1972	17,950	17,275	10.6	71.7	2,050	19,325	3,450
1973	15,875	15,280	36.0	64.6	8,595	23,875	4,875
1974	19,000 1/	15,290	51.4	35.7	19,345	37,635	12,070
1975	26,550	25,565	17.9	84.5	5,575	31,140	9,010
1976	22,725 1/	21,870	24.2	54.2	6,890	28,850	6,350
1977	22,500	21,650	44.3	56.9	17,225	38,875	15,100
1978	23,775 5/	23,000 5/	24.8	71.8	7,600	30,600	5,100
1979	25,500 5/	24,500 5/	16.0	87.0	3,700	28,200	6,200
1980	22,000 5/	21,300 5/	23.7	67.4	6,600	27,900	4,900
1981	23,000 5/	22,200 5/					

1/ Calculated from spring breeding grounds survey.
2/ Mid-winter less 0.035 mortality (Chapman et al. 1969).
3/ Percent of total adults seen in flocks with no young.
4/ Fall flight less mid-winter inventory.
5/ Preliminary estimates pending further analyses.

In 1973, there were about 3,000 lesser Canada geese (B. c. taverneri and B. c. parvipes) post-season in dusky goose wintering areas; in 1981 there were 48,500 (unpubl. FWS survey data and R. Jarvis, unpubl repts.). The number of lessers is still growing, but the population increase in 1981 (6.3%) was the smallest since 1975. The large number of lessers is beginning to buffer the harvest of duskys on Willamette Valley refuges, and probably to a greater degree off the refuges. Harvest data are only available for refuges.

Once the lesser Canada situation stabilizes, new and innovative regulations may be warranted to encourage harvest of lessers.

Band Recoveries

Duskys have not been banded in large numbers since 1978 (9 females were nest-trapped in 1979). The revised flyway management plan for dusky geese calls for banding every 3-4 years to monitor distribution and timing of harvest. Banding is planned for 1982.

The recovery distribution of bands reported from birds shot or found dead during the hunting seasons by area since 1975, is as follows (through 7/20/81 IBM run):

Year	No. Recoveries	Oregon	Alaska	Br. Columbia	Washington
1975	198	67.3	14.0	13.5	5.2
1976	241	65.5	10.0	13.3	11.2
1977	245	71.4	17.0	4.1	7.5
1978	225	63.3	19.3	14.2	3.2
1979	84	64.2	18.5	2.5	14.8
1980	102	82.4	2.9	8.8	5.9

We can currently offer no explanation for the apparent relative decline in harvest in Alaska and increase in Oregon that occurred in 1980.

Fall Duck Survey, Duck Food Habits, and Hunter Survey

In response to public concern over an apparent decline in duck use of the Copper River Delta, during fall, the U.S. Forest Service held a meeting on April 29, 1980 to discuss past and present conditions on the Delta. As a result of that meeting, the ADF&G, with financial support from the FWS, agreed to conduct aerial surveys of the west Copper River Delta from late August through October 1980. The objectives of the fall duck surveys were to: 1) document migration timing in 1980, 2) identify habitat use by time period through the fall, and 3) locate major concentration areas for future evaluation.

ADF&G also volunteered to assess duck food habits and to conduct a hunter survey (this work was accomplished by J. Reynolds, D. Sellers, and M. Jackson). All tasks were to provide ground work and base data for a duck study to be contracted by the U. S. Forest Service in 1981 (that study fell through).

Aerial Surveys

Procedures

Surveys were flown along predetermined transects, totaling 116 linear miles, designed to sample habitats from barrier islands inland to shrub communities south of the Copper River Highway. Flight lines were broken into 34 segments, according to habitat type and physiographic features.

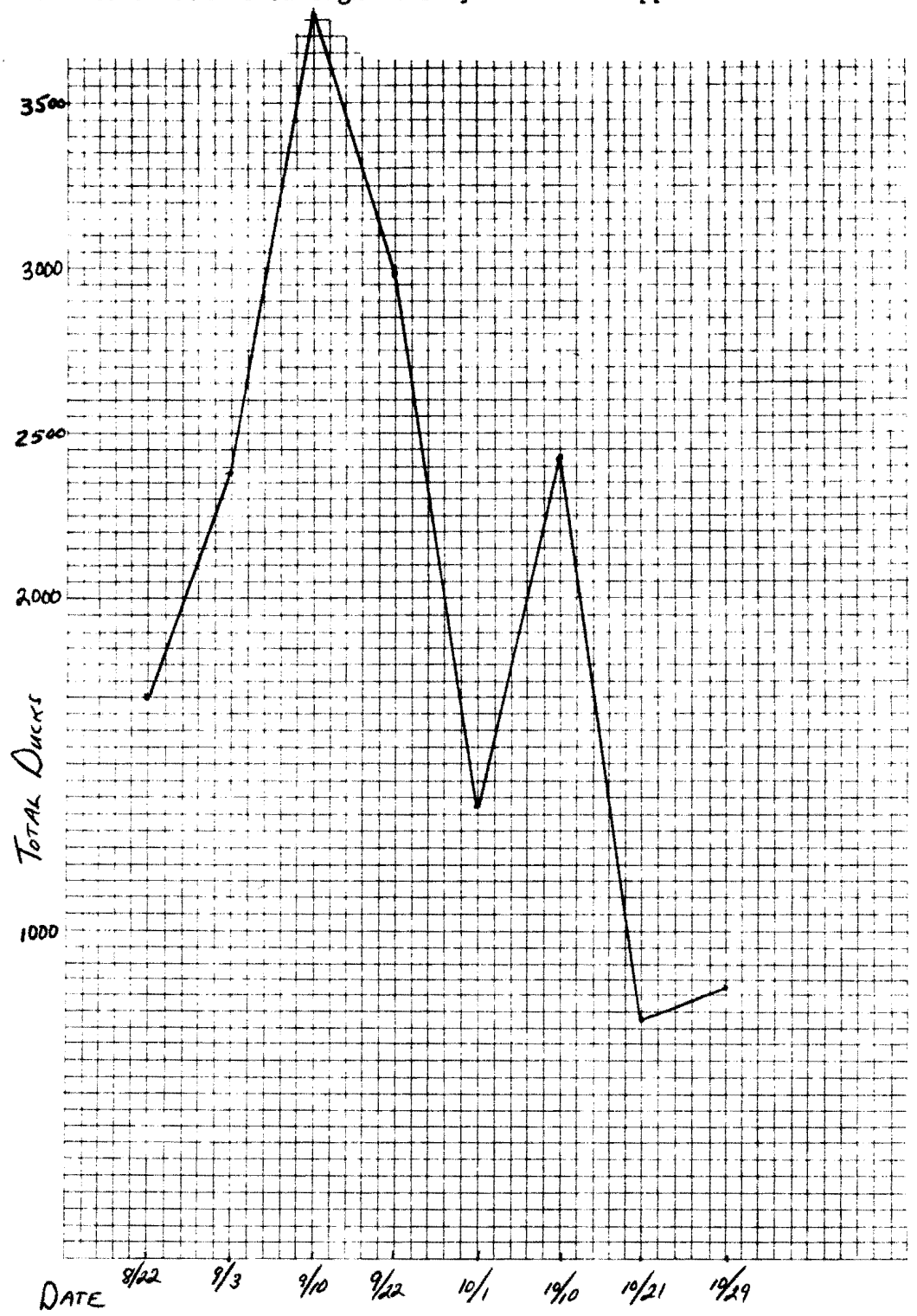
Five segments, totaling approximately 20 miles, were along the water/mud interface and varied from survey to survey depending on tide stage. Two other segments (14 miles) were also over unvegetated intertidal flats, but were fixed between Egg Island and Eyak River. The remaining 27 segments (82 miles) were over supra-tidal habitats, except where they crossed tidal sloughs and rivers. The same plane (Cessna 185), pilot and two observers were used for all eight surveys, except for a third observer who flew only the first survey. Altitude was maintained between 100 and 150 feet, and air speed at 90 MPH. The front seat observer (J. Reynolds) helped with navigation and plotted waterfowl concentrations on the right side as either small (15-50 ducks) or large (50+ ducks) on 1 in = 1 mile topographical maps. The other observer (M. Jackson) recorded all birds within 220 yds of the aircraft on the right side, according to transect segment, habitat type (pond, slough/river, mud flats, tide line, meadow, or other), and when possible by species.

Results and Discussion

Eight surveys were conducted between August 22 and October 29, 1980. Flight time per survey ranged from 1.1 to 1.4 hours and averaged 1.25 hours. Because of identification problems in early fall, most ducks were not recorded by species. Consequently, we were unable to identify habitat or site specific preferences by species, nor to quantify species composition during migration. However, impressions during aerial surveys and ground obser vations suggest that early concentrations were comprised primarily of pintails, wigeon, teal, and mallards, with relatively small numbers of other dabblers or divers. Later in the fall, mallard and divers (primarily scaup) were more numerous.

Duck numbers peaked on September 10, 1980, with a second smaller peak on October 10 (Fig. 2). The "two peak" pattern of duck migration is normal for southcentral Alaska (Mickelson et al. 1980, Quimby 1972, and our past observations). Weather was the predominant factor affecting the timing of peak migration. In

Fig. 2. Total ducks counted on eight surveys of west Copper River Delta.



1980, southcentral Alaska experienced a cold snap on September 2-3, which probably pushed birds to the CRD in greater numbers than normal. Poor weather apparently held ducks on the CRD until September 10. Typically, the first and largest concentration of ducks occurs near the end of August. Had not poor weather in early September held ducks on the CRD, the September 10 peak probably would not have been so pronounced. The October 10 peak corresponded to a significant movement of waterfowl through Cook Inlet and the Alaska Peninsula. Peak numbers of geese and swans were also recorded on the October 10 survey.

During the first four surveys, 90 percent of the ducks were on intertidal areas, while during October an average of 58 percent was on intertidal areas. Use of marsh ponds mirrored use of intertidal areas (Fig. 3). Part of that shift in habitat use may be attributed to a change in species composition, but changes in food availability are also possible.

These surveys confirmed local residents' impressions that following the 1964 earthquake, ducks have increased their use of intertidal flats at the expense of marsh ponds. More work is needed to understand the feeding ecology of ducks on the intertidal areas, and to further evaluate the greater use of ponds in October. Year-to-year variation in habitat use by time period may also occur.

Only two areas on the West CRD were used consistently by flocks of ducks throughout the survey period: Egg Island, and the mouth of a small slough east of Alaganik Slough. Three specific areas on Castle Island had greater duck use than the rest of the "old marsh" habitat. Virtually no large concentrations of ducks were found more than 3 miles inland from the mean high tide line.

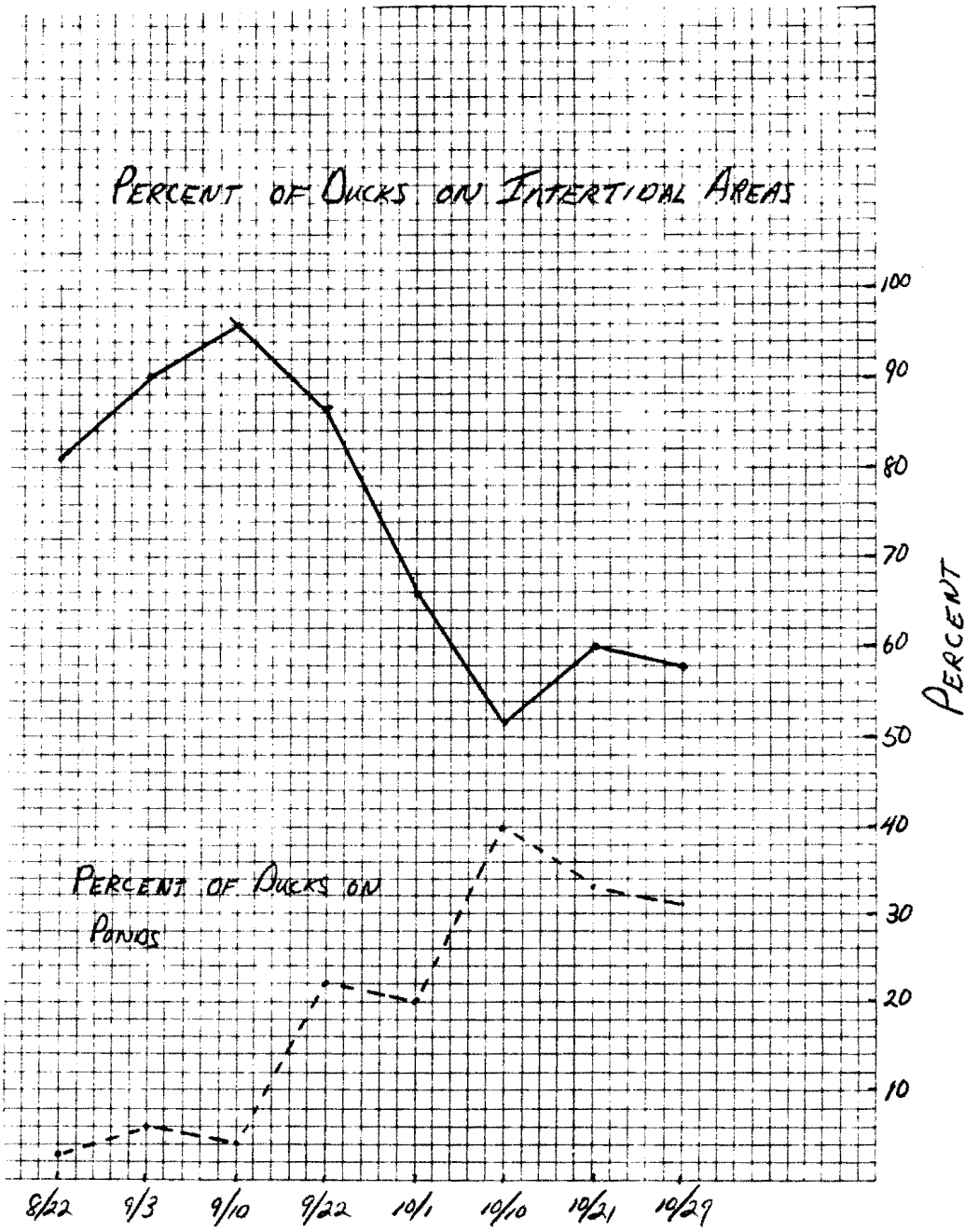
Fall duck surveys on the west CRD will be replicated in 1981, with some alteration in scheduling to ensure coverage immediately prior to the hunting season.

Food Habits

During fall 1980, esophagi and gizzards were collected from 47 ducks shot on the CRD. Not all esophagi were handled identically, because several nonbiologists also provided samples. Cooperators were instructed to remove esophagi and gizzards as soon as possible and to freeze or store the samples in 80 percent ethanol. Thirty-one esophagi from six species of ducks contained food and were analyzed. These birds were shot on ponds near Eyak River (16), along the Copper River Highway (10), on a tidal slough on Castle Island (3), and on Eyak Lake (2).

Because of the small sample size, analysis for individual species was impractical. Rather, the results are summarized (Table 9) for all species and habitats as percent occurrence and aggregate percent. Obvious differences existed in food contents from ducks

Fig. 3. Percent of ducks on intertidal areas and ponds.



(Table 9) collected in different habitats (Table 10). Two ducks from Eyak Lake contained only Myriophyllum vegetation. This plant was not found in ducks collected from other locations. Ducks on Castle Island (Table 10) ate seeds and vegetation of Potamogeton and Carex seeds. Ducks shot on ponds near the mouth of Eyak River had a more varied diet comprised primarily of aquatic vegetation and seeds of Hippuris, Carex, Potamogeton, Juncus and one unknown species. Several habitat types occur along the Copper River Highway, and consequently ducks from this area had the most diverse diet (mostly insects).

Dabblers on the CRD apparently rely more on soft vegetation and less on seeds, compared to mallards and pintails on Cook Inlet coastal marshes (Timm and Sellers 1979). During fall migration stopovers, waterfowl normally seek foods high in carbohydrates (seeds and root tubers) which provide concentrated energy. It is unknown whether the preponderance of leafy vegetation found in our small sample reflects a shortage of available seeds. Crow (1968) commented on decreased vigor, as reflected by less flowering, of Carex Lyngbyaei in pond basin habitat. Crow did not mention seed availability of Potamogeton, but it would be interesting to compare productivity of this important waterfowl food between the CRD and Cook Inlet. Several important duck foods in Cook Inlet (Scripus paludosus, Scripus validus and Zanichellia palustris) were not found in Copper River Delta birds, probably because of the limited distribution of these plants on the CRD.

Food habit studies for both Cook Inlet and the CRD are severely biased by the difficulty in collecting ducks feeding on intertidal mud flats. This bias is particularly serious on the CRD, since the majority of ducks use this habitat.

When intensive duck studies are initiated on the CR Delta, additional food habits work should: expand the sample size for all habitats; insure that ducks are collected from offshore areas; and identify several unknown food items found in 1980.

Copper River Delta Duck Hunter Survey

Although several hundred questionnaires were distributed by the Forest Service in various locations in Cordova, in Forest Service cabins, and at road access points, only 14 completed forms were returned. These reports represented a total of 116 hunter days and a total harvest of 107 ducks and 28 geese (Table 11).
Perhaps the most revealing question on the survey form was, "How would you best describe the number of ducks and geese your party saw during the hunt? Few, Moderate, Plentiful, Fantastic." Seventy-six percent reported few ducks, 14 percent saw moderate numbers and only 10 percent thought ducks were plentiful. No one reported fantastic hunting!

The small number of questionnaires returned precluded detailed analysis by specific areas or time periods. However, the best

Table 9. Esophageal contents of 31 ducks collected on the Copper River Delta, Alaska 1980.

Foods	Occurrence (%)	Aggregate Percent
SEEDS:		
Hippuris	10	tr.
Carex	19	5
Potamogeton	10	5
Juncus	6	tr.
CRD #7?	23	11
VEGETATION:		
Myriophyllum	6	6
Triglochin palustris	3	tr.
CRD #1?	13	9
CRD #3?	13	8
CRD #4?	48	39
CRD #6?	3	3
ANIMAL:		
Corixidae (Waterboatman)	9	6
Anisoptera (dragon fly larvae)	3	3
Chrionamidae (midge larvae)	6	tr.
Limnephilidae (caddis fly larvae)	3	tr.
Dytiscidae (predacious diving bettle)	3	tr.
Other Coleoptera	3	tr.
Clam	3	tr.
Snail	3	3

Table 10. Esophageal contents (percent occurrence) of 31 ducks collected by location on the Copper River Delta, Alaska 1980.

Foods	Eyak River Ponds (16)	Copper River Highway (10)	Castle Island (3)	Eyak River (2)
SEEDS:				
Hippuris	19			
Carex	19	20	33	
Potamogeton	6		67	
Juncus	12			
CRD #7?	44			
VEGETATION:				
Myriophyllum				100
Triglochin polustris		10		
CRD #1?	6	20		
CRD #3?	19	10		
CRD #4?	60		67	
CRD #6?		10		
ANIMAL:				
Corixidae (Waterboatman)		10		
Anisoptera (dragon fly larvae)		10		
Chrionamidae (midge larvae)	6	10		
Limnephilidae (caddis fly larvae)		10		
Dytiscidae (predacious diving bettle)		10		
Other Coleoptera		10		
Clam		10		
Snail		10		

Table 11. Results of 1980 Copper River Delta duck hunter questionnaire (14 separate reports).

	Dates of Hunt			Season
	Sept. 1-15	Sept. 16-30	Oct. 1-18	Totals
Hunter Days	42	20	54	116
Ducks Harvested	44	43	20	107
Geese Harvested	24	1	3	28
Ducks/Day	1.0	2.1	0.4	0.9
Total Waterfowl/Day	1.6	2.1	0.4	1.2
Harvest Composition (%)				
Pintail	23	53	20	35
Mallard	36	26	60	36
Wigeon	7	9	20	10
G-W Teal	9	7	0	7
Shoveler	7	5	0	5
Scaup	18	0	0	7

daily success was generally reported for the last half of September. This conflicts with the general pattern for Cook Inlet where best success is generally encountered the first few days of September, and again about the second week of October. Judging from the aerial duck surveys, the best duck hunting on the CRD should have occurred about October 10, due to relatively large numbers of ducks present and greater use of onshore habitats. However, only one hunt was reported then, and the party reported few ducks and geese present.

LESSER CANADA GOOSE STUDIES

Cold Bay

Canada geese were banded by FWS personnel in 1980 without as sistance from ADF&G. Timm and Sellers (1979) reported 21 recoveries from banding in 1977 and 1978 (no birds were banded in 1979). As of the July 20, 1981 FWS, IBM listing, there have been 36 hunting season recoveries from birds banded at Cold Bay, plus sightings of 5 dyed birds. The distribution of recoveries is: Oregon - 17 (41.5%); Alaska - 12 (29.3%); California - 9 (22.0%); and Washington - 3 (7.2%). The recoveries in Alaska were at Cold Bay (9) and on the Yukon-Kuskokwim (Y-K) Delta (3). An additional bird was recaptured on the Y-K Delta during summer banding operations.

Cook Inlet

The U. S. Army requested that Canada geese be transplanted to Otter Lake on Fort Richardson. The Army made extensive waterfowl habitat improvements at Otter Lake in early 1980, which included small islands and other suitable goose nesting areas.

During July 1979 and 1980, a crew of Army and ADF&G personnel captured 108 and 30 Canada geese, respectively, on the Palmer Hay Flats, using an Army Huey helicopter. Ninety-one goslings and 16 adults were transplanted to Otter Lake, while the remaining birds were banded and released on Palmer Hay Flats.

As of the July 20, 1981, there have been nine recoveries (9.9%) of transplanted locals and 1 recovery (6.2%) of a transplanted adult. For banded and released locals and adults in 1979 and 1980, total recovery rates have been 5.3 and 8.1 percent, respectively, (N=19 locals, 37 adults).

Because the Otter Lake project was less than 2 years old, we expected no use of the area by nesting Canada geese until the transplanted goslings were at least 3 years old. However, a brood of five goslings was reared on the area in 1980. One of the adult pair had a leg band. In 1981, three pairs of adults raised 14 goslings on Otter Lake. It is not known if those adults were banded.

INVESTIGATION OF TULE WHITE-FRONTED GEESE IN ALASKA

Since first described on their California wintering grounds in 1917, the existence of tule white-fronted geese (Anser albifrons gambeli) as a bona fide subspecies has been debated. Location of the nesting grounds was necessary to ascertain the relationship with A. a. frontalis. Random interspersion on the nesting area would preclude subspecies designation; sympatry would warrant full species recognition; while an allopatric relationship would dictate subspecific classification.

In 1979, the suspected nesting grounds were located by Bob Elgas, Warren Hancock, and Dan Timm in Redoubt Bay, across Cook Inlet from Kenai. Because of the wide concern for, and attention given to, these birds in recent years, the ADF&G considered it prudent to assume leadership in further investigating the status of white-fronts on the State-owned marshes in Cook Inlet.

1980 PROGRESS REPORT

A study was initiated in 1980 with these objectives:

1. Verify the subspecies of white-fronted geese nesting and molting in the Redoubt Bay area of Cook Inlet, Alaska.

2. Determine the number and location of white-fronted geese summering in Cook Inlet.

3. Identify and describe nesting habitat and nest site locations.

4. Identify other areas used by white-fronts from Redoubt Bay.

The following describes how each objective was satisfied.

Objective 1 - Verify Subspecies

Subspecies verification was obtained from morphological criteria, observation of birds marked in California, and recognition of gambeli's allopatric relationship with frontalis.

Morphological Characteristics

During July 1980, representatives of ADF&G, USFWS and the University of Alaska captured in Redoubt Bay and marked (with plastic neck collars) 79 young, 98 yearlings and 115 older birds. All 43 adult geese that accompanied young (including one male from Susitna Flats) were measured and weighed, as was a random sample of 33 nonbreeding birds. Measurements of adults, with and without young, were combined for each sex because no significant differences existed for any data set ($P > .01$), using the Student's t-test.

Table 12 shows comparisons of measurements taken from gambeli in Alaska and measurements from geese in California considered to be gambeli and frontalis. Comparisons of mean culmen, tarsus and nare to culmen tip lengths for both sexes of gambeli from Redoubt Bay and California showed no significant differences ($P > .05$). Differences in means for these measurements between gambeli from Redoubt Bay and frontalis from California were highly significant for both sexes ($P < .001$). A higher incidence of heavy orange staining on white head feathers of adult gambeli (82%, N=62) compared to frontalis (5%, N=178) has been observed in California. Sixty percent (N=65) of adult gambeli at Redoubt Bay were heavily stained. One male tule goose, which accompanied young, was collected on Susitna Flats in late July (culmen = 58 mm, tarsus = 79.9 mm). All geese on Susitna were similar in size and color when observed closely from a helicopter.

Two yearling geese captured in Redoubt Bay were much smaller and lighter colored than all other birds. We classified these two geese as frontalis. For the male and female, respectively, culmen and tarsus measurements were 49.8mm/48.0mm and 77.0mm/71.0)mm.

Observation of Marked Birds

During winter 1979-80, 70 tule geese and nearly 600 frontalis were captured and neck-collared in California by Mike Wege (USFWS) and Craig Ely (U. of Calif. at Davis). Small radio transmitters were also placed on a few tule geese. After known losses from hunting and other factors, a maximum of 59 collared tules could have migrated north (Mike Wege, pers. commun.). In reality, collar loss and unreported mortality probably resulted in 40 to 50 collared birds remaining in the population.

During the spring and summer, we positively identified 13 of these birds plus two other tules which had been marked in California the previous year. Another 60 observations of marked geese were made, but collar symbols were unreadable due to weather, terrain and the birds' habits. A radio signal from one gambeli marked in California was heard in the Redoubt Bay area by J. King and B. Conant on August 14, and by A. Franzmann on September 3.

During May 19-30 and June 8-13, 1,652 geese (416 adults, 193 yearlings and 1,043 unknown age) were checked for collars. Fifty-nine (3.6%) of the geese were collared (23 adults, 8 yearlings and 28 unknown age). Of the collared and known-age birds seen (31), 74.2 percent were adults and 25.8 percent were yearlings. Interestingly, of the maximum collared geese in the population, 45 (76.3%) would be adults and 14 (23.7%) would be young (Mike Wege, pers. commun.).

During the May 19-30 and June 8-13 period, we saw 28.6 percent and 38.6 percent yearlings, respectively. An increase in average

Table 12. Morpholological features of gambeli examined in Alaska, gambeli from California (*) and frontalis from California (*).

Morphological features	Subspecies	Males N	Males $\bar{X}$ (mm)	Males S.D.	Males Range	Females N	Females $\bar{X}$ (mm)	Females S.D.	Females Range
Culmen	gambeli	37	59.7	2.37	54-64	39	55.7	2.33	52-62
	gambeli(*)	26	58.3	2.78	54-66	12	54.4	2.02	50-61
	frontalis(*)	83	51.0	2.64	45-58	35	47.7	2.20	40-56
Posterior nare to culmen tip	gambeli	37	41.5	1.59	36-44	39	39.1	1.45	35-43
	gambeli(*)	20	41.2	1.95	37-45	13	39.6	1.82	35-43
	frontalis(*)	40	36.1	2.66	31-43	32	34.6	1.50	31-38
Tarsus length	gambeli	37	81.8	2.61	77-89	39	76.4	2.38	69-82
	gambeli(*)	16	81.0	3.32	74-87	13	76.0	4.21	67-82
	frontalis(*)	36	75.0	3.13	66-81	32	72.0	2.71	64-77
Bill depth	gambeli	37	31.1	1.44	27-33	39	29.4	1.18	27-32
	gambeli(*)	20	27.5	1.00	25-29	15	26.2	1.26	23-28
	frontalis(*)	46	24.2	1.18	20-27	36	23.2	0.97	21-25
Mid toe	gambeli	37	74.2	3.27	67-83	39	70.2	2.81	65-76
Weight (grams)	gambeli	37	2735	--	2025-3050	39	2285	--	1825-2600
	gambeli(*)1/	69	2960	--	1930-3520	61	2670	--	2040-3180
	frontalis(*)1/	223	2230	--	1800-2280	195	2005	--	1360-2750

1/ Weights obtained late October through late January.

flock size was also detected between the two periods ($\bar{x}$=4.7 birds and 16.0 birds per observation, respectively). We assume that yearlings congregated in molting flocks more quickly than subadults and adults. The 1979-80 wintering population of tule geese was estimated to have 30 percent young.

Allopatry

Based on our knowledge, that of P. E. K. Shepherd, and published information, the nearest nesting white-fronts are about 90 miles west and 120 miles southwest of Redoubt Bay in the Stoney, Hoholitna, and Mulchatna River drainages and on the Bristol Bay lowlands. Therefore, gambeli are geographically isolated from frontalis by towering mountains.

Objective 2 - Survey Geese in Cook Inlet

On July 17, and from July 19-24 Bill Overway, USFWS pilot, and Timm flew about 14 hours of surveys over 11 areas in Cook Inlet. A 35 mm motor-driven camera with a 105 mm lens was used to photograph larger flocks of geese to check visual counting accuracy. Locations of all geese were plotted on 1 in/mile maps. Table 13 summarizes count data.

Visual estimates were close to actual numbers for both adult and immature Canada geese (10% error). Immature white-fronts were underestimated by 50 percent, perhaps because of their tendency to utilize flooded brushy areas. Also, large flocks of molting adults sometimes contained a few young which were easily overlooked.

The 2,029 Canada geese represent a 96 percent increase in numbers and distribution since the last comparable survey in 1974. Surprisingly, no geese of either species were seen in Trading Bay. In 1974, 110 molting white-fronts and one Canada goose were seen there.

Tules were seen between Stump Lake and Lewis River Slough, and near Seeley Lake on Susitna Flats. In Redoubt Bay, nearly all geese were seen in the Big River drainage. Only six adults were seen near the mouth of Kustatan River, although the entire Bay was flown at least three times. Rae Baxter, who in 1962 first reported summering white-fronts in Redoubt Bay, said that the Big River drainage was the only place she had seen birds.

We assume that substantial numbers of young geese were not seen, especially if Redoubt Bay and Susitna Flats are the only summering areas. A total of 1,537 geese considered to be tules was counted (Table 13), 214 of which (13.9%) were young. The winter population in 1979 reportedly contained 30 percent young. Considering the favorable weather for nesting in 1980, the 13.9 percent young is believed to be low. We believe that most adults

Table 13. Geese seen during late July 1980 survey.

Area	White-fronted			Canada		
	Ad.	Imm.	Total	Ad.	Imm.	Total
Palmer-Hay	-	-	0	480	45	525
Goose Bay	-	-	0	16	11	27
Potter	-	-	0	45	60	105
Chickaloon	-	-	0	47	68	115
Susitna	50	68	118	497	676	1173
Trading Bay	-	-	0	-	-	0
Redoubt Bay	1273	146	1419	1	3	4
Kalgin Island	-	-	0	-	-	0
Kenai River Delta	-	-	0	-	-	0
Kasilof River Delta	-	-	0	-	-	0
Tuxedni Bay	-	-	0	-	-	0
Anchorage Vicinity 1/	-	-	0	40	40	80
Total	1323	214	1537	1126	903	2029

1/ Estimated number present in Anchorage city proper and military bases.

without young were seen because they congregated in large and more easily seen flocks. Smaller flocks of family groups in flooded trees and brush were probably not seen. Over 80 percent of all young were seen in two flocks, one near the mouth of Big River (126 young), and the other near Seeley Lake on Susitna Flats (46 young).

Objective 3 - Identify Nesting Habitat and Nest Sites

Because young geese were seen near the mouth of Big River in 1979, and because a cabin owner (Frank Woodfill, pers. commun.) said he had found a white-front nest along Montana Bill Creek (½ mile south of Big River) near tidal water, nest searching was conducted within the zone between intertidal mud and poorly drained sweet gale (Myrica gale). Accurate surface orientation was possible from infra-red 4 in/mile maps furnished by NASA.

Habitat Description

Habitat in the Big River area, is characteriszed by a transition from intertidal mud, to saline sedge-grass marsh, fresh marsh, expanses of poorly drained sweet gale, alderwillow thickets, aspen-spruce-birch forest, and alluvial glacial plain terminating at rugged mountains and glaciers within 14 miles of saltwater. Braided rivers and streams overflow from glacial and snow melt in July and August to form a shallow, flowing lake in the upper portions of the Big River drainage.

The Drift, Big and Kustatan Rivers bisect Redoubt Bay. Smaller streams include Bachatna Creek, Little Jack Slough, Montana Bill Creek, and Seal River. Additionally, there are numerous smaller tidal sloughs of shorter length. All streams, rivers and tidal sloughs are fed by small tidal "guts" which form a spider web-like drainage pattern in the near-tidal portions of the area. For purposes of describing the habitat searched for nests, four broad types of plant communities are recognized.

Intertidal mud flats extend towards the inlet from about mean high tide and consist of exposed mud/sand flats vegetated only by algae.

Saline sedge-grass flats are the most conspicuous habitat type and begin inland of tidal flats. In the 1980 nest search area near Big River (a strip of land 4.6 miles long), saline sedge-grass flats were 0.3 miles to 1.7 miles wide. This area is occasionally flooded by tides higher than 22 feet. On elevated ground such as stream and tidal gut levees, flooding occurs only with tides higher than 24 feet or with strong, wind-driven high tides. High tides during April, May and June ranged from 12.1 to 22.3 feet.

Prominent vegetation on unelevated sites included: creeping alkali grass (Puccinellia phygranodes), Ramenski sedge (Carex

ramenski), seaside arrow-grass (Triglochin maritmum), marsh arrow-grass (Triglochin palustris), Lyngbye sedge (Carex Lyngbyaei), Pacific silverweed (Potentilla egedii), and goosetongue (Plantago maritima). On better drained and slightly elevated sites such as banks of streams and tide guts, dominant vegetation included: beach rye (Elymus arenarius mollis), blue grass (Poa eminens), Arctic daisy (Chrysanthemum arcticum), beach lovage (Ligusticum scoticum and Saussurea nuda). Small patches of dwarf willow (Salix sp.) are occasionally found.

Within a month after snow melt, large expanses of standing sheet water had shrunk to numerous, small permanent ponds of brackish water. These ponds are shallow, have sharply defined shorelines, relatively little emergent vegetation, and unvegetated bottoms. Pondweeds (Potamogeton sp. and Zanichellia palustris), and mare's tail (Hippuris tetraphylla) are sometimes present.

Fresh Marsh is a generally narrow band of habitat (up to 0.5 miles wide) inland of the saline sedge-grass flats where flooding by tide water occurs infrequently (only on the highest tides). Most of the area is poorly drained and has numerous ponds up to 3 feet deep with indefinite shorelines of emergents. Carex. Lyngbyaei, C. mackenziei, dock (Rumex spp.), and marsh five finger (Potentilla palustris) are common plants. Stream courses are far fewer in number than in saline sedge-grass flat habitat, and are larger. The spider web pattern of tidal guts terminates at the fresh marsh-saline sedge-grass boundary. Fresh marsh extends inland for several miles parallel to streams and rivers, and is maintained in those areas by stream flooding from snow melt, and by freshwater backed up by tides. The vegetation on stream banks in this habitat type is a transition between that found in saline sedge-grass flats and shrub-bog habitat.

Shrub-Bog begins inland of fresh marsh and consists mostly of sweet gale (Myrica gale), dwarf birch (Betula nana), willow, red fescue (Festuca rubra) and bluejoint (Calamagrostris spp.). C. mackenziei, C. rariflora, C. spp. and buckbean (Menyanthes trifoliata) occur in wetter sites. The edge between shrub-bog and fresh marsh is sometimes precise, but other times is a transition of scattered brush patches for several hundred yards. Stream bank vegetation was varied and became very dense and lush by mid-June. Major species included: beach pea (Lathyrus maritimus), Arctic lupine (Lupinus arcticus), water hemlock (Cicuta douglasii), dock, cow parsnip (Heracleum lanatum), Angelica lucida, Trientalis spp., Rocippa spp., Sanguisorba spp., Fritillaria camsch atcensis, yarrow (Achillea borealis), Equisetum spp., and Calamagrostis spp.

Nest Site and Habitat Characteristics: Eight nests were found in 107 hours of searching (13.4 hrs/nest). During May 19-30, seven nests were found in 72 hours (10.3/hr), while one nest in 35 hours was discovered June 8-13. During the early period, we believe all nests were found within the area searched; vegetation

was taller and more dense during the later period and nests were possibly missed. Comparable habitat was covered in both periods.

Seven nests were found in 5.37 mi^2 of saline sedge-grass habitat (1.30 nests/mi^2) and one nest was located within 1.62 mi^2 of fresh marsh and shrub-bog area (0.62 nests/mi^2), for a total of eight nests in a 6.99 mi^2 area (1.1 nests/mi^2).

Other nests found included 51 duck nests in saline sedge-grass flats (9.5 nests/mi^2) and one duck and three sandhill crane nests in the fresh marsh/shrub-bog areas. Ten of the duck nests were common eiders. The density of duck nests is underestimated because we searched mostly before major nest initiation.

Seven tule goose nests were located on the elevated (about 2 ft) levees of streams and tide guts in saline, sedge-grass, flat habitat. The other nest was in a small clump of sweet gale on the edge of shrub-bog/fresh marsh communities, near the shore of a 300 ac lake. Table 14 characterizes the eight nests.
Nest sites (slightly elevated locations along stream banks and ond edges) were as expected, judging from work on frontalis on Canada's Anderson River Delta (Barry 1967) and on the Y-K Delta (Ely 1979). The plant species composition near each nest was also similar to what Ely found about 13 miles from the coast on the Y-K Delta.

Nesting, and possibly most production, occurs farther inland in Redoubt Bay. On June 12, 1980, six Class Ia broods were seen. Five were on two tributaries of Big River, about 5 and 6 miles from the mouth of Big River. One brood was 8 miles upstream on a large, flooded meadow adjacent to Big River. Upriver habitat is characterized by Carex and Equisetum riparian meadows, alder and willow lined stream banks, patches of spruce and birch forest, and expanses of outwash plain. Much of the upriver area floods in early spring and late summer.

Objective 4 - Identify Other Areas Used by Tule Geese

Table 15 summarizes the encounters of the 292 birds seen north of California through October 1980. A complete picture of the bird's range will not be obtained for several years.

Eight radio transmitters were furnished by the USFWS, and we placed them on tule geese in July. During August and September three flights were made specifically to monitor radios, while on several occasions radios were monitored incidental to bear and moose work. Seven of the eight radios were heard at least once, and one radio placed on a bird in California earlier was heard twice. Fig. 4 shows locations and dates of birds monitored. Besides Redoubt Bay, birds were located in Trading Bay, on Chickaloon Flats, and on Potter Marsh near Anchorage. Wege (pers. commun.) reported that as of late October 1980, seven of eight radioed birds had been located in California, and six still had functioning radios.

Table 14. Tule geese nest characteristics

Character	1	2	3	4 1/	5	6	7	8	1-8 3/ Ave.
Distance (feet) to inter-tidal mud	3,800	2,500	3,900	17,500	5,700	2,800	1,400	2,600	3,200
Distance inland to Myrica	2,800	3,100	1,500	-	4,100	9,400	4,300	7,500	4,700
Located on 2/:									
Small slough	X					X	X		3
Medium slough		X			X				2
Large slough			X					X	2
Pond/lake				X					1
Nearest other tule nest	2,225	1,950	3,575	>1 mile	3,775	3,200	1,950	3,200	2,850
Initiation date 4/	5/11	5/09	5/12	5/10	?	5/15	5/16	5/13	5/12 5/
Max. No. eggs	6	7	4	5	?	7	5	5	5.6
Hatching Date	-	-	-	6/10	-	6/16	6/16	6/12	6/13
% cover within 3' of nest (visual estimation in late incubation)									
Elymus	-	25	30	-	50	40	75	5	32
Ligusticium scoticum	10	5	5	-	-	-	-	3	3
Saussurea nuda	-	5	5	-	-	3	4	3	3
Chrysanthemum arcticum	-	4	-	-	5	-	4	3	2
Poa eminens	-	3	-	-	-	-	-	-	<1
Lathyrus maritimus	1	-	-	-	-	-	-	-	<1
Myrica gale	-	-	-	70	-	-	-	-	-
Salix spp.	3	-	-	15	-	-	-	-	<1
Potentellia egedii	-	15	5	-	-	4	4	3	4
Plantago maritima	-	-	-	-	-	4	-	3	1
C. rariflora	-	-	-	10	-	-	-	-	-

Table 14. Tule geese nest characteristics. (cont'd)

Character	1	2	3	4	5	6	7	8	1-8 Ave.
C. Lyngbyaei	-	-	-	-	10	-	-	-	1
C. Ramenskii	-	-	-	-	-	4	-	-	≤1
C. spp. (fine grass-like)	-	-	10	-	-	-	-	-	1
Triglochin palustris	-	3	-	-	-	-	-	-	≤1
Angelica lucida	35	-	-	-	15	-	-	-	7
Unk. fine grass	15	-	-	-	-	-	10	-	4
Unk. large stem grass	35	-	-	-	-	-	-	-	5
Bare ground or ground cover	-	40	45	5	20	45	3	80	33

1/ Nest located on fresh marsh/shrub-bog edge.
2/ Small ≤ 15' top of berm to top of berm; medium 16-30; large > 30'.
3/ Averages do not include nest #4.
4/ Date of first egg layed (assume 1 egg/day and one skip day, 26 days incubation).
5/ Including nest #4.

Table 15. Observations of marked tule geese, late summer and fall 1980.

Note: As of August 1, 1981, 253 (86.6%) collared tules had been accounted for. Observations will be updated in the next S&I Report.

Date	Location	Observation
8/5-8/8	Big River, Redoubt Bay	12 observations of ~560 tules of which ~205 and 3 had blue and yellow collars, respectively
8/30-9/1	Stump Lake & Lewis River-Susitna Flats	15 observations of 266 tules of which 10 had blue collars; up to 300 frontalis also present
8/30-9/2	Big River area, Redoubt Bay	6 observations of 79 tules of which ≥9 had blue collars; 150-200 tules in area
8/18-9/4	East side of Copper River Delta	Of 2,245 whitefronts seen, 115 identified as tule (but no collars seen) 1,093 frontalis and 1,037 unknown; tules seen 8/18(28), 8/30(67), 9/1(1), 9/4(19)
9/1	Redoubt Bay	4 collared tules shot
9/1-2	Susitna Flats	3 collared tules shot
9/1	Mile 9, Copper River Delta	1 collared tule shot
8/28-9/27	Summer Lake, OR	28 different collared tule geese observed; peak population of tules estimated at 1,000 to 1,500 birds
9/6&9-9/12	Yakutat Forelands	1 blue collared tule seen; only ~100 whitefronts observed Aug. thru Oct.
9/13-16	Golf course on Southern Vancouver	1 of 3 whitefronts had a blue collar; birds fed with domestic geese
9/14-9/27	Malheur NWR, OR area	3 blue collared geese seen; peak population (many tules) ~3,000 on 22 Sept.; first arrivals of tules 26 Aug. and last departure ~3 Oct.
10/8	Turnbull NWR, Cheney, WA	7 collared imm. in a flock of 9 imm. and 2 ad.; only 3rd record of whitefronts in 10 years on Turnbull

Management Implications

Numerically small populations tend to spark concomitant public attention and concern. Therefore, it seems likely that special interest groups will petition the Secretary of the Interior to consider the tule goose for endangered or threatened classification. (Note: A petition was received by the FWS in May 1981). The tule white-front, with an estimated population of more than 3,500 birds (late 1981 estimate), has already influenced land use in upper Cook Inlet, and has complicated harvest management of white-fronts in California. Even without threatened/endangered classification, tule geese will receive special consideration if the tentative population objective of the flyway management plan for a population of 5,000 birds, or the full utilization of summering habitat, is to be realized.

Redoubt Bay and Susitna Flats are on the south and north ends, respectively, of Alaska's second largest producing oil field, and Susitna Flats is in the middle of the State's largest producing gas field. Nearly the entire area has been leased for oil, gas and coal exploration, although many leases have expired. However, State Lease Sale #33 (1981) originally would have allowed the sale of expired and unleased land in most of Redoubt Bay and Susitna Flats. Upon advice from ADF&G, and a request from the Audubon Society, the Department of Natural Resources agreed to delete all of Redoubt Bay from the impending sale and future sales at least until 1983.

Because Susitna Flats is a State Refuge, we have required special stipulations for exploration to protect tule geese and other wildlife resources there. Redoubt Bay will again be nominated to the State Legislature in 1981 for designation as a State Game Refuge.

The Beluga coal fields, located between Susitna Flats and Trading Bay, may be the world's largest single deposit of coal. A methanol plant, a city of up to 3,000 people, coal export facilities, and a road down the west side of Cook Inlet are all under active consideration. These developments would undoubtedly open the west side of Cook Inlet to other developments, at least as far south as Trading Bay.

Plans for 1981

The following objectives are proposed for 1981 field studies:

1. Locate and describe nesting habitat in the upriver regions of Big River.

2. Determine whether nesting and brood rearing occurs, and determine the suitability of nesting habitat, in the northern portions of Redoubt Bay.

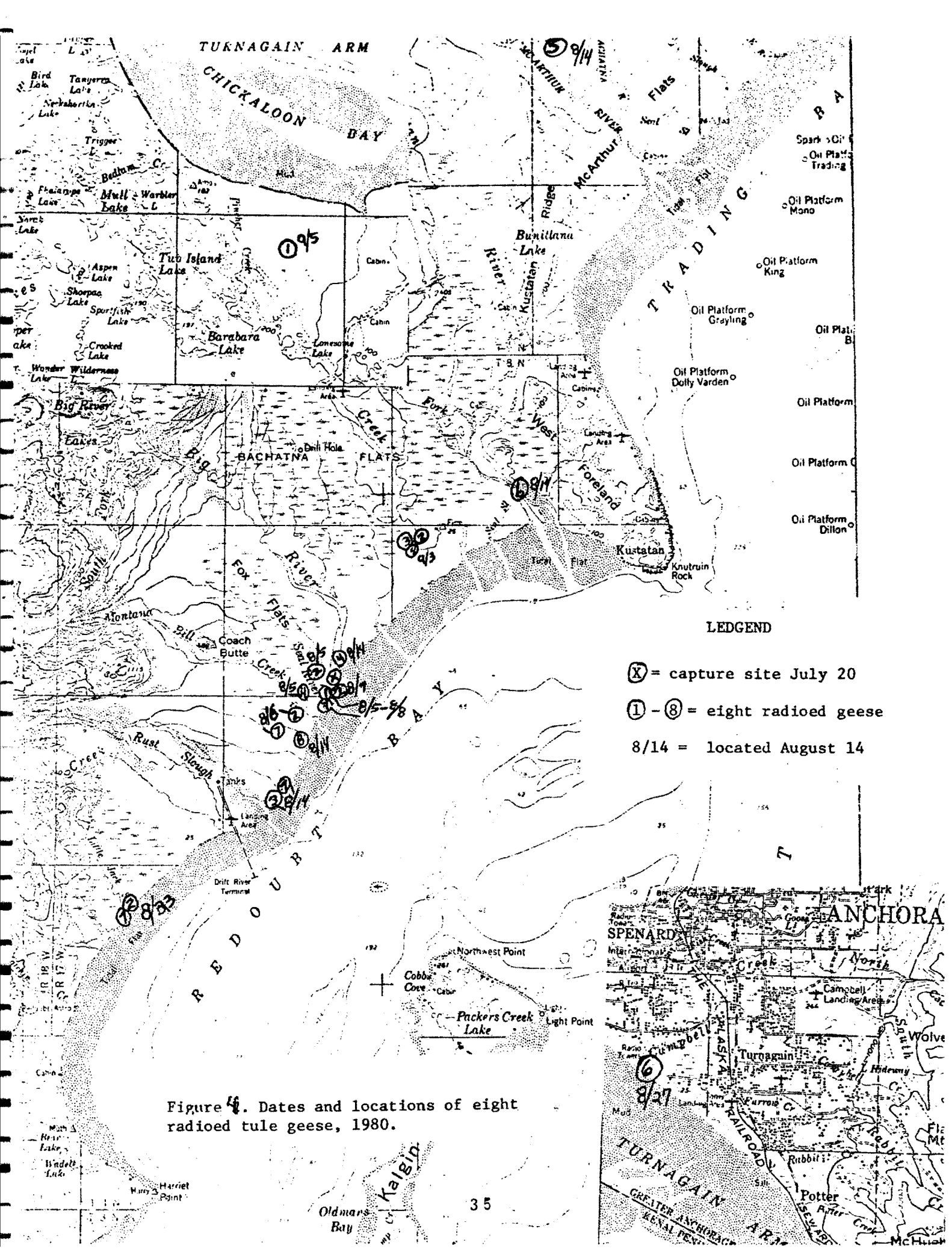


Figure 4. Dates and locations of eight radioed tule geese, 1980.

3. Locate and describe nesting habitat on Susitna Flats.

4. Determine the suitability of Trading Bay as nesting habitat for tule geese.

5. Determine spring arrival dates and use areas in Cook Inlet.

6. Capture, neck-collar and measure tule geese on Susitna Flats and additional birds (mostly young and their parents) on Redoubt Bay.

7. Conduct a second comprehensive aerial survey of tule geese in Cook Inlet during mid-July.

8. Further define the fall departure pattern of tule geese from Cook Inlet.

Objectives 1, 2, 3. Systematic ground searches will be made using aerial photos for orientation. If spring chronology is similar to 1980, nest searching will begin about May 18. Time permitting, a second search in some areas will be made to measure late nesting and to better quantify total nest densities. A portion of the saline sedge-grass flat area searched in 1980 will also be double searched in 1981.

Besides those areas where broods were seen up Big River in 1980, nest searching will also occur in the Bachatna Creek and Kustatan River areas. About 5 days will be spent searching for nests in each of those two areas, about 6 days up Big River, 3-4 days on saline sedge-grass flats, and 5-6 days in the Seeley Lake area on Susitna Flats. Vegetative cover will be minimal until early June, so initial efforts will be up Big River where nests will probably be most difficult to find.

The location and description of tule goose nest sites on Susitna will allow comparisons between nest sites used by Canada geese there, so the potential for competition can be assessed.

Personnel from Special Studies, FWS, have an interest in helping on the tule goose project. Additional volunteers from the University of Alaska and the general public may participate, plus other ADF&G biologists may assist for short periods.

Objective 4. We recently asked NASA to provide a computer analysis of vegetation in salt marshes of upper Cook Inlet, using U-2 or other photos. They provided two sets of infra-red photos last year and then indicated the possibility of computer analyses.

By constructing a vegetation profile or "signature" around nest sites, molting areas or other essential habitat, the identification of other similar habitats in Cook Inlet may be possible. This may allow accurate upper population limits to be predicted.

NASA currently has this capability for 3.8 acre habitat parcels, but that scale wouldn't provide acceptable precision. They will soon have the capability to analyze 1.1 acre parcels, but that scale may be cost prohibitive.

Objective 5. Collared geese provide an opportunity to determine by age class, arrival dates, prenesting activities, and food habits. Arrival times will be premigration observations in Oregon and California by FWS and University of California researchers.

Special Studies personnel will closely monitor bird use on the Kenai River Delta, during a riparian habitat study. Observations will be made in 1981 from early April until most waterfowl depart.

On April 23, 1980, 265 and 60 tule-appearing white-fronts were counted from the air on Redoubt Bay and Trading Bay, respectively. On April 30 about 150 tules were seen in Redoubt Bay, but many were missed because singles and pairs were being located and plotted on aerial photos. At least 89 frontalis were seen, as judged by obvious size and color differences. Major departures of tules from the Klamath Basin occurred on 8, 15-16, and 28-29 April 1980 (Mike Wege, pers. commun.).

In spring 1981, observers will be at Seeley Lake on Susitna Flats, on the Kustatan River, and in the Big River area. The McArthur River area in Trading Bay will also be covered. The timing of nest construction and egg laying in relation to snow melt may be monitored on Susitna Flats and Redoubt Bay. In 1980, observations and photographs of snow melt in Redoubt Bay were made on 14, 23, and 30 April .

Objective 6. Documentation of tule geese on Susitna Flats will be made by capturing birds in July. Several white-front subflocks on the wintering grounds are suspected, and birds from Susitna could compose one subflock. Birds will be captured using a helicopter because their habitat precludes conventional capture with float planes and boats. Marking more birds in Redoubt Bay will allow a more complete picture of range and habitat use.

Objective 7. We are reasonably confident that tule geese do not summer, at least regularly in significant numbers, on Chickaloon Flats, Portage Flats, Potter Marsh, Palmer-Hay Flats, Goose Bay, Kenai River Flats, Kasilof Flats, and Kalgin Island. We are not certain of Trading and Tuxedni Bays. If no geese are found there during a 1981 survey, that would corroborate the 1980 survey, and efforts could be made elsewhere in the future.

For land management purposes and baseline population data, it is desirable to again thoroughly survey Redoubt Bay and Susitna Flats. Hopefully, aircraft for the survey will again be available from the FWS.

Objective 8. Ground observations in late summer and fall 1980 occurred at Redoubt Bay, Susitna Flats, Chickaloon Flats (none seen on Chickaloon September 1-3), the east side of the Copper River Delta and near Yakutat (Table 15).

In 1981, mid-August to early September observations will be made in Redoubt Bay, Susitna Flats, Trading Bay and possibly Chickaloon. Although more information will be available for 1980 when band recoveries are reported, birds apparently began leaving Cook Inlet by mid-August, and had mostly departed by September 10, 1980.

Miscellaneous

Redoubt Bay has an impressive bear population (browns in coastal areas and blacks in the foothills). For example, nine bears were seen at one time in July by F. Woodfill (pers. commun.) from his cabin. We expected significant nest predation by bears, since Woodfill reported goose nests near the cabin. However, bears only infrequently left the shrub-bog and inland areas to roam the fresh marsh and saline sedge-grass flats through mid-June 1980, and did not frequent these areas consistently until silver salmon runs in July, long after hatching had occurred. Equisetum was frequently present which indicated extensive grazing in inland habitats.

Glaucous-winged and herring gulls were seen infrequently during the summer, and ravens and jaegers were not abundant. Mew gulls were abundant and are believed to have destroyed goose eggs, presumably after nests were abandoned. Four of 8 nests were abandoned, probably due to human activity which occurred after incubation began.

Observations of tule goose food habits were made 22 times during the spring, summer and fall. Foods eaten on the saline sedge-grass flats included Carex Lyngbyaei, C. Ramenskii, Triglochin palustris (both vegetative matter and rhizome tubers). T. maritima, Puccinellia nutkaensis, and P. phryganodes. C. Lyngbyaei and Equisetum spp. were heavily grazed up Big River.

Large weight gains were recorded for two collared adult geese shot in September at Redoubt Bay. In 42 days (July 20-September 1), an adult male gained 1,200g (2,725 g to 3,925 g) and an adult female 1,125 g (2,200 g to 3,325 g). These represent weight gains of 44 and 51.1 percent, respectively, in just 6 weeks. Two immature females and one immature male shot September 1, 1980 at Redoubt Bay weighed 3,050 g 2,860 g, and 3,075 g, respectively, while an adult female shot on September 1 at Susitna Flats weighed 2,900 g.

Fifty cloacal swabs were taken and sent to the National Wildlife Health Lab in Wisconsin. All but six swabs were nonviable, due to thawing and dehydration in shipment. The six cultured samples were negative for fowl cholera.

The collared yearling shot on the Copper River Delta (Table 15) had immature markings. Observation of known-age geese in the lower flyway will document feather molt, and could identify a source of field aging bias for white-fronts.

Average length and width of eggs (N=34) was 83.1 mm and 54 mm, respectively. Frontalis eggs from the Y-K Delta (N=313) averaged 80.1 mm and 53.5 mm in length and width, respectively. There was no significant difference in mean width ($P>.10$), but a significant difference occurred in mean lengths ($P<.01$, Student's t-test).

A forest horizon lies about 3 feet under Redoubt Bay. The historical implications of this are interesting, and carbon dating and other historical sources of information will be investigated.

Cooperative Studies

Work on the wintering grounds by the FWS in 1978-80 was instrumental in initiating the Alaska study and in accomplishing several of our objectives; continued interchange of information between agencies is important. It is also important to obtain an accurate population estimate; this can probably be done best on wintering (or migration) areas. Major use areas and habitat requirements throughout the bird's range should also be identified. The tule goose represents a rare opportunity to investigate the life history of white-fronted geese in the detail with which some subspecies of Canada goose have been studied; we hope the FWS or universities will pursue this opportunity.

ACKNOWLEDGEMENTS

The USFWS provided a plane and pilot for the July inventory and goose banding operation. NASA provided small and large scale color infra-red photos. D. Bynon, J. Hawkings, D. Herter, C. Lensink, B. Overway, and K. Timm all helped in field work at Redoubt Bay, and Hawkings and Herter observed geese on the Copper River Delta. M. Peterson observed geese on the Yakutat Fore lands. Numerous other Federal and State biologists and hunters contributed observations and reports of white-fronted geese. C. Ely and R. Bromley provided helpful information on procedures and data collection in nesting studies. F. Woodfill and his hunting partners, and A. Russell and J. Sangster made their cabins and knowledge of Redoubt Bay available to us.

LITERATURE SEARCHED - TULE GOOSE

Barry, T. W., 1967. The geese of the Anderson River Delta, Northwest Territories. Ph.D. Thesis, Univ. of Alberta, Edmonton. 181pp.

Bauer, R. D. 1979. Historical and status report of the tule white-fronted goose. Pages 44-55 in R. L. Jarvis and J. C. Bartonek (eds.), Management and biology of Pacific Flyway geese. Oreg. State Univ. Book Stores, Inc. Corvallis, OR.

Boyd, H. 1956. Mortality and fertility of the white-fronted goose. Bird Study 4:80-93.

_____. 1965. Breeding success of white-fronted geese from the Nenets National area. Wildfowl Trust Report 16:34-40.

DeLacour, J. 1954. The waterfowl of the world. Country Life Limited, London. Vol. 1. pp 102-114.

____, and S. D. Ripley. 1975. Description of a new subspecies of the white-fronted goose Anser albifrons. Am. Mus. Nat. Hist. Novitates, No. 2565. pp 1-4.

Elgas, B. 1970. Breeding populations of tule white-fronted geese in northwestern Canada. Willson Bull. 82:4, pp 420-426.

_____. 1972. Observations of tule geese at the Sacramento Wildlife Refuge. Unpubl. rept. 5pp.

Ely, C. R. 1979. Breeding biology of the white-fronted goose (Anser albifrons frontalis) on the Yukon-Kuskokwim Delta, Alaska. M.S. Thesis, Univ. of California, Davis. 110pp.

Gabrielson, I. N., and F. C. Lincoln. 1959. The Birds of Alaska. The Stackpole Book Co., Harrisburg, Penn. 922pp.

Havens, P. D. 1971. Report of survey and inventory activities-waterfowl and small game. Alaska Dept. Fish and Game, Proj. Prog. Rep., Fed. Aid Wildl. Rest. Proj. W-17-3, Job 10 and 11. 52pp.

Krogman, B. D. 1973. A morphometric study of the white-fronted geese wintering in California. M.S. Thesis, Univ. Calif., Berkeley. 99pp.

_____. 1978. The tule goose mystery - a problem in taxonomy. American Birds 32:2, pp 164-166.

_____. 1979. A systematic study of Anser albifrons in California. Pages 22-43 in R. L. Jarvis and J. C. Bartonek (eds.) Management and biology of Pacific Flyway geese. Oregon State Univ. Book Stores, Inc. Corvallis, OR.

Kuroda, N. 1929. On the subspecific validity of Anser gambelli Hartlaub. Condor 31:173-180.

Mayfield, H. 1975. Suggestions for calculating nest success. Wilson Bull. 87:456-466.

Miller, H. W., and D. H. Johnson. 1978. Interpreting the results of nesting studies. J. Wildl. Manage. 42:471-476.

Palmer, R. S. 1976. Handbook of North American birds. Vol. 2 pt. 1. Yale Univ. Press. New Haven, Connecticut. pp 89-110.

Ploeger, P. L. 1968. Geographical differentiation in Arctic Anatidae as a result of isolation during the last glacial. ARDEA. pp 80-84.

Raveling, D. G. 1978. The timing of egg laying by northern geese. Auk 95:2, pp 294-303.

Rearden, J. D. 1956. Identification of waterfowl nest predators. J. Wildl. Manage. 15:386-395.

Smith, S. R. 1961. Notes on birds of the alpine zone, Kenai Peninsula, Alaska. Bull. Alaska Ornith. Soc. 1:3. 16pp.

Timm, D. E. 1975. Report of survey and inventory activities-waterfowl. Alaska Dept. Fish and Game, Proj. Prog. Rep. Fed. Aid Wildl. Rest. Proj. W-17-7, Jobs 11.4 and 11.5. 53 pp.

_____. 1979. An Alaskan summering area for tule white-fronted geese. Alaska Dept. of Fish and Game, Unpubl. Rep. 4pp.

Todd, W. E. C. 1950. Nomenclature of the white-fronted goose. Condor 52:63-68.

Voelzer, J. F. Productivity surveys of geese, swans, and brant wintering in North America. Unpubl. Rep., U. S. Fish Wildl. Serv., Columbia, Missouri. 41pp.

Wege, M. 1979. Wintering ecology of the tule white-fronted goose (A. a. elgasi). U.S. Fish Wildl. Ser. Prog. Rep., Proj. 909.10. 37pp.

_____. 1980. Wintering ecology of the tule white-fronted geese in California. U. S. Fish Wildl. Ser. Prog. Rep., Proj. 909.10. 12pp.

Westerkov, K. 1950. Methods of determining the age of game bird eggs. J. Wildl. Manage. 14:56-67.

PILOT POINT AND CINDER RIVER GOOSE STUDIES

Over the past 5-8 years, local residents, long-time hunters and ADF&G area biologists have been concerned over the changing patterns of geese using Pilot Point and Cinder River Critical Habitat Areas. Some of the suspected changes include: (1) fewer geese present at peak migration; (2) later arrival and lack of a gradual build up of geese; (3) a shorter period of peak use; and (4) less use of coastal habitat by snow geese.

During October 1979, a reconnaissance trip was made to Pilot Point and Cinder River to begin evaluating fall goose use (Timm 1980). Because few geese were present during the 1979 study, firm conclusions were not reached and another trip was made from October 7-20, 1980 by Dick Sellers.

Fall Migration Timing

In 1979, cackling Canada geese and snow geese did not leave the Yukon-Kuskokwim Delta en masse until an October 18 cold snap. Cackler use of Pilot Point was concentrated between October 19 and 21, when up to 15,000 geese were reported in the area. The geese departed by October 22 when all marsh ponds froze.

In 1980, goose migration through Pilot Point was more prolonged, and a period of peak use was unapparent. Christian Smith (ADF&G) flew over Ugashik Bay and Cinder River on October 2 and reported totals of less than 1,000 cacklers, no snows and about 3,000 emperors for both areas. Robert Gill, Jr. and Rodney King (FWS) observed a significant migration of snow geese across the eastern Alaska Peninsula between October 5 and 7.

On October 7 several flocks of snow geese were north of Egegik, and one flock of about 100 birds were near Pilot Point. On October 7 Gill and King reported 100 snows, 9,380 cacklers and 320 emperors on Ugashik, and 1,135 cacklers and 5,285 emperors on Cinder River. On October 9 at least 1,500 cacklers moved through Pilot Point, and many of the geese already present departed. Geese passed continuously that night; north winds calmed and ponds glazed over with one-fourth inch of ice.

Several thousand cacklers and 100 snows remained on Ugashik Bay after this initial migration surge. The cackler population built slowly through October 13, thereafter remaining between 5,000 and 7,000 through October 20. On October 18 there were about 3,900 cacklers and 3,180 emperors on Cinder River/Hook Lagoon.

Johnny Ball, a Pilot Point resident , reported only small numbers of migrating geese after October 21, although a few geese remained through the end of October.

Habitat Use and Food Habits

Snow Geese: Too few snow geese have been seen over the past two falls to draw definite conclusions on habitat use. Some observers reported that snows formerly used Puccinellia flats concurrently with cacklers. However, a recent trend indicates that snows use larger inland water bodies more consistently than cacklers. Both snows and cacklers reportedly feed heavily on tundra berries when plentiful, but neither 1979 or 1980 were particularly bountiful berry years at Pilot Point. Other studies on snow geese emphasize the importance of Triglochin palustris bulbs, T. maritimum, Puccinellia, Carex, Eleocharis, and Equisetum (Prevett et al. 1979) as food during fall staging.

Cacklers: In 1979, about 450 cacklers consistently used two areas along Ugashik River. Both areas were sparsely vegetated with patches of Puccinellia and a few associated pioneer species. In 1980, cacklers also preferred early successional plant communities containing Puccinellia phryanodes, a preferred goose food. Two types of sites are colonized by Puccinellia: (1) newly exposed mud bottoms of drained ponds (e.g., several pond basins in Section 30, T33S, R55W recently drained by tide guts); and (2) exposed mud flats created by silt deposition or by alteration of river channels (e.g., the mud flats in Sections 14 and 15, T31S, R51W). Wet "meadows" within the sedge marsh were used only if vegetation was low and rather sparse, and especially where Triglochin palustris was common.

Of 31 cacklers examined in 1980, 20 had food in their esophagi. Triglochin palustris bulbs and Puccinellia phryanodes were dietary staples (Table 16). Puccinellia is probably underrepresented, because geese feeding on the mud flats were less vulnerable to hunters.

Catastrophic habitat destruction on the two Critical Habitat areas was originally ruled out as the reason for reduced goose use, based on no documented natural or man-caused disasters (e.g., the 1964 uplift of the Copper River Delta). However, the effects of habitat alteration from natural plant succession needs evaluation. Ringius (1980) studied coastal marsh vegetation at James Bay, Canada and estimated "the time required at Kapiskau for the vegetation to pass from the emergent stage on the inter-tidal flats to the thicket stage...ranges from 106 to 142 years." Unfortunately, no aerial photography is available to document changes in plant communities at Pilot Point. Nevertheless, long-time observers have witnessed plant succession resulting in former areas of Puccinellia--once heavily used by geese--being converted to tall and lush grass/ sedge meadows, which are unattractive to geese. The amount of newly vegetated mud flats is apparently not keeping pace with areas lost to goose use through plant succession, resulting in a gradual deterioration of Pilot Point as a goose staging area.

Table 16. Esophogeal contents of 20 cackling Canada geese from Pilot Point, Alaska, October 1980.

	% Occurrence	Aggregate Volume	Aggregate Percent
Triglochin palustris bulbs	30	44.9	27.1
Puccinellia phyganodes	25	13.1	12.9
Atriplex seeds	20	16.4	11.9
Small leaf clusters	25	9.9	6.3
Large leaf clusters	10	9.5	3.8
Course grass	20	4.7	18.9
Carex spp.	15	tr.	15.0
Zanichellia palustris	5	1.1	5.0

Hunting Activity and Aircraft Disturbance of Geese

Another theory explaining the decrease in goose use is that hunting pressure and associated disturbance has increased in recent years to an intolerable level for geese. There is ample evidence that geese, especially snow geese, are easily disturbed by low flying aircraft.

During October 1979 and 1980, an average of 3.6 and 1.7 aircraft per hour, respectively, flew below 500 feet over Ugashik Bay. In 1979, 35 percent of the low-flying aircraft were wheeled; in 1980 only 20 percent of the aircraft were wheeled. More air traffic in 1979 was at least partially due to the open bear season that fall. Another contributing factor was that FWS enforcement personnel were doing more low level flying in 1979 than in 1980. Officers left Pilot Point on October 8, 1980.

Air traffic over Cinder River was much less frequent than at Pilot Point, and did not change significantly from 1979 (0.4 flights/hr) to 1980 (0.55 flights/hr).

Low-flying aircraft often disturbed cacklers to the extent of causing them to flush. They normally flushed as a flock and either milled briefly before landing, or flew to another location in the Pilot Point area. Only one such incident resulted in a flock splitting, with part disappearing towards Cinder River.

One flock of 400 newly arriving cacklers appeared to be seeking a landing place along the Ugashik River, but they were shot at when approximately 80 yards up. The flock climbed quickly and continued southeasterly over the Aleutian Range. Apparently, this one incident discouraged the flock from settling into Pilot Point; generally when a resting flock was flushed by hunters on foot or in boats, less dramatic reactions ensued. Typically, the disturbed flock simply moved to another part of the marsh.

During 1979 and 1980, one commercial goose-guiding operation was based at Pilot Point. An estimated 100 to 200 hunter-days were associated with this guide, and in 1980 a harvest of less than 50 geese resulted. Besides a Wigeon aircraft used by the guide, an average of two or three additional planes/day were used to hunt in Ugashik Bay. Peak use in 1980 occurred on October weekends when approximately eight planes were on the Ugashik Flats.

Cinder River experienced much less hunting pressure than Pilot Point. During the weekend of October 18-20, 1980, two people hunted from a cabin at the mouth of the bay. One other plane was on the ground during those 3 days.

Considering the relatively low levels of hunting activity and disturbance of geese by aircraft at Pilot Point and Cinder River, it is difficult to attribute the dramatic decrease in goose use totally to human activity. Yet, experience at Palmer Hay Flats

in Cook Inlet suggests that aircraft disturbance can definitely help to discourage geese from using an otherwise attractive area.

Management Recommendations

To aid ADF&G in formulating management recommendations, an informal meeting was held in February 1981. Although only three persons outside ADF&G (Alec Griechen, Ray Tremblay, Orin Siebert) attended, discussions helped to define the problems and possible causes. Four theories were offered to explain why cacklers and snows are not using the area as they did in the past.

1. Both Wrangel Island snow goose and cackling Canada goose populations have been depleted independently of conditions at Pilot Point and Cinder River. Wrangel Island snows have recently experienced a series of late springs which resulted in low production. Both the 1979 and 1980 populations were only 50 percent of levels occurring 10 years ago. Cacklers may have been over-harvested both on wintering areas and on their Yukon-Kuskokwim breeding grounds, and now number about 40 percent of their former levels. If fewer total geese is the primary problem, local goose use should increase as populations recover.

2. An apparent loss of early successional plant communities to tall and lush grass/sedge habitat may have diminished goose feeding areas. Two experimental habitat improvement projects were suggested:

   (a) burning tall grass/sedge communities to set back succession and encourage plant species preferred by geese

   (b) seeding exposed mud flats with Triglochin maritimum and Plantago maritima, both good goose foods.

3. Human disturbance by hunters and aircraft occurs, but the observed level of disturbance only contributes to reduced goose use.

   One recommendation was to advise hunters of the problem, and elicit voluntary cooperation to minimize aircraft harassment. Pilots would be asked to not intentionally disturb geese, and to avoid flying over one or two specific areas entirely.

4. Because geese are migratory, conditions elsewhere may affect their use of Pilot Point and Cinder River. Conditions may have changed on more northern staging areas (Nunivak Island?) that altered goose use on the Alaska Peninsula. Because of the entirely speculative nature of this theory, the only recommendation was to contact people with knowledge

of cackler and snow goose behavior during fall migration on northern staging areas.

PACIFIC AND CENTRAL FLYWAY MANAGEMENT PLANS

The authors participated in writing management plans for geese, swans and cranes common to Alaska, the Central Flyway and the Pacific Flyway. One-half of Timm's salary was paid directly by the FWS until September 30, 1980. In return, ADF&G has been deeply involved with writing 15 plans. The documents are mostly written and are in various stages of inter and intra-agency review.

Some plans have already been beneficial by prompting changes in goose surveys in Oregon and California, reducing the frequency of dusky goose banding, and by providing population objectives which the states and the FWS used to justify recent goose harvest reductions in the lower Pacific Flyway.

ALEUTIAN CANADA GOOSE RECOVERY TEAM

Since 1975, Timm has served on the Aleutian Canada Goose Recovery Team. One team meeting is attended each year and costs are paid by the FWS.

Indications of eventual success at restoration (reestablishing nesting populations on three additional islands) were evident this year. Of 245 total birds, either transplanted from Buldir Island to Agattu Island, or raised in captivity and released on Amchitka or Agattu Island, about 25 percent were resighted in California. The highest resighting rate (60%) was from wild birds transplanted to Agattu from Buldir Island.

LITERATURE CITED

Carney, S. M., M. F. Sorensen, and E. M. Martin. 1981. Waterfowl harvest and hunter activity in the United States during the 1980 hunting season. U. S. Fish and Wildl. Serv. Admin. Rept., July 14, 1981. 27pp.

Chapman, J. A., C. J. Henny, and H. M. Wight. 1969. The status, population dynamics, and harvest of the dusky Canada goose. The Wildl. Soc., Wildl. Monog. 18, 48pp.

Crow, J. H. 1968. Plant ecology of the Copper River Delta, Alaska. Ph.D. Thesis, Washington State Univ., Pullman. 120pp.

Mickelson, P. G., J. S. Hawkings, D. R. Herter, and S. M. Murphy. 1980. Habitat use by birds and other wildlife on the eastern Copper River Delta, Alaska. Alaska Coop. Wildl. Res. Unit, Univ. Alaska, Fairbanks. 189pp.

Quimby, R. L. 1972. Waterbird habitat and use on Chickaloon Flats. M. S. Thesis, Univ. Alaska. 86pp.

Sorensen, M. F. 1981. Sandhill crane harvest and hunter activity in the Central Flyway during the 1980-81 hunting season. U. S. Fish and Wildl. Serv. Admin. Rept., July 15, 1981. 8pp.

Timm, D. E. 1978. Report of survey and inventory activities-waterfowl. Fed. Aid in Wildl. Rest. Proj. W-17-10, Job No. 10.0. Alaska. 27pp.

_____, and D. Sellers. 1979. Report of survey and inventory activities-waterfowl. Fed. Aid in Wildl. Rest. Proj. W-17-11, Job No. 10.0. Alaska. 29pp.