Alaska Department of Fish and Game Division of Wildlife Conservation Federal Aid in Wildlife Restoration Annual Report of Survey-Inventory Activities 1 July 1988-30 June 1989

WATERFOWL



by Bruce H. Campbell Thomas C. Rothe Vol. XX, Part XIII Project W-23-2, Study 11.0 June 1990

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WATERFOWL HARVEST AND HUNTER ACTIVITY

GAME MANAGEMENT UNITS: All

GEOGRAPHIC DESCRIPTION: Statewide

PERIOD COVERED: 1 July 1988 - 30 June 1989

Introduction

Except for the period 1977 to 1981 and 1986, the state of Alaska has surveyed waterfowl hunters to estimate annual harvest and hunter activity since 1972. This survey was redesigned in 1987 to increase efficiency and accuracy (Campbell et al. 1989). Results from both state and U.S. Fish and Wildlife Service (FWS) surveys were used to determine hunter activity and harvest for the 1988-89 waterfowl season. Because of the scheduling of this report, final FWS survey data for the reporting period were not available; however, because their third-quarter harvest data typically do not vary significantly from their final data, they will be used in this report.

<u>Methods</u>

The distribution of hunter questionnaires has been incorporated into the sales of the state duck stamp. Self-addressed, preposted questionnaires (Fig. 1) were issued by license vendors to the purchasers of the first 2 stamps out of each booklet of 5 stamps (40% sample). Harvest and hunter activity data were compiled from survey cards returned by 1 May 1989. Reminder questionnaires were not sent to nonrespondents.

Harvest location information from the questionnaires were coded by a hierarchical system based on specificity of responses. Locations were coded to the lowest level or most specific location when possible. When a specific location was not reported, a general area (e.g., based on the respondent's resident ZIP code) was assigned. These were then coded according to a geographical region (Fig. 2); e.g., if a reported harvest of ducks from the Fairbanks area could not be assigned to a specific harvest location, it would be coded to the central region (005). For reporting purposes, the harvest data were combined when harvests for several locations were low and scattered throughout a local geographical area; for example, reported harvests from Kenai Lake, Summit Lake, and Anchor River were reported as the Greater Kenai Peninsula area (119). Harvest location codes are To facilitate comparison of ADF&G and FWS presented in Table 1. harvest locations were also categorized according to data. location codes used in the FWS parts collection survey.

Reporting bias was corrected during data analysis (Voelzer et al. 1982). Briefly, this was done by correcting for memory and prestige response biases by multiplying the reported duck and



Figure 1. Alaska State waterfowl hunter questionnaire.



Figure 2. State waterfowl and crane harvest survey regions.

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ADF&G Code	FWS Code	ADF&G geographical region (R)and harvest location names	Original FWS "county" name	FWS harvest zone
000	0000	linknown	Unknown	Unknown
001	0101	North Slope (R)	Arctic Slope	Northwest
002	0301	Seward Peninsula (R)	Seward Peninsula	NW
020		Shishmaref	Seward Peninsula	NW
021		Norton Sound	Seward Peninsula	NW
022		Nome area	Seward Peninsula	NW
023		Safety Lagoon	Seward Peninsula	NW
024		Serpentine River	Seward Peninsula	NW
003	0502	Upper Yukon Valley	Upper Yukon-Kuskokwim	Central
004	0502	Lower vukon Valley	Upper Yukon-Kuskokwim	С
005	0702	Central (R)	Fairbanks-Minto	С
070	0752	Delta area	Fairbanks-Minto	С
071		Denali Highway	Fairbanks-Minto	С
079	0722	Eielson AFB	Fairbanks-Minto	C
080		Fort Wainwright	Fairbanks-Minto	C
081	0742	Healy Lake area	Fairbanks-Minto	C
082	0712	Minto Flats	Fairbanks-Minto	C
083		Salcha River	Fairbanks-Minto	C
084	0732	Salchaket Slough	Fairbanks-Minto	C
085		Tanana Flats	Fairbanks-Minto	C
086		Tetlin Flats	Fairbanks-Minto	C
087	0762	Tok-Northway	Fairbanks-Minto	C
088		Fort Greely	Fairbanks-Minto	C
089		Chena River	Fairbanks-Minto	C
090		Creamer's Field	Fairbanks-Minto	C
006	0901	Yukon Delta (R)	Yukon-Kuskokwim Delta	NW
007	1103	Cook Inlet (R)	Anchorage-Kenai	Southcentral
115	1153	Chickaloon Flats	Anchorage-Kenai	SC
116		Eagle River	Anchorage-Kenai	SC
117	1133	Goose Bay	Anchorage-Kenai	SC
118	1193	Kachemak Bay	Anchorage-Kenai	SC
119		Greater Kenai Pen. Area	Anchorage-Kenai	SC
120		Jim-Swan Lakes area	Anchorage-Kenai	SC
121	1123	Palmer Hay Flats	Anchorage-Kenai	SC
122	1163	Portage	Anchorage-Kenai	SC
123	1143	Potter's Marsh	Anchorage-Kenai	SC
124	1183	Redoubt Bay	Anchorage-Kenai	SC
125	1113	Susitna Flats	Anchorage-Kenai	SC
126	1173	Trading Bay	Anchorage-Kenai	SC
127		Kenai River Flats	Anchorage-Kenai	SC
128		Kasilof River	Anchorage-Kenai	SC
129		Knik River	Anchorage-Kenai	SC
130		Skilak Lake	Anchorage-Kenai	SC
131		Tuxedni Bay	Anchorage-Kenai	SC
132		China Poot Bay	Anchorage-Kenai	SC

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

Table 1. (Cont).

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		ADF&G geographical		
ADF&G	FWS	region (R)and harvest	Original FWS	FWS harvest
Code	Code	location names	"county" name	zone
	<u></u>			
000	1202			0.0
150	1212	Gulf Coast (R)	Cordova-Copper River	SC
150	1313	Copper River Delta	Cordova-Copper River	SC
151	1202	Prince William Sound	Cordova-Copper River	SC
152	1323	Yakutat area	Cordova-Copper River	SC
123		Montague, Hawkins, Hinchenbrook Islands	Cordova-Copper River	SC
154		Valdez area	Cordova-Copper River	SC
009	1503	Southeast Coast (R)	Juneau-Sitka	Southeast
170	1523	Blind Slough	Juneau-Sitka	SE
171	1513	Chilkat River	Juneau-Sitka	SE
172	1543	Duncan Canal	Juneau-Sitka	SE
173	1573	Farragut Bay	Juneau-Sitka	SE
174		Icy Strait	Juneau-Sitka	SE
175		Ketchikan area	Juneau-Sitka	SE
176	1563	Mendenhall Flats	Juneau-Sitka	SE
177		Petersburg area	Juneau-Sitka	SE
178		Prince of Wales Is.	Juneau-Sitka	SE
179	1533	Rocky Pass	Juneau-Sitka	SE
180		Seymour Canal	Juneau-Sitka	SE
181		Sitka area	Juneau-Sitka	SE
182	1553	St. James Bay	Juneau-Sitka	SE
183	1583	Stikine River Delta	Juneau-Sitka	SE
194		Thorne Bay	Juneau-Sitka	SE
195		Lynn Canal	Juneau-Sitka	SE
196		Pybus Bay	Juneau-Sitka	SE
197		Tenakee Inlet	Juneau-Sitka	SE
198		Admirality Cove	Juneau-Sitka	SE
199		Eagle River	Juneau-Sitka	SE
010	1704	Kodiak (R)	Kodiak Island	Southwest
200	1714	Kalsin Bay	Kodiak Island	SW
201		Middle Bay	Kodiak Island	SW
202		Old Harbor	Kodiak Island	SW
203		Ouzinkie	Kodiak Island	SW
204		Raspberry Straits	Kodiak Island	SW
205		Women's Bay	Kodiak Island	SW
206		Port Lion's	Kodiak island	SW
207		Pasagshak	Kodiak Island	SW
208		Afognak	Kodiak Island	SW
011	1904	Alaska Peninsula (R)	Cold Bay-Ak Peninsula	SW
220		Cinder River	Cold Bay-Ak Peninsula	SW
221	1914	Cold Bay	Cold Bay-Ak Peninsula	SW
222		Naknek River	Cold Bay-Ak Peninsula	SW
222	1924	Pilot Point	Cold Bay-Ak Peningula	SW
223	1937	Port Moller	Cold Ray-Ak Peningula	SW
224	1944	Port Heiden	Cold Bay-Ak Poningula	SW
443	1744	TOTE HETGEH	our bay ne reministra	Un

Table 1. (Cont).

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ADF&G Code	FWS Code	ADF&G geographical region (R)and harvest location names	Original FWS "county" name	FWS harvest zone		
226		Egegik River	Cold Bay-Ak Peninsula	SW		
227		Dillingham/Nushegak River and Bay	Cold Bay-Ak Peninsula	SW		
228		Ugashik	Cold Bay-Ak Peninsula	SW		
012	2104	Aleutian Chain (R)	Aleutian-Pribilofs			
240		Unimak	Aleutian-Pribilofs			
241		Adak	Aleutian-Pribilofs			

goose bags by 0.7895 and 0.8516, respectively. Adjustments for junior hunter activity were made by multiplying the estimated ducks and geese bagged by 1.0451 and 1.0871, respectively. Reported crane and snipe harvest data were not corrected for memory bias or junior harvest.

Because of nonreporting by hunters without duck stamps and these hunting outside legal seasons, the assessment of waterfowl hunting and harvest is complicated. Analysis did not include data from 29 respondents who reported hunting without a federal duck stamp or did not respond to the relevant questions. Estimates of hunters, harvest, etc. in this report are based solely on duck stamp sales and, therefore, reflect only the reported fall harvest.

<u>Results</u>

Number of Hunters:

Based on licensing reports, 4,074 questionnaires were distributed to state duck stamp buyers; of these, 1,201 were returned (i.e., response rate of 29.5%); 1,168 (97.3%) of thereturned questionnaires contained sufficient information to be used in the Of the 1,168 hunters who reported purchasing a state survey. duck stamp, 823 (70.5%) reported hunting in 1988 (Table 2), compared with a FWS estimate of 70.3%, a 12-year state survey average of 68.8%, and a 20-year FWS average of 69.7% active hunters (Fig. 3). Based on the sales of 15,017 federal duck stamps (up 6% from 1987, 10.5% below the 20-year average, Fig. 3) and a state estimate of a minimum of 14.3% sales to stamp collectors, there were 12,870 potential waterfowl hunters in Alaska during the 1988-89 season (Table 2), compared with a FWS estimate of 13,768 potential hunters and a correction factor of 8.3% for philatelic sales (Martin et al. 1989). The 1988 state estimate of potential hunters is above the 12-year state survey average of 10,282, while the FWS estimate is 6% above that for 1987 and over 16% above the 20-year average (Fig. 3). After adjustment for inactive and nonhunters, an estimated 9,068 adults hunted waterfowl in 1988 (Table 2), compared with a federal estimate of 9,679 adult hunters.

Hunting Activity:

Hunters reported hunting an average of 4.9 days during the 1988-89 season, representing a total of 44,625 waterfowl hunter days (Table 2), considerably lower than the federal estimate of 56,009 days. The state estimate was down about 24% from the 12-year average, and the FWS estimate was down 22% from the 20-year average (Fig. 4). The distribution of hunter days and resulting harvest are summarized by region in Table 3 and by specific hunting locations in the following sections. Table 2. Summary of Alaska waterfowl hunter activity and harvest from the state survey, 1988-89.

Number of survey cards issued: <u>4,074</u>
Number of survey cards returned: <u>1,201</u> (29.5%)
Number of survey cards usable for data analysis: <u>1,168</u> (97.3%)
Projected number of fall sport hunters:
Total federal duck stamps sold^a: <u>15,017</u>
Federal duck stamps sold to potential hunters in Alaska: <u>12.870</u>
Number of active hunters: <u>9,068</u> (70.5%)
Calculated statewide fall sport harvest:
Ducks: Dabblers/divers: <u>78,065</u>; Sea ducks: <u>6,364</u>;
Total: <u>84,429</u>
Geese: Canada: <u>7,064</u>; white-fronted: <u>910</u>; brant: <u>610</u>
snow: <u>124</u>; emperor: <u>10</u>; unknown species: <u>62</u>
Total: <u>8,781</u>
Cranes: <u>1,443</u>

Snipe: <u>1,807</u>

Calculated hunter days: 44,625

^a Martin et al. 1989



Figure 3. Twenty year trend in duck stamp sales and potential hunters in Alaska as estimated by the State and U.S. Fish and Wildlife Service (FWS).



Figure 4. Twenty year trend in hunter days for Alaska as estimated by the State and U.S. Fish and Wildlife Service (FWS).

	Ľ	Jucks	Hunter days			
	Calculated	% of	Calculated	% of		
Location	harvest	state total	days	state total		
Susitna Flats	10,925	12.9	4,264	9.6		
Minto Flats	7,559	9.0	2,149	4.8		
Palmer hay Flats	5,885	7.0	2,865	6.4		
Kenai River/Flats	2,989	3.5	1,983	4.4		
Copper River Delta	2,915	3.5	1,961	4.4		
Redoubt Bay	2,869	3.4	584	1.3		
Portage	2,005	2 5	1 521	3 4		
Tok-Northway	2,113	2.5	595	1 3		
China Poot Bay	1 848	2.4	595	1 3		
Chickaloon Flats	1 738	2.2	716	1.5		
Kachomak Bay	1,730	1 0	628	1.0		
Mandanhall	1 554	1 Q	1 020	1.4 0 /		
Prince William Cour	1,554	1.0	1,091	2.4		
Trading Par	1 499	1.0	2004	1.0		
Irading Bay	1,490	1.8	380	0.9		
Healy Lake	1,343	1.6	628	1.4		
Cold Bay	1,085	1.3	1,223	2.7		
Stikine River Flat	1,076	1.3	463	1.0		
Denali Highway	1,048	1.2	419	0.9		
Potter's Marsh	947	1.1	1,025	2.3		
Pilot Point	920	1.1	176	0.4		
Jim Creek/Swan Lake	e 828	1.0	375	0.8		
Duncan Canal	800	0.9	562	1.3		
Sitka Area	607	0.7	364	0.8		
Delta Area	589	0.7	1,576	3.5		
Greater Kenai Pen.	589	0.7	518	1.2		
Naknek River	589	0.7	430	1.0		
Adak	589	0.7	364	0.8		
Women's Bay, Kodial	k 552	0.7	242	0.5		
Nushegak River/Bay	524	0.6	198	0.4		
Knik River	441	0.5	353	0.8		
Goose Bay	377	0.4	430	1.0		
Yakutat	377	0.4	231	0.5		
Icy Strait	331	0.4	176	0.4		
Montague Hawking	٤.	0.4	210			
Hinchenbrook Islan	de 257	03	209	0.5		
Middle Ray	0.5 2.57 220	0,5 0 3	176	0.5		
Kalein Bay	102	0.5	1/3	0.4		
Naisin Day	102	0.2	740 740	0.5		
Vacilat Divar	193 107	0.2	00 125	0.2		
Rasilui Kivel	104	0.2	110	0.4		
Lgegik Kiver	184	0.2	110	0.2		
SKILAK LAKE	1/5	0.2	99	0.2		
Ketchikan Area	175	0.2	264	0.6		
Farragut Bay	166	0.2	55	0.1		

Table 3. Calculated hunting activity and duck harvest for specific locations in Alaska where more that 0.2% of the harvest occurred in 1988-89.

	E	ucks	<u> Hunter</u>	<u>days</u>
Location	Calculated harvest	% of state total	Calculated days	% of state total
Afognak	166	0.2	209	0.5
Eielson AFB	156	0.2	121	0.3
Norton Sound	147	0.2	33	0.1
Pasagshak	147	0.2	66	0.1
Safety Lagoon	138	0.2	187	0.4
Seymour Canal	138	0.2	66	0.1
Subtotals	63,324	75.0	31,887	71.5
Statewide Totals	84,429	100	44,625	100

Table 3. (Cont).

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<u>Duck Harvest</u>. According to state and FWS surveys, the average harvests per active hunter were 9.2 and 4.7 ducks, respectively (Martin et al. 1989), compared with a FWS 20-year average of 5.3 ducks/active hunter and a 12-year state survey average of 8.5 ducks/active hunter (Fig. 5). Average daily hunting success from state data was 1.9 ducks/hunter in 1988.

The projected statewide harvest was 84,429 ducks, of which 78,065 (89.4%) were dabbling and diving ducks and 6,364 (10.6%) were sea ducks and mergansers (Table 4), compared with the FWS estimate (Martin et al. 1989) of 67,865, of which 60,671 (89.4%) were dabbling and diving ducks and 7,194 (10.6%) were sea ducks and mergansers (Table 5). The 1988 state duck harvest estimate was down 5.5% from the FWS 20-year average and down 9.8% from the 12-year state average (Fig. 5).

Based on the FWS parts collection survey, which is believed to provide the best estimate of duck species composition in the harvest, the mallard (<u>Anas Platyrhynchos</u>) was the most important game duck in 1988, composing about 33% of the harvest. The green-winged teal (<u>Anas crecca</u>) was the second-most important game duck, composing a little over 14% of the harvest, followed by the Northern pintail (<u>Anas acuta</u>) (14%) and American wigeon (<u>Anas americana</u>) (13%) (Table 5). Species composition of the statewide duck harvest has remained relatively constant during the past 20 years; 86% of the harvest has been composed of dabbling ducks, 10% diving ducks, and 4% sea ducks and mergansers (Table 6).

As calculated from the state survey, about 45% of the statewide duck harvest occurred in Cook Inlet, followed by about 20% in the central region and 12% in Southeast Alaska (Table 4). Nearly 25% of the statewide harvest and 20% of the hunter days occurred at 3 locations in Cook Inlet: Susitna, Palmer Hay, and Kenai River Flats. The only other area in the state with similar harvest and hunter effort was Minto Flats northwest of Fairbanks (Table 3). Nearly 23% of the statewide sea duck and merganser harvest occurred in Kachemak Bay.

<u>Goose Harvest</u>. Hunters reported taking an average 1.0 geese/active hunter in 1988; this was above the 20-year FWS average of 0.7 geese/hunter but somewhat below the 12-year state survey average of 1.2 geese/hunter (Fig. 7). The FWS estimate of 0.4/hunter (Martin et al. 1989) was also considerably below both the state and FWS averages.

The calculated 1988 goose harvest was 8,781 (Table 2), up over 60% from the 1987 average but still well below the 12-year average. The FWS estimated harvest of 6,059 was also up from the 1987 estimate of 5,389 but well below the 20-year average (Fig. 6).

Based on the state survey, which had a sample size 7 times greater than the FWS parts collection survey, the Canada goose



Figure 5. Twenty year trends in the duck harvest and average ducks/hunter in Alaska as estimated by the State and U.S. Fish and Wildlife Service (FVS).

Harvest Region	Hunter Days	Dabblers, Divers	/ Sea Ducks	Geese	Cranes	Snipe
North Slope	0.7	0.1	1.0	0.7	0.0	0.6
Seward Peninsula	2.7	1.1	2.0	3.7	9.2	0.6
Upper Yukon Valley	1.6	0.9	0.0	0.9	2.3	0.0
Lower Yukon Valley	0.8	1.7	0.0	2.0	0.0	0.0
Central	17.4	21.1	3.0	13.2	69.5	11.6
Yukon Delta	1.4	2.0	2.3	0.1	5.3	5.5
Cook Inlet	41.0	45.3	37.3	37.1	9.2	52.4
Gulf Coast	7.3	6.3	3.2	6.8	0.0	7.9
Southeast	15.2	11.4	17.2	10.5	3.8	19.5
Kodiak	5.8	5.4	24.0	0.2	0.0	0.0
Alaska Peninsula	5.1	4.2	2.6	24.3	0.8	1.8
Aleutian Chain	0.8	0.2	7.2	0.0	0.0	0.0
Unknown	0.7	0.5	0.1	0.5	0.0	0.0
Statewide Days/Harvest	44,625	78,065	6,364	8,781	1,443	1,807

Table 4. Proportion (%) of duck, goose, crane, and snipe sport harvests and hunter activity in the fall by geographic region from the state survey for 1988-89.

Specles	Seward Pen.	Yukon Valley	Central	Yukon Delta	Cook Inlet	Gulf Coast	South- east	Kodiak	Ak Pen.	State- wide ^b
Mallard	0.0	100.0	27.0	20.3	33.2	52.0	26.5	65.5	18.3	32.6
Green-winged Teal	L 23.6	0.0	10.9	0.0	14.6	11.5	13.4	6.5	29.9	14.2
Northern Pintail	35.6	0.0	15.8	20.3	14.6	7.8	9.7	1.3	20.9	13.5
Wigeon	0.0	0.0	21.9	39.8	11.8	18.0	8.1	2.6	12.2	12.9
Northern Shoveler	r 5.9	0.0	6.8	0.0	7.1	1.3	1.6	0.0	0.5	4.9
Gadwall	0.0	0.0	0.4	0.0	0.8	1.5	0.8	9.2	1.1	1.3
Blue-winged Teal	0.0	0.0	0.2	0.0	0.2	0.0	0.4	0.0	1.0	0.2
Total Dabblers	65.1	100.0	83.1	80.5	82.4	92.1	60.5	85.1	83.9	79.7
Lesser Scaup	0.0	0.0	8.0	0.0	1.4	5.9	0.0	1.3	2.0	2.7
Common Goldeneye	0.0	0.0	1.7	0.0	2.6	1.3	1.5	0.7	1.5	2.0
Barrows Goldeney	e 0.0	0.0	0.8	0.0	1.9	0.0	4.9	2.6	0.5	2.0
Bufflehead	0.0	0.0	2.9	0.0	1.3	0.0	0.8	2.6	0.5	1.5
Ring-necked duck	0.0	0.0	0.9	0.0	0.4	0,6	1.1	0.0	0.0	0.6
Greater Scaup	5.8	0.0	0.0	19.5	0.7	0.0	0.0	1.3	1.5	0.6
Canvasback	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Redhead	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2
Total Divers	5.8	0.0	15.5	19.5	8.7	7.9	8.4	8.4	6.0	9.7
Surf Scoter	0.0	0.0	0.0	0.0	2.6	0.0	20.5	0.0	0.0	4.5
White-W. Scoter	0.0	0.0	0.6	0.0	4.1	0.0	6.5	0.7	3.0	3.3
Steller's Eider	0.0	0.0	0.0	0.0	0.4	0.0	0.0	1.3	5.0	0.6
Black Scoter	0.0	0.0	0.0	0.0	0.0	0.0	3.4	1.3	0.0	0.6
Harlequin	0.0	0.0	0.0	0.0	0.5	0.0	0.8	0.6	1.0	0.5
Oldsquaw	29.1	0.0	0.4	0.0	0.2	0.0	0.0	1.3	0.0	0.5
R.B. Merganser	0.0	0.0	0.2	0.0	0.7	0.0	0.0	0.0	0.0	0.4
Common Merganser	0.0	0.0	0.2	0.0	0.3	0.0	0.0	1.3	1.0	0.3
Total Sea ducks	29.1	0.0	1.4	0.0	8.9	0.0	31.1	6.5	10.1	10.6
Total Ducks	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5. Regional species composition of the 1988-89 Alaska duck harvest from FWS Parts Collection Survey^a

^a No harvest reported by FWS for the North Slope or Aleutian chain regions.

^b Includes birds harvested in unknown locations.

Year	Dabbling ducks	Diving ducks	Sea ducks/ mergansers	
1966	86.5	10.3	3.0	
1967	84.6	10.1	5.1	
1968	89.6	8.9	1.8	
1969	83.8	10.1	6.1	
1970	86.0	9.0	5.0	
1971	89.7	5.9	4.3	
1972	90.0	7.6	2.3	
1973	90.5	8.7	0.9	
1974	82.3	16.4	1.4	
1975	88.0	5.8	6.2	
1976	82.6	9.5	7.9	
1977	88.2	10.3	1.5	
1978	82.5	11.1	6.5	
1979	87.5	8.2	4.2	
1980	85.0	12.5	2.5	
1981	87.8	9.9	2.3	
1982	85.4	11.0	3.6	
1983	82.7	15.3	2.2	
1984	88.3	9.6	1.8	
1985	84.0	10.9	4.9	
1986	82.7	13.1	4.2	
1987	84.8	10.1	5.1	
1988	79.7	9.7	10.6	
x	85.6	10.2	4.2	
S.D.	<u>+</u> 3.0	<u>+</u> 2.7	<u>+</u> 2.5	

Table 6. Con	mposition ((%) of	the	statewide	duck	harvest	in	Alaska,	1969-88 ^a .
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 $^{\rm a}$ $\,$ Based on FWS parts collection surveys.



Figure 6. Twenty year trends in average geese/hunter and goose harvest in Alaska as estimated by the State and U.S. Fish and Wildlife Service (FWS).

(Branta canadensis) was by far the most common goose harvested by sport hunters in 1988 (Table 2). This species made up over 80% of the harvest, followed by the white-fronted goose (Anser <u>albifrons</u>) (10%), Pacific brant (Branta bernicula) (7%), and Snow goose (Chen caerulescens) (1%). A small portion of the harvest (< 1%) was composed of emperor geese (Chen canagica) and unknown geese. The FWS estimated that the Canada goose made up 79% of the sport harvest, followed by white-fronted geese (17%), brants (2%), and snow geese (2%) (Martin et al. 1989), compared with a 1987 harvest composition of 83% Canadas, 7% white-fronts, 6% Pacific brants, 3% snow geese, 1% emperors, and 1% unknown (Campbell et al. 1989).

A regional breakdown of the 1988 goose harvest indicates that, similar to the duck harvest, over a one-third of the harvest An additional 13% of the harvest occurred in Cook Inlet. occurred in the central region, followed by 16% on the Alaska Peninsula and 10% in Southeast Alaska (Table 7). Major regions for the Canada goose harvest were Cook Inlet (40%), Alaska Peninsula (24%), Gulf Coast (8%), and Central Alaska (8%). Most of the white-fronted goose harvest (65%) occurred in the central region (midcontinent population), followed by Cook Inlet (26%) with Pacific white-fronts. Most of the Pacific brant harvest took place on the Alaska Peninsula (71%). Snow geese were harvested primarily in Cook Inlet and Southeast Alaska and, while questionable because emperor geese are not common in the area, the only reported emperor goose harvest was in Cook Inlet. Table 8 summarizes the 1988 goose harvest by specific location.

Crane Harvest. A calculated 1,443 sandhill cranes (<u>Grus</u> canadensis) were harvested in 1988 (Table 2), up 42% from 1987 and 18% above the 1971-87 state survey average (Table 9). No estimate of the Alaska harvest was made by the FWS. Approximately 86.3% of the harvest were midcontinent from populations and 13.7% were from the Pacific Flyway population of lesser sandhill cranes (Table 4).

<u>Snipe Harvest</u>. The calculated snipe (<u>Capella gallinago</u>) harvest for 1988 was 1,807 (Table 2), down 32% from 1987 and 50% below the 17-year average (Table 9).

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Region	Canada	White- fronts	Pacific brant	Snow	Emperor	Total
North Slope	0.1	5.7	0.0	0.0	0.0	0.7
Seward Peninsula	4.0	0.0	6.8	0.0	0.0	3.7
Upper Yukon Valley	1.2	0.0	0.0	0.0	0.0	0.9
Lower Yukon Valley	2.5	0.0	0.0	0.0	0.0	2.0
Central	7.8	64.8	1.7	0.0	0.0	13.2
Yukon Delta	0.0	0.0	1.7	0.0	0.0	0.1
Cook Inlet	40.6	26.1	8.5	66.7	100.0	37.1
Gulf Coast	7.6	1.1	3.4	0.0	0.0	6.8
Southeast	12.4	0.0	0.0	33.3	0.0	10.5
Kodiak	0.3	0.0	0.0	0.0	0.0	0.0
Alaska Peninsula	23.6	2.3	71.2	0.0	0.0	16.7
Aleutian Chain	0.0	0.0	0.0	0.0	0.0	0.0
Unknown	0.0	0.0	6.8	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 7. Distribution (%) of the fall goose harvest by species and harvest region, 1988-89.

Location	Calculated harvest	%of state total
Cold Bay	2,120	24.1
Susitna Flats	1,117	12.7
Palmer Hay Flats	952	10.8
Delta	662	7.5
Chickaloon Flats	662	7.5
Copper River Delta	486	5.5
Minto Flats	186	2.1
Goose Bay	124	1.4
Prince William Sound	93	1.1
Kachemak Bay	83	0.9
Trading Bay	83	0.9
Stikine River Flats	83	0.9
Duncan Canal	62	0.7
Mendenhall	52	0.6
Safety Lagoon	41	0.5
Eielson AFB	41	0.5
Creamer's Field	41	0.5
Potter's Marsh	41	0.5
Portage	31	0.4
Kenai River Flats	31	0.4
Norton Sound	31	0.4
Tok-Northway	21	0.2
Tuxedni Bay	21	0.2
Shishmaref	21	0.2
Montague, Hawkins, Hinchenbrook Is.	21	0.2
Prince of Wales Is.	21	0.2
Rocky Pass	21	0.2
Sitka Area	21	0.2
Subtotals	7.171	81.8
Statewide Totals	8,781	100.0

Table 8. Calculated goose harvest and proportion of the state total for specific locations in Alaska where more than 0.2% of the harvest occurred in 1988-89.

Year	Cr	ane	Snipe		
	FWS	State	FWS	State	
1971		502		3,087	
1972		765		3,498	
1973		602		1,661	
1974		640		2,205	
1975	288	1,642		4,318	
1976	1,082	873		7,003	
1977	619				
1978	312				
1979	675				
1980	1,049				
1981	553				
1982	948	1,746		4,833	
1983	903	1,805		3,476	
1984	1,552	2,376		3,564	
1985	642	1,270		1,597	
1986	731		** **		
1987	1,206	1,014		2,654	
1988	·	1,443		1,807	
x	812	1,197		3,445	
SD	+358.5	+643.9		+1,557.4	

Table 9. FWS and state estimated crane and snipe harvest in Alaska, 1971-88

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DUSKY CANADA GOOSE STUDIES

GAME MANAGEMENT UNIT: 6

GEOGRAPHIC DESCRIPTION: Copper River Delta

PERIOD COVERED: 1 July 1988 - 30 June 1989

Introduction

Dusky Canada geese (Brant canadensis occidentalis) are known to nest only on the Copper River Delta and Middleton Island in Alaska and winter primarily in southwestern Washington and the Willamette Valley of Oregon. Until the late 1970's population size, which has ranged from a midwinter index of 7,500-8,000 in 1953 to 28,000 in 1960, was limited by hunting on the wintering grounds. Hunting was responsible for nearly all (95%) of the 45% annual population mortality (Chapman et al. 1969). Band recoveries indicated that about 70% of this harvest occurred in Oregon; the remaining 30% was about equally split between Washington, British Columbia, and Alaska. Production was typically good, and during the mid-1970's the increased, despite a heavy annual harvest. population Around 1979 production dropped off considerably and the population began to decline. Poor response of the population to harvest restrictions between 1983 and the present indicate that conditions influencing production are now limiting the population.

The Dusky Canada Goose Subcommittee of the Pacific Flyway Study Committee was formed in the early 1970's to set objectives and coordinate management of the dusky goose. In 1985 this subcommittee developed a council-endorsed management plan that established a population objective of 20,000 (i.e., based on a midwinter population index) and recommended guidelines for achieving and maintaining that objective. The recommended management procedures in the plan that involve ADF&G are as follows: (1) monitor and describe changes in nest site selection and nest success as related to changes in vegetation; (2) monitor annual nest density and success; (3) conduct annual production surveys and develop fall flight forecasts; (4) mark and band geese annually to monitor population age structure, survival rates, harvest distribution, and support studies on the wintering grounds; and (5) describe and evaluate interactions between habitat change, predator ecology, and production.

Study Area

The Copper River Delta is an approximately 650-km² deltaic plain at the mouth of the Copper River on the Gulf of Alaska (Fig. 1). It is bounded on west, north, and east by the Chugach Mountain Range and to the south by the Gulf of Alaska. The area has a typical maritime climate: cool summers, mild winters, and abundant precipitation. Annual precipitation averages 205 centimeters, including 319 centimeters of snowfall; annual temperatures average 3.4 C, ranging from averages of -5 C in January to 12 C in July.

The major dusky goose nesting area is the approximately 450-km² west Copper River Delta. This area is interlaced with tidal sloughs; glacial streams; and numerous small, shallow, freshwater ponds between drainages. Plant communities are evolving as a result of uplifting of the area by as much as 2 meters during the 1964 Good Friday earthquake (Potyondy et al. 1975). Currently coastal communities are dominated by freshwater sedge (Carex interspersed with dense tall shrub (Alnus crispa spp.) meadows and <u>Salix</u> spp.) stringers along drainages. Stands of tall shrub (<u>Myrica gale</u>, and shrub-boq <u>Carex</u> spp., and Menyanthes trifoliata) increase in frequency inland from the coast. An Alder, Sitka spruce (Picea sitchensis), and western hemlock (Tsuga heterophylla) community becomes dominant 7-11 km from the coast.

Projects

Monitor and Describe Changes in Nest Site Availability and Selection:

This project was completed in 1988. A final report has been submitted to the <u>Canadian Field Naturalist</u>.

Describe and Evaluate Interactions Between Habitat Change, Predator Ecology, and Production:

A manuscript for a paper summarizing the results of an investigation of the activities of brown bears (<u>Ursus arctos</u>) on the Copper River Delta and their impacts on nesting geese has been submitted to <u>The Journal of Wildlife Management</u>. Manuscripts summarizing the effects of an experimental reduction of bear numbers on dusky goose production and homing of bears translocated off of the Delta are in preparation.

Monitor Nest Densities and Fate:

Methods. The number and size of study plots used to sample nest densities and fates have varied since they were originally established in 1974 (Campbell and Rothe 1989). Seven plots totaling 2.49 km² were sampled twice in 1989 (Fig. 2). Each was extensively sampled immediately after the peak of incubation and again after the peak of hatch. During the first sampling, clutch size and stage of development (i.e., based on egg flotation) were recorded for active nests (Westerkov 1950). To facilitate relocation, all nests were also marked with wands and their location plotted on large-scale (1:330-1:700) maps. Wands were placed at least 50 feet from the nests to minimize the possibility of attracting predators.

During the second visit, the fates of both previously located and newly discovered nests were determined. Nests in which one or



Figure 1. The Copper River Delta, Alaska.

more eggs had hatched were considered successful. Attended nests were considered to be incubating, and nest that were unattended and where egg development had ceased were classified as abandoned. Nest destruction was classified as avian, unknown mammal, canid, or bear, when sufficient evidence allowed, using published characteristics of predation (Darrow 1938, Sooter 1946, Rearden 1951) and techniques applicable to the local area that were developed during the project.

Areas adjacent to the study plots that had similar habitat were searched after the peak of hatch. Nest fate information from these areas was used as a control to determine if the presence of field crews had influenced nest fates on the study plots. Because this project is a cooperative venture, assistance was provided by the Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service (Region 1), U.S. Forest Service, and nongovernmental volunteers.

<u>Results</u>. As a result of the <u>Exxon Valdez</u> oil spill, personnel were not available to document the arrival of dusky geese on the Copper River Delta in 1989; however, based on observations by local residents, geese arrived around 20 April. Conditions on the nesting grounds were favorable when they arrived; heavierthan-normal spring snow pack had been removed by above-normal temperatures, and spring appeared to be "early". Unfortunately, about the time nest initiation should have occurred the weather became cold and wet, with frequent below-freezing temperatures and heavy precipitation. As a result, development of vegetation for nest cover was retarded and nest sites became limited because of wet conditions and flooding.

Very few nests were still active when study plots were initially sampled in mid-May, limiting nest initiation and clutch size data. Based on the stage of development of 26 nests, the peak of nest initiation in 1989 was around 11-17 May. A secondary peak, primarily on Egg Island, occurred during the period 22-25 May. Average clutch size ($\underline{N} = 25$) was 5.3 \pm 1.5 eggs. The calculated density of nests was 98/mi², down about 16% and 6% from 1988 and the 1980-88 averages, respectively (Table 1).

Nest success was 4.3% in 1989, the poorest success rate on record. Nest predation was the primary cause of this poor success. Avian predators, including ravens, crows, magpies, gulls, and jaegers, were responsible for nearly half of the nest destruction, while brown bears contributed an additional 34% and canids 20% (Table 2). Most of the destruction occurred early in the nesting period, probably before clutches were complete. Of the 70 nests visited during the first sample period, over 70% had already been destroyed. Many of these appeared to have had incomplete clutches of 1-3 eggs.

While control data were difficult to obtain because low nest densities, it appears that the presence of field crews had little influence on the fates of nests on the mainland sample plots.



	Nest density	Nest_	Success	Clutc	h <u>Size</u>	
Year	nests/mi ²	N	8	N	x	
1959	105	222	89.2	194	5.6	
1964		102	82.4	114	4.3	
1965		221	62.9	140	5.8	
1966		100	97.0	100	4.8	
1967	111					
1968		38	86.8	75	5.1	
1969						
1970		164	88.2	146	5.4	
1971		100	76.0	113	3.6	
1972		116	81.0	92	4.4	
1973				48	4.9	
1974		81	82.7			
1975	179	215	31.6	215	4.8	
1976	156	168		168	4.8	
1977	175	229	79.0	181	5.4	
1978	183	390	56.2			
1979	133	409	18.8	338	5.7	
1980	108			152	5.4	
1981				28	4.9	
1982	102	158	49.2	135	4.8	
1983	91	162	51.9	87	5.5	
1984	95	161	75.8	123	5.6	
1985	97	168	8.9	64	4.4	
1986	119	201	11.4	78	4.9	
1987	116	196	23.7	121	5.2	
1988	116	111	17.3	121	5.2	
1989	98	94	4.3	25	5.3	

Table 1. Dusky Canada goose nest densities, nest success, and average clutch size on the west Copper River Delta, 1959-89.

The fates of 24 control nests were similar to sample plot nests (Table 2). No control data were obtained for Egg Island.

Predation of adult geese was again a problem in 1989. A calculated 16.7 goose carcasses or kill sites per mi² were recorded (Table 3). This was down from last year but still considerably above the 1983-88 average of $11.7 \pm 10.1/\text{mi}^2$. The continued high rate of loss was probably related to the absence of alternate prey. Only 1 small mammal was captured on the Alaganik Slough assessment trap lines during 3,600 trap-hours (Table 3).

Production Survey:

<u>Methods</u>. A production survey was conducted on 18 July 1989, using techniques that facilitate development of weighted regression corrections for visual estimates (Campbell et al. 1988). Because of limited biometrics staff and priority of studies associated with the impacts of the <u>Exxon Valdez</u> oil spill, statistical analyses and correction factors have not yet been completed. The production estimate for 1989 is based on visual estimates only.

<u>Results</u>. Conditions were good for flying, with clear sunny skies and light, variable winds; however, the very bright light conditions and temperatures in the high 70's took their toll on the observers. Contrary to 1988 when production was estimated from a sampling of the population, a reasonably complete survey of the west delta and count of geese was obtained during 5.6 hours of survey in 1989. An estimated 5,590 adults and 524 young were observed for an uncorrected production estimate of 8.6% young. This was the second-lowest production estimate on record; only the 3.7% young recorded in 1985 was lower.

Goose Banding and Collaring:

This project has two objectives: (1) maintain a sample of marked geese in the population to facilitate monitoring of population size, age structure, survival rates, harvest distribution and (2) estimate annual collar retention rates in support of studies on the wintering grounds. Assistance was provided by the Washington Department of Game.

<u>Methods</u>. Molting, flightless geese with young were captured by driving them into portable traps with a helicopter. Unmarked geese were banded with FWS leg bands, and approximately 500 birds were fitted with red plastic collars supporting white characters. Previously marked geese were released after their identity has beem determined and recorded. A ratio of the birds retaining collars to those losing them was obtained by comparing leg band numbers and collar status of these geese with original banding records.

						Type destruction			
Year	No. nests	۲ Successful	% Abandoned	۲ Fate unknown	% Destroyed	% Mammal	% Avian	% Flooded	% Unknown
1959 ^a	1,162 ^b	79.6	1.8	2.0	6.0	0	11.4	88.6	0
1974 ^c	81	82.7	2.5	ND ^d	14.8	NDd	e	0	NDd
1975 ^c	215	31.6	3.7	NDd	64.6	ND ^d	e	0	NDd
1982	158	49.2	1.8	ndd	49.0	45.0	33.8	0	21.8
1983	162	51.9	3.7	8.0	35.2	64.8	5.6	0	29.6
1984	161	745.8	3.1	6.2	14.9	62.4	37.6	0	4.0
1985	258	7.0	1.9	10.9	81.0	78.8	18.4	0	2.8
1986	201	11.4	9.0	12.5	67.2	83.7	5.2	0	11.1
1987	213	23.9	14.1	1.0	61.0	45.6	47.3	7.0	0.2
1988	110	17.3	3.6	17.3	61.8	53.3	40.0	6.7	0.1
1989	94	4.3	3.2	14.8	76.6	54.1	45.8	0.0	0.1
1989 control	24	4.2	8.3	4.2	83.3	50.0	50.0	0.0	0.0

Table 2. Fate of dusky Canada goose nests on the west Copper River Delta study area, 1958, 1974-75, 1982-89.

a Trainer 1959

^b Eggs rather than nests

^c Bromley 1976

d Not reported

 $^{\rm e}$ $\,$ Percentages not given, but majority of losses attributed to avian predators.

Year	Trap hours	Small mammals captured	Abundance index ^a	Goose carcasses and kill sites	Carcasses/ mi2
1983	2,304	31	13.46	3	1.7
1984	1,849	25	13.52	4	2.3
1985	3,000	4	1.33	17	9.8
1986	3,125	2	0.64	34	20.1
1987	1,621	26	16.04	15	8.9
1988	3,015	1	0.33	26	27.1
1989	3,600	1	0.28	16	16.7

Table 3. Alternative prey abundance and dusky goose carcass indices for the west Copper River Delta study plots, 1983-89.

^a Number of small mammals captured divided by trap-hours multiplied by 1000.

<u>Results</u>. A total of 1,665 geese were captured at 6 locations on the delta between 25 and 27 July (Fig. 3). Three hundred ninetyfour had been previously marked, and the remaining 1,271, including 80 goslings, were unmarked. One thousand and eightyseven birds were marked with FWS leg band, and 492 were also marked with plastic collars (Table 4).

Three hundred ninety-four geese marked between 1984 and 1988 were recaptured in 1989, bringing the 5-year total for recaptures of previously marked geese to 832. While sample size is inadequate for birds marked as goslings, preliminary analysis of data for birds marked as adults indicates that annual retention rates (Table 5) vary significantly and reduce the utility of average retention rates. A logit model of collar retention in adult geese (G = 10.22, df = 9) indicates that retention rates vary according to sex of the bird, year collared, year of data collection or year of study, and a combination of the year of study and sex of bird. A detailed analysis of collar retention rates is being completed and a manuscript for publication in either the <u>Wildlife Society</u> <u>Bulletin</u> or <u>Journal of Field</u> <u>Ornithology</u> is in preparation.

Goose Transplant:

This was to be the last year of a proposed 3-year transplant of goslings to Middleton Island in the Gulf of Alaska; however, because of the scarcity of goslings, importance of the few goslings that were produced in sustaining the population in the future, apparent poor survival of goslings transplanted to Middleton Island in the past, increasing predation problems on Middleton Island, and apparent expansion of geese that are naturally pioneering on the island, no transplant occurred in 1989.

The results of a 1989 field evaluation of the 1987 and 1988 transplants are presented in the following summary. This evaluation was conducted with cooperation from the FWS and U.S. Coast Guard; it was permitted on private lands by the Chugach Alaska Corporation.

A survey of Middleton Island to determine the size of the summer population of geese on the island, measure goose reproduction, and look for birds transplanted from the Copper River Delta in 1987 and 1988 was conducted on 18 June 1989. The entire Island was covered on foot, and all observations of geese and evidence of habitat use recorded. Weather conditions were ideal for the survey, with clear skies, warm temperatures, and a gentle southeast breeze.

While continual movement of birds and the possibility of multiple counts prevented an actual count, an estimated 150 geese were observed during 8 hours of surveying. Of these, about 85 (56%) were young. Most of the geese were observed at the south end of the island in tidal areas, coastal lowland marshes, beach ridges,

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	Total	Number of recaptures	Banded only ^a				Ban	Banded and collared			
Capture location	geese captured		АНУМ	AHYF	LM	LF	АНУМ	AHYF	LM	LF	
Mountain Slough	228	125	0	0	4	7	20	22	8	42	
Glacier Slough	126	0	0	0	1	1	60	47	5	12	
Pete Dahl Slough	638	150	208	145	0	0	79	56	0	0	
Castle Island ^b	577	90	126	103	0	0	89	52	0	0	
Walhalla Slough ^C	74	7	0	0	0	0	0	0	0	0	
Teideman Slough	22	22	0	0	0	0	0	0	0	0	
Total	1665	394	334	248	5	8	248	177	13	54	

Table 4. Summary of dusky Canada geese captured and marked on the Copper River Delta, Alaska in 1989.

^a AHYM = Adult male; AHYF = Adult female; LM = Local Male or male gosling; LF Local female or female gosling.

 $^{\rm b}$ Includes the capture of 121 (4 recaps) geese for collar retention data only.

^c Geese not marked, captured for collar retention data.

Year collared	Sex	Year 1	Year 2	Year 3	Year 4	Year 5	
1984	M F	53.8 25.0	16.7 90.9	12.5 83.3	0.0 88.8	0.0 85.7	
1985	M F	96.2 96.8	93.3 95.2	57.4 95.5	40.0 90.0		
1986	M F	81.8 100.0	75.0 2.9	40.0 0.9			
1987	M F	94.7 93.3	83.3 93.3				
1988	M F	95.7 96.6					

Table 5. Annual collar retention (%) for adult dusky geese collared on the Copper River Delta between 1984-88.

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and upland tussock meadows (<u>see</u> 18 June 1987 memo from Campbell to Rothe, and Rausch [1958] for descriptions of habitat types). In contrast to last year when broods were observed in salmon berry thickets at the top of the bluffs, most of the broods were seen in the surf or on tide pools and beaches this year. They may have moved to these areas to avoid survey personnel, because evidence of brooding was found in stands of skunk cabbage and ferns on top of the bluff at the south end of the island.

Little evidence of transplanted geese were found. One goose with a red collar was seen in a flock of 39 birds, but the collar could not be read. More disconcerting evidence of the fates of transplanted goslings was found by USFWS personnel this spring. While searching for evidence of predation on marine birds they discovered 2 metal leg bands under the active bald eagle nest on the northwest side of the island. Both of these bands had been placed on goslings released in 1988. Predation by the eagles plus a rapidly growing glaucous-winged gull colony (Hatch, pers. commun.) suggests that Middleton Island is not as predator-free as was originally thought.

Several miscellaneous observations of interest were also made during the survey. A sandhill crane was observed at the north end of the island, and 3 immature trumpeter swans were seen in the lowland marsh at the south end of the island. A harrier and an unidentified falciform were also seen.

Based on the apparent poor return of transplanted geese, potential for high predation on transplanted birds, poor production on the Copper River Delta this year, and high production by geese on the island, it is recommended that the transplant scheduled for late July of this year be cancelled. Also, pending results of the current effort to identify the genetic relationship of Canada geese along the gulf coast and Southcentral Alaska, a reevaluation of the transplant project may be warranted.

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COLVILLE RIVER DELTA SURVEY AND INVENTORY

GAME MANAGEMENT UNITS: GMU 26

GEOGRAPHIC DESCRIPTION: Colville River Delta

PERIOD COVERED: 1 July 1988 - 30 June 1989

<u>Introduction</u>

The Colville River Delta is the most productive tundra swan breeding area on Alaska's north slope; it is also an important area for black brant colonies, white-fronted geese, and yellowbilled loons. Stemming from concerns about future development of known oil reserves on the delta and encroachment of the Kuparuk Oilfield from the east, intensive waterfowl studies were initiated in 1981. The USFWS conducted baseline habitat and species projects and began regular June breeding-pair and August In 1984 ADFG production surveys for tundra swans in 1982. assumed responsibility for the surveys and coordinated banding and neck-collaring of a sample of swans.

<u>Methods</u>

June surveys are targeted at midmonth, but they are often delayed until snow patches are gone so that swans can be easily detected. Production surveys are conducted around mid-August because cygnets are large enough to count and molting birds and still flightless. The survey course, replicated since 1982 on both annual surveys, is a 2-mile band along the east bank mainland and a 4-mile coastal band northwest of the delta through the Fish Creek area that covers the entire delta; i.e., a total area of about 493 km² (190 mi²). Survey lines are spaced 1 mile apart, providing a half-mile recording corridor for the pilot and a right seat observer. A Cessna 206 is flown at 100-120 knots and a nominal altitude of 800 feet AGL. Data are recorded on 1:63,360-scale topographic maps.

Results and Discussion

Results of the June and August surveys are shown in Tables 1 and 2, respectively. In general, June surveys indicate that about 60 pairs of swans nest annually in the delta, and fluctuations in total swans are related to the number of flocked birds in the region during June. Based on intensive air and ground surveys in 1982 and 1983, only about half the nests are detected on an aerial survey.

The primary factors influencing production are the timing of snowmelt and spring phenology, but flooding in some years and Arctic fox (<u>Alopex lagopus</u>) predation contribute to nest losses. Total swans in August also fluctuate as a result of the number of swans in groups. Since 1985 number of groups, grouped swans, and

Year	Total singles	Singles +nest	Pairs	Group swans	Groups	Total s swans	Potential pairs ^a	Nests ^b
1982 ^C	31	17	17	29	6	94	34	28 (+23)
1983	58	25	45	101	9	249	70	47(+12)
1984	73	21	48	115	5	284	69	25
1985	61	15	73	68	12	275	88	26
1986	39	16	55	31	4	180	71	27
1987	70	21	46	26	5	188	67	31
1988	62	24	49	32	5	192	73	31
1989	70	19	51	4	1	176	70	25
AVG	58.0	19.8	48.0	50.8	5.9	204.8	67.8	30.0

Table 1. Composition of tundra swans, potential pairs, and nests on the Colville River Delta, Alaska observed during June aerial surveys.

^a Potential pairs = pairs + singles at nests.
 ^b Additional nests found by ground survey in parentheses.
 ^c Fog precluded survey of 15 miles square of Colville River east shore (91 percent coverage).

Year	Singles	Pairs	Group swans	Groups	Cygnets	Total swans	Broods	Average brood
1982	7	69	105	20	87	337	35	2.49
1983	10	72	98	20	119	371	47	2.53
1984	13	67	90	16	41	278	18	2.28
1985	29	71	67	13	74	312	28	2.64
1986	15	61	108	18	28	273	14	2.00
1987	14	82	45	9	68	291	30	2.27
1988	27	59	14	3	52	211	24	2.17
1989	24	64	58	9	40	250	20	2.00
AVG	17.4	68.1	73.1	13.5	63.6	290.4	27.0	2.36

Table 2. Composition of tundra swans, number of broods, and average brood size on the Colville River Delta, Alaska observed during August aerial surveys.

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total swans have been lower than those in previous years, possibly suggesting that banding activities and/or field crews from concurrent studies throughout the summer may have caused relocation of swans off the delta. Experience from banding indicates that the majority of flocked birds are subadults that may be easily displaced prior to molting.

Data from this project have been used in local resource plans and the Environmental Protection Agency's advanced identification project for identifying sensitive wetland habitats, and they will continue to provide a baseline on swan productivity for monitoring eventual petroleum development. Jim Helmericks of Golden Plover Air has been an invaluable pilot and skilled observer as well as a source of detailed natural history information on the Colville Delta's bird life. The Alaska Department of Fish and Game administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

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