Alaska Department of Fish and Game
Division of Game
Federal Aid in Wildlife Restoration
Annual Report of Survey—Inventory Activities

WATERFOWL

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ALASKA WATERFOWL REGULATIONS SUMMARY - SEASONS AND LIMITS

Species and Units	Open Seasons	Bag Limits
DUCKS (Except sea ducks)		
Units 1-4	Sept. 1-Dec. 16	Seven a day, 21 in possession
Units 5-7, 9, 14-16 and 10 (Unimak Island only)	Sept. 1-Dec. 16	Eight a day, 24 in possession. No more than 3 a day, 9 in possession may be Pintails
Units 8 and 10 (except Unimak Island)	Oct. 8-Jan. 22	Seven a day, 21 in possession
Units 11-13 and 17-26	Sept. 1-Dec. 16	Ten a day, 30 in possession
SEA DUCKS (Eiders, scoters, old squaw, harlequin) and Mergansers		
Units 1-7, 9, 10 (Unimak Island only) and 11-26	Sept. 1-Dec. 16	Fifteen a day, 30 in possession
Units 8 and 10 (except Unimak Island)	Oct. 8-Jan. 22	Fifteen a day, 30 in possession
CANADA GEESE		
Units 1-4, 7, 9 (except 9E), 10 (Unimak Island only), 11-17, and 19-26	Sept 1-Dec 16	4 a day*, 8* in possession
Units 5 and 6	Sept. 21-Dec. 16	4 a day*, 8* in possession
Units 8	Oct. 8-Jan. 22	4 a day*, 8* in possession
Units 9E, 10 (except Unimak Island) and 18	No open season	

* No more than 4 a day or 8 in possession may be any combination of Canada or white-fronted geese. The combined bag limit of Canada, white-fronted and snow geese is 6 a day, 12 in possession.

Species and Units	Open Seasons	Bag Limits
WHITE-FRONTED GEESE		
Units 1-7, 9, 14-16 and 18	Sept. 1-Dec. 16	2 a day, 4 in possession
Unit 8	Oct. 8-Jan 22	2 a day, 4 in possession
Unit 10 (except Unimak Island)	Oct. 8-Jan 22	4 a day*, 8* in possession
Units 10 (Unimak Island only), 11-13, 17, and 19-26	Sept. 1-Dec. 16	4 a day*, 8* in possession
SNOW GEESE		
Units 1 (except 1C), 2-7, 9, 10 (Unimak Island only), and 11-26	Sept. 1-Dec. 16	6 a day*, 12* in possession
Unit 1C	No open season	
Units 8 and 10 (except Unimak Island)	Oct. 8-Jan. 22	6 a day*, 12* in possession

* The combined bag limit for snow, Canada, and white-fronted geese is 6 a day, 12 in possession

Species and Units	Open Seasons	Bag Limits
BRANT		
Units 1-7, 9, 10 (Unimak Island only) and 11-26	Sept. 1-Dec. 16	2 a day, 4 in possession
Units 8 and 10 (except Unimak Island)	Oct. 8-Jan. 22	2 a day, 4 in possession
SNIPE		
Units 1-7, 9, 10 (Unimak Island only) and 11-26	Sept. 1-Dec. 16	Eight a day, 16 in possession
Units 8 and 10 (except Unimak Island)	Oct. 8-Jan. 22	Eight a day, 16 in possession
CRANES		
Units 1-7, 9, 10 (Unimak Island only) and 14-17	Sept. 1-Dec. 16	2 per day, 4 in possession
Units 11, 12, 13, and 18-26	Sept. 1-Dec. 16	3 per day, 6 in possession
Units 8 and 10 (Except Unimak Island)	Oct. 8-Jan.22	2 per day, 4 in possession
EMPEROR GEESE		
Units 1-7, 9, 10 (Unimak Island only) and 11-26	Sept. 1-Dec 16	2 a day, 4 in possession
Units 8 and 10 (except Unimak Island)	Oct. 8-Jan. 22	2 a day, 4 in possession

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

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

CONVEYANCES: Hunting is not permitted from an aircraft, motor-driven vehicle, airboat, jet boat, or propeller driven boat, which the motor of such has not been completely shut off and its progress therefrom has ceased.

POSSESSION: No state tagging requirements, see Federal Regulations.

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

SHOOTING HOURS: One half hour before sunrise to sunset.

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) and Alaska Waterfowl Conservation tag (stamp) on his person.

SPECIAL RESTRICTIONS In the Palmer Hay Flats State Game Refuge, no person may transport any waterfowl, snipe, crane, or a part of these, or any waterfowl hunter or waterfowl hunting gear, with the use of a motorized vehicle except within the main channels of the Matanuska River, Rabbit Slough, Knik River and adjacent tidal saltwaters.

pub. July 1987

WATERFOWL HARVEST AND HUNTER ACTIVITY

Introduction

A state waterfowl hunter survey was conducted by the Alaska Department of Fish and Game (ADF&G) in 1985. This was the 4th year of the state survey program which was reinstituted in 1982. The state survey, used in conjunction with data from the U.S. Fish and Wildlife Service's (FWS) survey, provides a more accurate estimate of hunter activity and harvest in Alaska. Due to the time schedule for this report, final FWS survey data for the reporting period are not available. Since FWS 3rd quarter harvest data for Alaska typically do not vary significantly from final survey data, 3rd quarter harvest estimates and hunter activity summaries are used in this report.

Survey Procedures

A list of all Alaska residents licensed to hunt in 1985 was used as a sampling base. Seven thousand five hundred and six individuals (9.9% sample) were randomly selected by computer and mailed a survey form (Fig. 1). The survey form was revised in 1985 to facilitate analysis of state duck stamp sales and to more accurately identify harvest locations and hunting effort. Due to poor response rates and high project costs in the past, reminder notices were not sent to nonrespondents in 1985. Reminder notices accounted for about 37% of the total survey costs in 1983 and 1984, but resulted in only an average 15% increase in response.

Harvest location coding methods were also modified in 1985. A hierarchical system similar to that used in previous years was used; however, listed locations (Table 1) were developed from the survey data rather than from predetermined location categories. When the reported harvests for several locations were low and scattered throughout a local geographical area, harvest data were combined and coded according to the local geographical area. For example, reported harvests from Kenai Flats, Kasilof Flats, and Skilak Lake were combined and coded to the Greater Kenai Peninsula area (code 119). When a specific harvest location was not reported, a general harvest area code based on the geographical region of the state (Fig. 2) was assigned. For example, a reported harvest of ducks from the Fairbanks area could not be assigned to a specific harvest location, so the harvest would be coded to the Central Region (005). While this coding system is more complicated and time-consuming than that used previously, it allows more precise identification of harvest locations and analysis of the harvest. In the past, if a specific harvest location was not on the predetermined coding list, the harvest

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

WATERFOWL HUNTER SURVEY
1985 - 1986

DEAR HUNTER:

Your cooperation is needed to better manage Alaska's waterfowl. By accurately answering the questions below concerning your hunting activities in 1985, you can help insure proper management and good hunting for the future. If you can't remember exact numbers, give your best estimate. Complete the form printed below and drop this card in the mail. No postage stamp is necessary. Thank you for your cooperation.

PART I (ALL RECIPIENTS COMPLETE)

A. DID YOU BUY A FEDERAL DUCK STAMP IN 1985?
YES ☐ NO ☐

B. HOW MANY ALASKA STATE DUCK STAMPS DID YOU BUY? ☐

C. DID YOU HUNT FOR WATERFOWL DURING THE 1985-1986 SEASON? YES ☐ NO ☐

PART II (COMPLETE ONLY IF YOU HUNTED)

D. PLEASE LIST ALL THE PLACES WHERE YOU HUNTED WATERFOWL, NUMBER OF DAYS HUNTED AT EACH LOCATION AND NUMBER OF BIRDS SHOT AND RETRIEVED.

PART II (CONT.)

PLACES HUNTED (FOR EXAMPLE, MINTO FLATS, STIKINE FLATS, SUSITNA FLATS, ETC.)	NUMBER BIRDS SHOT AND RETRIEVED									
	7. DAYS HUNTED	8. DUCKS	9. SEA DUCKS & MERGANSERS	10. CANADA GEESE	11. SNOW GEESE	12. WHITE-FRONTED GEESE	13. BRANT	14. EMPEROR GEESE	15. UNKNOWN GEESE	16. CRANE	17. SNIPE
1.											
2.											
3.											
4.											
5.											

Figure 1. Waterfowl hunter survey form.

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

ADF&G Code	FWS Code	ADF&G geographical region (R) and harvest location names	Original FWS "country" name	FWS harvest zone
000	0000	Unknown	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 Yukon Valley	Upper Yukon-Kuskokwim	C
005	0702	Central (R)	Fairbanks-Minto	C
070	0752	Delta area	Fairbanks-Minto	C
071	----	Denali Highway	Fairbanks-Minto	C
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
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
008	1303	Gulf Coast (R)	Cordova-Copper River	SC
150	1313	Copper River Delta	Cordova-Copper River	SC
151	1333	Prince William Sound	Cordova-Copper River	SC
152	1323	Yakutat area	Cordova-Copper River	SC
009	1503	Southeast Coast (R)	Juneau-Sitka	Southeast
170	1523	Blind Slough	Juneau-Sitka	SE

Table 1. Continued.

ADF&G Code	FWS Code	ADF&G geographical region (R) and harvest location names	Original FWS "country" name	FWS harvest zone
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 Island	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
010	1704	Kodiak (R)	Kodiak Island	Southwest
200	1714	Kalsin	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	----	Womans Bay	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
223	1924	Pilot Point	Cold Bay-AK Peninsula	SW
224	1934	Port Moller	Cold Bay-AK Peninsula	SW
225	1944	Port Heiden	Cold Bay-AK Peninsula	SW
012	2104	Aleutian Chain (R)	Aleutian-Pribilofs	SW
240	----	Unimak	Aleutian-Pribilofs	SW

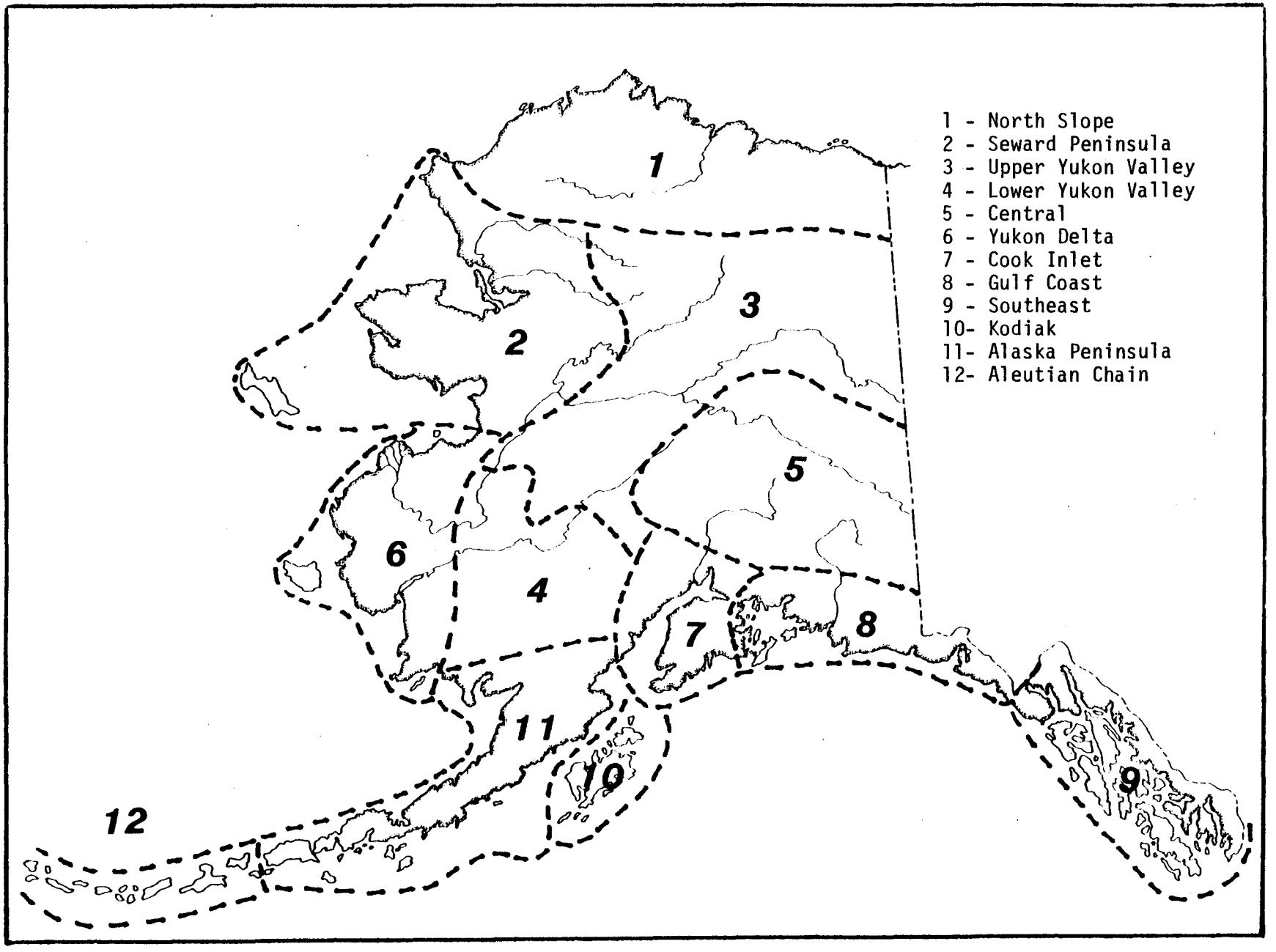


Figure 2. State waterfowl and crane harvest survey areas.

was combined with those from other unlisted locations in the geographical region (e.g., Central, Cook Inlet, Southeast, etc.) and the particularities of the harvest were lost. The new coding system allows combination or isolation of harvest data depending upon what is appropriate for analysis.

To allow comparison of ADF&G and FWS data, harvest locations were also categorized according to location codes used in the FWS parts collection survey (Table 1).

Reporting bias was corrected during data analysis as described by Timm (1977). For comparison, and to document long-term trends, 1985 harvest data are compared with FWS and state survey averages when possible.

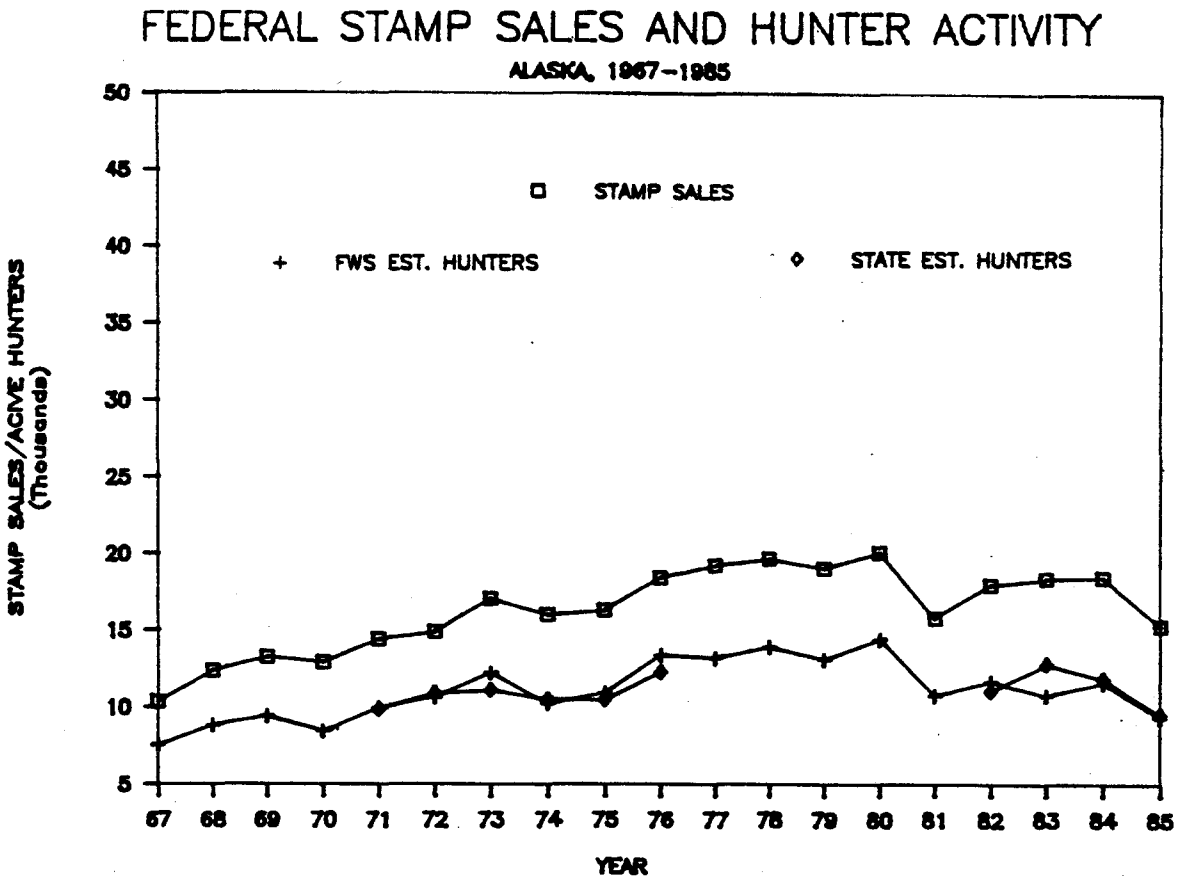
Results

Number of Hunters:

Because of the number of people in Alaska hunting without duck stamps and the incidence of hunting outside legal season limits, the assessment of waterfowl hunter activity and waterfowl harvest
is complicated (Timm 1972). While 12 people reported hunting waterfowl without purchasing a federal duck stamp, these data were not included in the analyses. Data on number of hunters, harvest, etc. in this report are based solely on federal duck stamp sales and, therefore, reflect only the fall sport hunting harvest.

A total of 3,135 people returned the questionnaire for a response rate of 42.5%. Of the 679 individuals indicating that they had purchased a federal duck stamp, 449 reported hunting 1 or more days (66% active hunters). Based on the sale of 15,335 federal duck stamps in Alaska, which was down 17% from 1984 and 5% below the 1966-84 average (Fig. 3), and adjusted for sales to nonhunters, approximately 9,585 people hunted waterfowl during the 1985-86 season (Table 2). This compares to a FWS estimate of 9,386 (65.4%) active hunters (Carney et al. 1986) and is 19% below the 1984 state estimate of 11,879 active hunters. The number of active waterfowl hunters in 1985 was 15% below both the 1967-84 FWS average of 11,210, and the 1971-76 and 1982-84 state survey average of 11,230 active hunters (Fig. 3).

While the 1985 FWS estimate of 65.4% active hunters was similar to the 1984 estimate (65.8%), it was down 4.5% from the 1967-84 average of 69.9%. Similarly, the state estimate of 66.1% active hunters was comparable to 1984 (67.1%) but down 2.6% from the 1971-76 and 1982-84 average of 68.7% (Fig. 3).



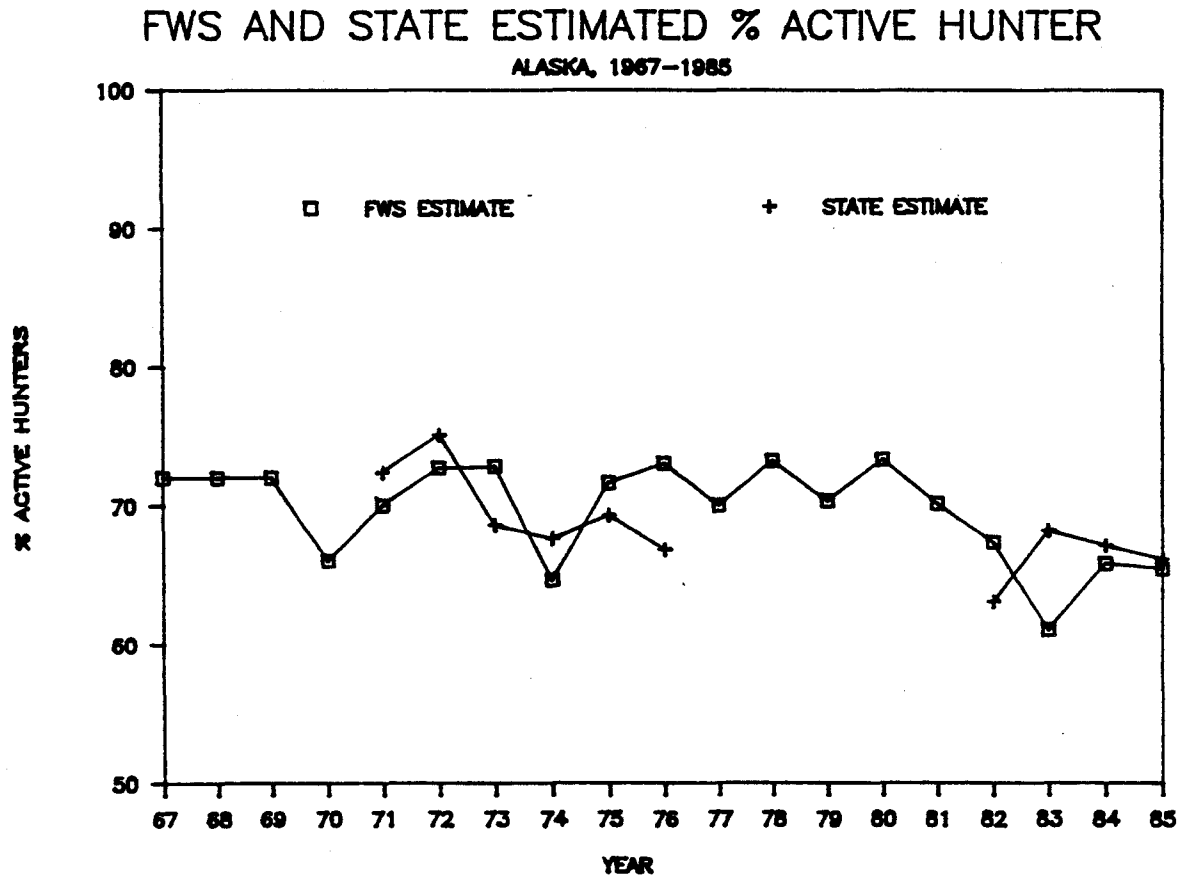


Fig. 3. Federal duck stamp sales and Fish and Wildlife Service and State estimated hunter activity in Alaska, 1967-85.

Table 2. Summary of Alaska waterfowl hunter activity and harvest from the state mail questionnaire survey, 1985-86.

Number of licensed resident hunters (all classes): 75,070

Number of license buyers sampled: 7,506 (9.9%)

Number and proportion of respondents from survey[a]: 3,135 (42.5%)

Number of returns usable for data analysis: 449 (14.3%)

Projected number of fall sport hunters:

Total federal duck stamps sold[b]: 15,335

Federal duck stamps sold to potential hunters in Alaska[c]: 14,500

Number of active hunters: 9,585 (66.1%)

Percent of active hunters buying a state stamp: 95.5%

Calculated statewide fall sport harvests:

Ducks: Dabblers/divers: 79,605; sea ducks: 7,185; Total 86,790

Geese: Canada: 5,534; emperor: 835; brant: 726; white-fronted: 490

snow: 863; unknown species: 327; Total: 8,775

Cranes: 1,270

Snipe: 1,597

Calculated Hunter Days: 52,856

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a Deliverable questionnaires only; excludes change of address, insufficient address, deceased hunter, etc.

b Carney et al. 1986.

c Total stamp sales minus 5.44% sold to nonhunters as computed from state survey.

This was the 1st year in which hunters were required to buy an Alaska Waterfowl Conservation Stamp along with a federal stamp. Although there were some initial problems with distribution of state stamps to license vendors, hunter questionnaire data indicate that 95.5% of active hunters purchased a state stamp.

Hunting Activity:

Hunters reported hunting an average of 5.5 days during the 1985-86 season. This projects to a total of 52,856 waterfowl hunter-days (Table 2), down 30% from the 1984 total of 75,963 days, 23% below the FWS 1965-84 average of 68,773 days, and 14% below the state 1971-76 and 1982-84 average of 61,205 days (Fig. 4).

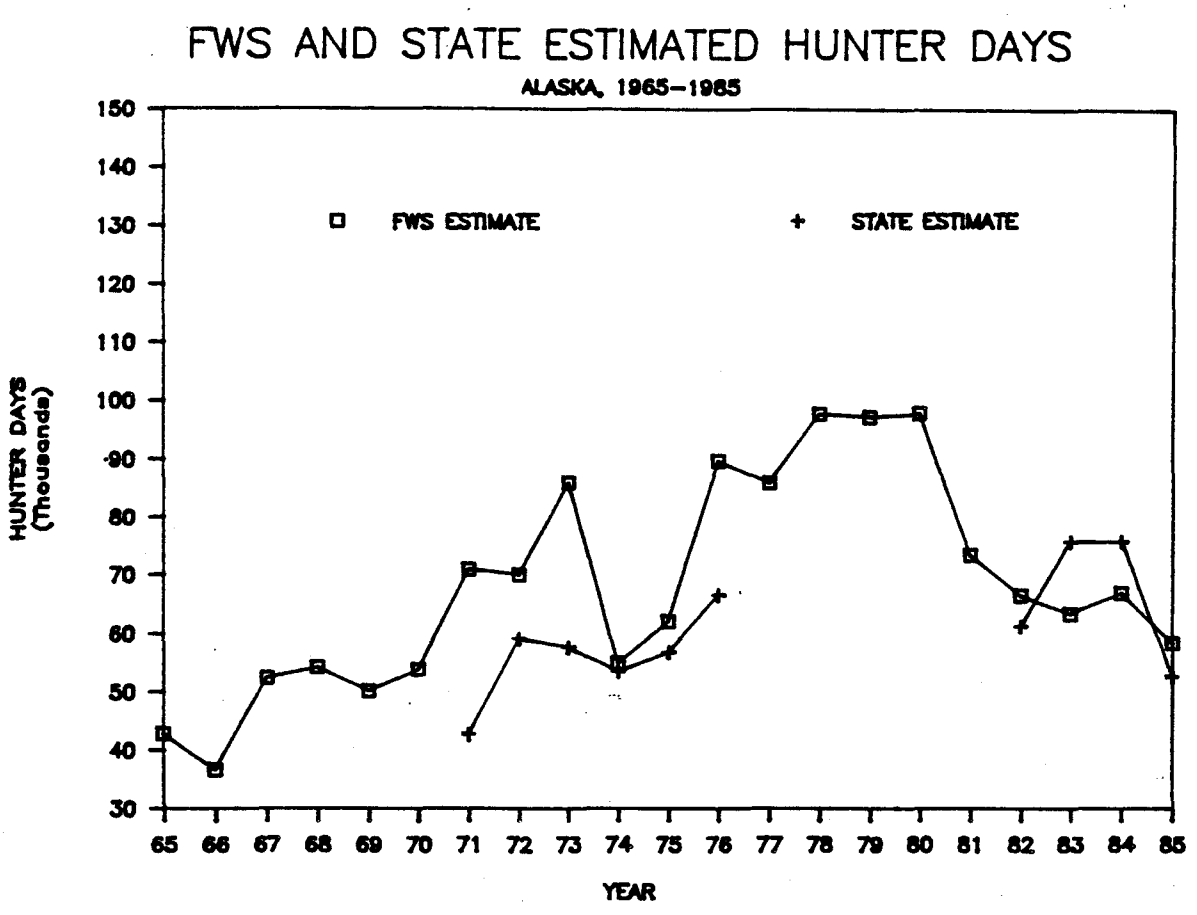
The distributions of hunter days and resulting harvest are summarized by region in Table 3 and by specific hunting locations in Table 4.

Duck Harvest:

An average of 9 ducks/active hunter was taken in 1985. This compares with 7.9 ducks/active hunter in 1984, a FWS 1965-84 average of 5.7 ducks/active hunter, and a state 1971-76 and 1982-84 average of 8.4 ducks/active hunter (Fig. 5). The FWS estimate for 1985 was 5 ducks/active hunter (Carney et al. 1986). Calculated average daily hunting success was 1.6 ducks/hunter in 1985 compared with 1.2 in 1984.

The projected statewide duck harvest was 86,790 of which 79,605 (92%) were dabblers and divers and 7,185 (8%) were sea ducks (Table 2). This is comparable to a FWS estimated harvest of 72,806, of which 61,229 (84%) were dabblers, 7,895 (11%) were divers, and 3,681 (5%) were sea ducks and mergansers (Carney et al. 1986). The 1985 state survey estimated harvest was down 14.5% from 1984 and 2% below the 20-year (1965-84) FWS average harvest of 88,102 ducks (Fig. 5). The 1985 harvest was 9.6% below the state 1971-76 and 1982-84 average of 95,970 ducks (Fig. 5).

Based on the FWS parts collection survey, which is believed to provide the best estimate of species composition in the harvest, the mallard (Anas platyrhynchos) was the most important game duck in 1985, composing about 27% of the harvest, followed by pintail (Anas acuta) (18%), green-wing teal (Anas crecca) (15%), and American wigeon (Anas americana) (15%) (Table 5). Species composition of the statewide duck harvest has remained relatively constant during the past 20 years with 86% (±2.7) of the harvest composed of dabbling ducks, 10% (±2.6) diving ducks, and 4% (±2.0) sea ducks and



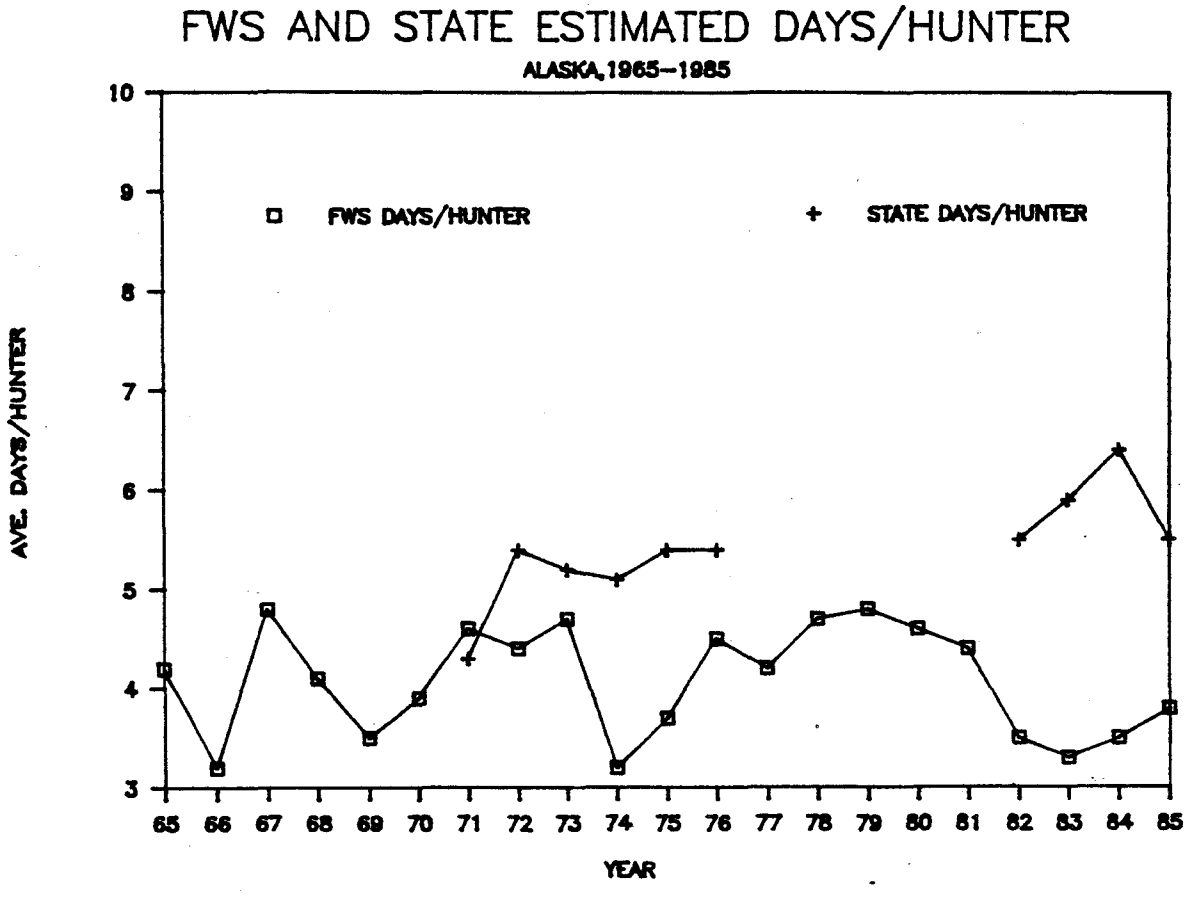


Fig. 4. Fish and Wildlife Service and State calculated waterfowl hunter days and average days per hunter in Alaska, 1965-85.

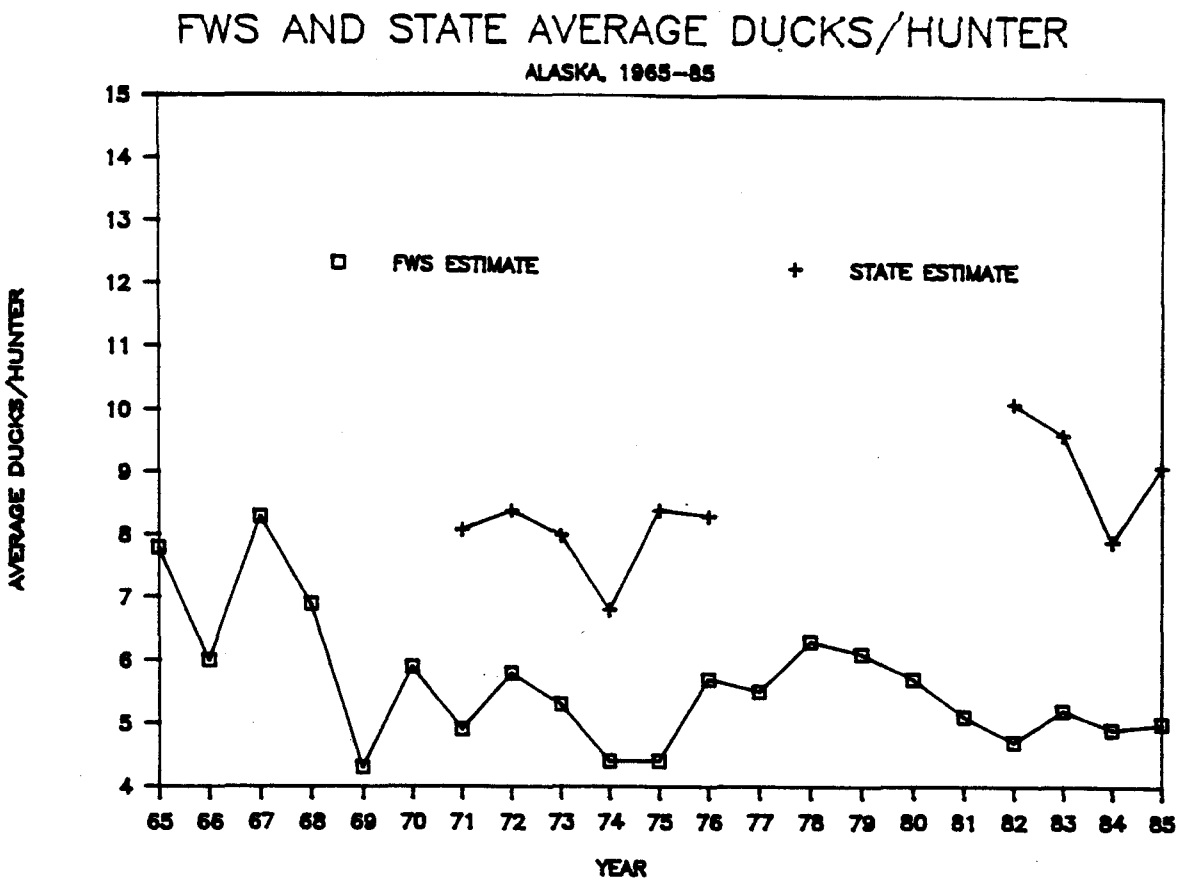
Table 3. Proportion (%) of calculated duck, crane, and snipe fall sport harvests and sport hunter activity by geographical region, 1985-86.

Harvest Area	Hunter Days	Dabblers/Divers	Sea Ducks	Cranes	Snipe
North Slope	0.0	0.0	0.0	0.0	0.0
Seward Pen.	0.7	0.7	1.3	0.0	0.0
Upper Yukon Valley	0.8	0.2	0.0	0.0	0.0
Lower Yukon Valley	0.1	T	0.0	0.0	0.0
Central	21.5	26.0	1.3	57.1	6.8
Yukon Delta	3.2	3.2	6.1	37.1	15.9
Cook Inlet	36.9	36.4	27.3	4.3	55.7
Gulf Coast	4.8	5.0	4.0	0.0	0.0
Southeast	19.2	18.6	18.4	0.0	21.6
Kodiak	6.6	5.3	40.4	0.0	0.0
Alaska Pen.	6.0	4.6	1.3	1.4	0.0
Aleutian Chain	0.0	0.0	0.0	0.0	0.0
Statewide Days/Harvest	52,856	79,604	7,186	1,270	1,597

Table 4. Calculated hunting activity and harvest for specific locations in Alaska, 1985-86.

Location	Calculated diver/dabbler duck harvest and hunter days: Ducks n	Ducks % of state total	Hunter days n	Hunter days % of state total	Location	Calculated goose harvest n	% of state total
Susitna Flats	13,770	17.3	5,890	11.1	Cold Bay	3,305	37.7
Minto Flats	6,950	8.7	1,945	3.7	Susitna Flats	980	11.2
Palmer Hay Flats	4,520	5.7	3,735	7.1	Delta	490	5.6
Mendenhall	3,265	4.1	2,175	4.1	Stikine River Delta	290	3.3
Copper River Delta	2,885	3.6	1,600	3.0	Palmer Hay Flats	220	2.5
Kenai Peninsula[a]	2,850	3.5	1,965	3.7	Ketchikan area	220	2.5
Delta Area	2,850	3.5	2,965	5.6	Minto Flats	200	2.3
Stikine River Flats	2,630	3.3	1,090	2.1	Chickaloon Flats	200	2.3
Kalsin Bay, Kodiak	2,470	3.1	1,090	2.1	Petersburg area	180	2.1
Healy area	1,600	2.0	1,005	1.9	Prince of Wales Is.	160	1.9
Sitka area	1,490	1.9	1,090	2.1	Sitka area	145	1.7
Kachemak Bay	1,470	1.8	1,195	2.3	Tanana Flats	90	1.0
Tok-Northway area	1,470	1.8	575	1.1	Mendenhall Flats	90	1.0
Cold Bay	1,470	1.8	2,090	3.4	Healy area	55	0.1
Petersburg area	1,195	1.5	575	1.1	Prince William Sound	55	0.1
Redoubt Bay	1,195	1.5	300	0.6	Port Heiden	55	0.1
Ketchikan area	1,125	1.4	575	1.1			
Chickaloon Flats	960	1.2	745	1.4			
Prince William Sound	960	1.2	915	1.7			
Portage	815	1.0	1,580	3.0			
Tanana	815	1.0	530	1.0			
Trading Bay	715	0.9	320	0.6			
Denali Highway	635	0.8	215	0.4			
Seymour Canal	545	0.7	170	0.3			
Naknek River	545	0.7	315	0.6			
Pilot Point	545	0.7	130	0.2			
Prince of Wales Is.	510	0.6	705	1.3			
Tetlin Flats	510	0.6	65	0.1			
Middle Bay, Kodiak	345	0.4	170	0.3			
Potter's Marsh	345	0.4	2,050	3.9			
Salcha River	345	0.4	130	0.2			
Yakutat	200	0.3	65	0.1			
Eagle River	180	0.2	65	0.1			
Jim Creek	180	0.2	130	0.2			
Womens Bay, Kodiak	180	0.2	1,175	2.2			
Eielson AFB	125	0.1	215	0.4			
Icy Strait	125	0.1	170	0.3			
Goose Bay	125	0.1	170	0.3			
Raspberry Straits	125	0.1	65	0.1			
Subtotals	63,035	78.4	39,955	74.8		6,735	75.4
Statewide totals	79,604	100.0	52,856	100.0		8,775	100.0

a Greater Kenai Peninsula area excluding Chickaloon Flats and Kachemak Bay.



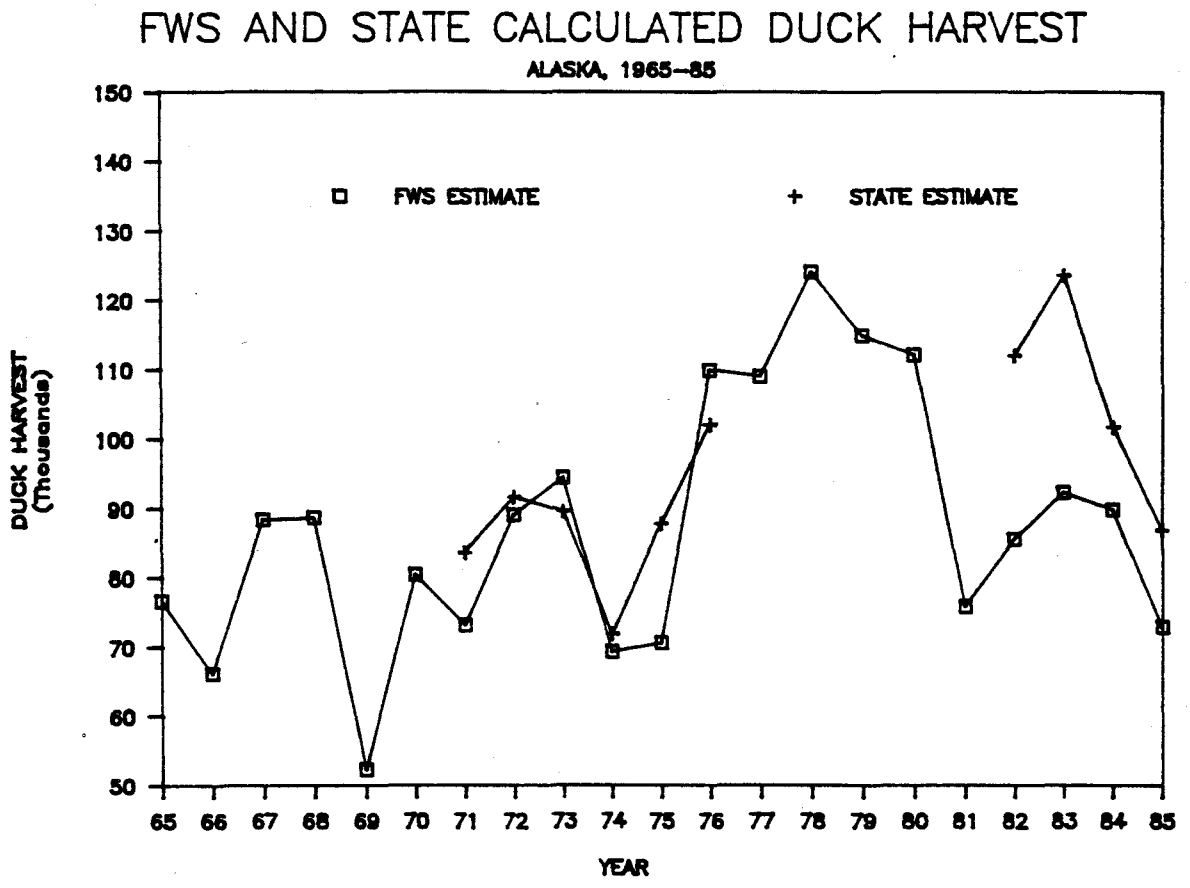


Fig. 5. Fish and Wildlife Service and State calculated ducks harvested per hunter and annual duck harvest in Alaska, 1965-85.

Table 5. Species composition (%) of the 1985-86 duck harvest by region based on the third quarter Fish and Wildlife Service parts collection survey report (n = 1,467 wings).

Species	North Slope[a]	Seward Pen.	Yukon Valley	Central	Yukon Delta	Cook Inlet	Gulf Coast	South-east	Kodiak	Alaska Pen.	Aleutian Chain	Statewide
Mallard	0	0.0	11.1	26.2	11.2	25.4	29.3	29.9	44.8	29.9	100	27.1
Pintail	0	34.8	11.6	16.6	8.8	23.2	10.6	11.1	5.6	7.8	0	17.9
American wigeon	0	15.8	12.1	15.5	21.8	17.8	11.6	8.6	11.7	12.4	0	15.3
Green-winged teal	0	21.9	0.0	12.4	31.6	12.9	13.0	33.1	9.4	38.2	0	15.4
Shoveler	0	4.9	0.0	11.6	17.3	7.0	1.8	8.0	0.0	3.9	0	7.0
Gadwall	0	0.0	0.0	0.0	0.0	0.8	1.0	0.0	7.1	4.1	0	1.1
Blue-winged teal	0	0.0	0.0	1.0	0.0	0.0	0.7	0.0	0.0	0.0	0	0.2
Unknown	0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0	T
Total dabblers	0	77.4	34.8	83.3	90.7	87.1	68.4	90.7	78.6	96.3	100	84.0
Lesser scaup	0	0.0	0.0	9.9	0.0	0.7	1.3	0.9	0.0	0.0	0	2.4
Greater scaup	0	0.0	0.0	0.0	3.0	0.8	5.1	0.0	1.4	0.0	0	1.1
Ringneck	0	0.0	0.0	0.8	0.0	0.6	0.0	0.8	0.0	0.0	0	0.5
Canvasback	0	0.0	0.0	2.2	0.0	0.3	0.0	0.0	0.0	0.0	0	0.6
Redhead	0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0	1.2
Bufflehead	0	0.0	0.0	2.5	0.0	2.6	5.1	2.4	1.3	0.0	0	2.5
Barrow's goldeneye	0	0.0	0.0	0.6	0.0	2.0	0.4	3.8	0.0	0.0	0	1.5
Common goldeneye	0	0.0	0.0	0.7	0.0	1.8	1.5	0.0	0.0	0.0	0	1.1
Total divers	0	0.0	0.0	16.7	3.0	11.4	13.4	7.9	2.7	0.0	0	10.9

Table 5. Continued.

Species	North Slope[a]	Seward Pen.	Yukon Valley	Central	Yukon Delta	Cook Inlet	Gulf Coast	South-east	Kodiak	Alaska Pen.	Aleutian Chain	Statewide
Common eider	0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.1
King eider	0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0	0.2
Steller's eider	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0	0.1
Black scoter	0	2.3	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0	0.3
White-winged scoter	0	0.0	32.6	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0	0.6
Surf scoter	0	0.0	32.6	0.0	0.0	0.4	5.1	0.5	0.0	0.0	0	0.9
Harlequin	0	2.3	0.0	0.0	0.0	0.4	1.7	0.5	11.7	0.0	0	1.2
Oldsquaw	0	13.3	0.0	0.0	6.3	0.2	1.4	0.0	4.4	0.0	0	1.0
R-b merganser	0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	0	0.5
Hooded merganser	0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0	T
Total seaducks	0	22.5	65.2	0	6.3	1.2	18.3	1.5	18.7	3.7	0	4.9

a No duck harvest reported by FWS parts collection survey.

mergansers (Table 6). As calculated from the state survey, over a third (36%) of the duck harvest occurred in Cook Inlet, with the central and southeast regions contributing an additional 24% and 19%, respectively (Table 7).

Goose Harvest:

Hunters reported taking an average 0.9 geese/active waterfowl hunter in 1985. This was lower than the 1.3 geese/active hunter reported in 1984, the 1965-84 FWS average of 0.8 geese/hunter, and the state 1971-76 and 1982-84 average of 1.3 geese/hunter (Fig. 6). The FWS estimated that an average of 0.4 geese was taken per active hunter in 1985 (Carney et al. 1986). The calculated 1985 statewide goose harvest was 8,775, down 42% from the 1984 harvest of 15,224, 33% below the 1965-84 FWS average of 13,038 geese, and 39% below the 1971-76 and 1982-84 state survey average of 14,440 geese (Fig. 6). The state estimated goose harvest for 1985 (8,775) was 49% greater than the FWS estimate of 5,899 geese (Carney et al. 1986).

The Canada goose (Branta canadensis) was the most common goose harvested by sport hunters in 1985 (Table 2). This species made up 63% of the harvest, followed by emperor (Chen canagica) and snow geese (Chen caerulescens) at 10% each, brant (Branta bernicla) (8%), white-fronts (Anser albifrons) (6%), and unknown species (4%). This compares with 62% Canadas, 13% white-fronts, 10% brant, 8% emperors, 4% snow, and 2% unknown in 1984, and a 1966-84 average composition of 70 ± 8.8% Canadas, 7 ± 3.8% white-front, 7 ± 4.2% brant, 12 ± 5.3% emperor, 4 ± 2.7% snow, and 0.3 ± 0.8% unknown (Table 8).

Crane Harvest:

Hunters reported taking an average of 0.1 sandhill cranes (Grus canadensis) per active hunter in 1985, compared with 0.2 in 1984. The calculated statewide crane harvest was 1,270 (Table 2) compared with a FWS estimate of 642 (Sorensen, 1986). The 1985 state estimated harvest was down 47% from 2,376 in 1984, but still above the 1971-76 and 1982-84 state survey average harvest of 1,217 (Table 9). Over 57% of the 1985 crane harvest occurred in the central region of the state. An additional 37% of the harvest occurred in the Y-K Delta region (Table 3) which was ranked either 2 or 3 in harvest magnitude since the state survey was reinstituted in 1982.

Snipe Harvest:

An average 0.2 snipe (Capella gallinago) was harvested/active hunter in 1985 for a calculated statewide harvest of 1,597

Table 6. Composition (%) of the statewide duck harvest in Alaska, 1966-85[a].

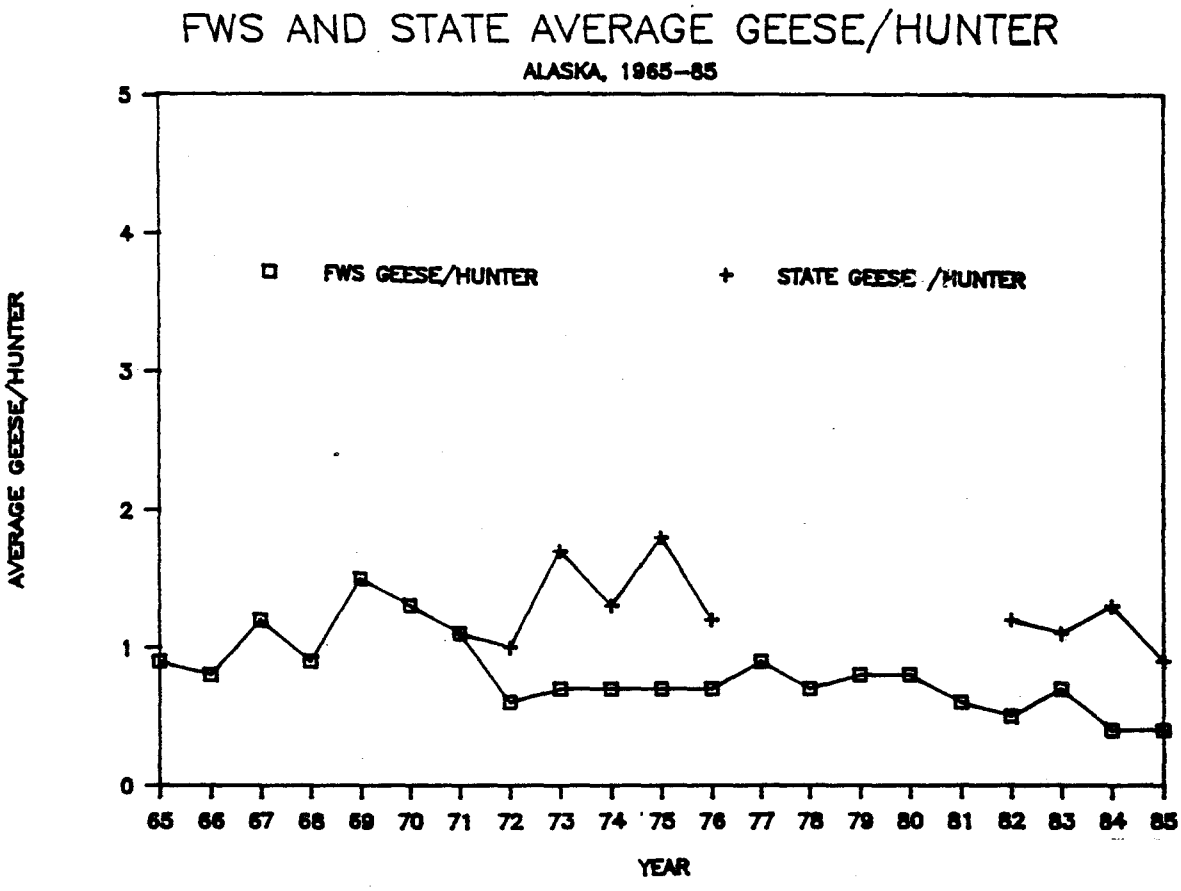
Year	Dabbling ducks	Diving ducks	Sea ducks/ mergansers
1966	86.5	10.3	3.0
1967	84.6	10.1	5.1
1968	89.6	8.9	1.8
1969	83.8	10.1	6.1
1970	86.0	9.0	5.0
1971	89.7	5.9	4.3
1972	90.0	7.6	2.3
1973	90.5	8.7	0.9
1974	82.3	16.4	1.4
1975	88.0	5.8	6.2
1976	82.6	9.5	7.9
1977	88.2	10.3	1.5
1978	82.5	11.1	6.5
1979	87.5	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
$\bar{x}$	86.3	10.1	3.7
±SD	2.7	2.6	2.0

a Based on FWS parts collection surveys.

Table 7. Projected distribution of 1985 duck harvest, by harvest region, compared with the 1972-76 ADF&G mail survey and the 1982-84 average.

Harvest area	1985 (%)	1972-76 and 1982-84 average (%)
North Slope	0	0.2 ± 0.2
Seward Peninsula	0.7	2.2 ± 1.4
Upper Yukon Valley	0.2	-[a]
Lower Yukon Valley	0.1	-[a]
Central	23.9	19.7 ± 3.5
Y-K Delta	3.5	2.3 ± 1.5
Cook Inlet	35.7	40.0 ± 6.0
Gulf Coast	5.0	6.9 ± 1.9
Southeast	18.5	18.4 ± 2.5
Kodiak	8.2	3.3 ± 1.1
Alaska Peninsula	4.3	4.2 ± 2.3
Aleutian Chain	0	0.5 ± 0.8

a New harvest regions formed by by dividing Yukon Valley region along approximately the 63rd parallel. Average for combined regions is 2.2% ± 0.6.



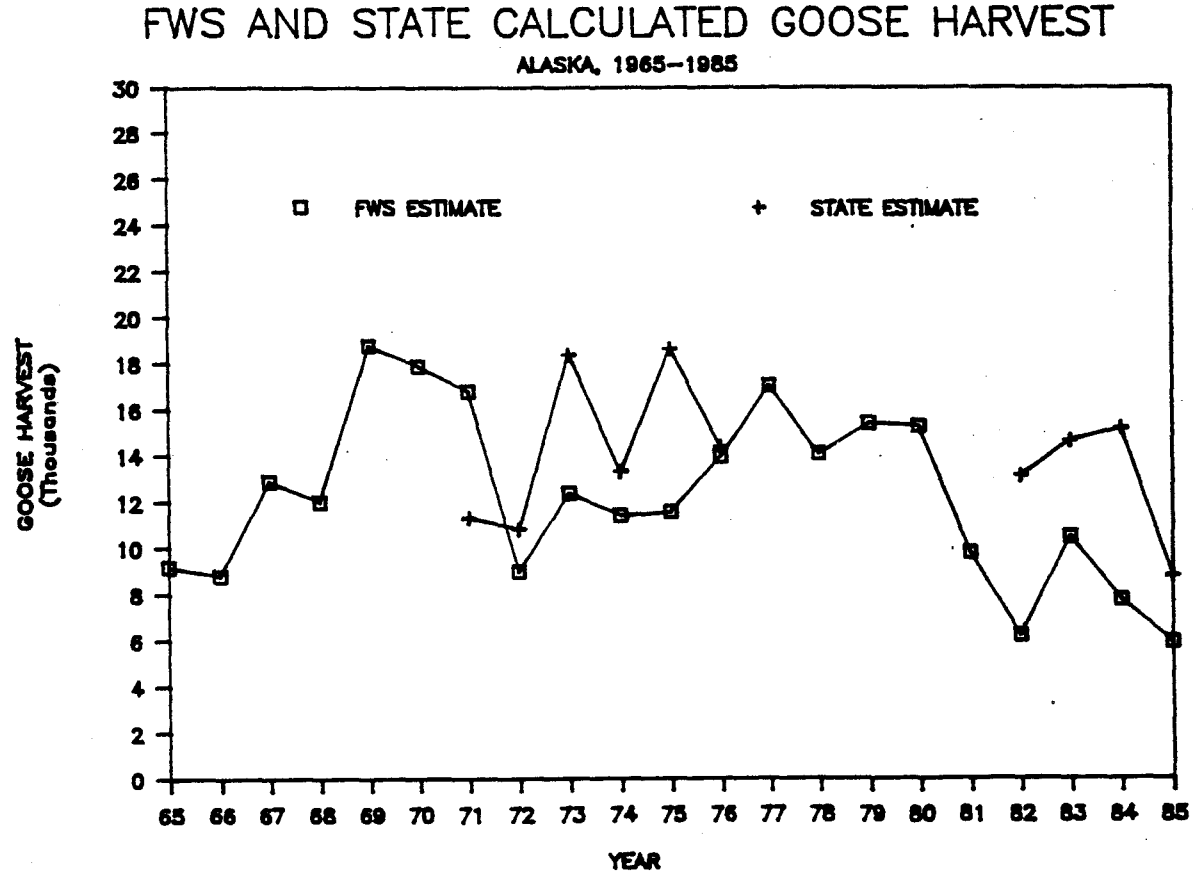


Fig. 6. Fish and Wildlife Service and State calculated geese harvested per hunter and annual goose harvest in Alaska, 1965-1985.

Table 8. Proportional (%) distribution of the fall goose harvest by species and harvest area, 1985-86.

Region	Canada	Emperor	Brant	Snow	Whitefront	Unknown	Total
North Slope	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seward Peninsula	1.0	0.0	20.0	4.3	0.0	0.0	2.3
Upper Yukon Valley	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lower Yukon Valley	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Central	13.1	0.0	0.0	19.0	51.9	27.8	14.5
Yukon Delta	4.6	4.3	0.0	6.4	3.7	11.1	4.6
Cook Inlet	22.3	0.0	0.0	0.0	25.9	61.1	17.8
Gulf Coast	1.3	0.0	0.0	0.0	0.0	0.0	0.8
Southeast	25.6	0.0	15.0	31.9	3.7	0.0	20.9
Kodiak	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alaska Peninsula	31.8	95.7	65.0	38.3	14.8	0.0	39.1
Aleutian Chain	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Statewide goose harvest	5,534	835	726	863	490	327	8,775

Table 9. FWS and state estimated crane and snipe harvest in Alaska, 1971-84.

Year	Crane		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
$\bar{x}$	798	1,217	-	3,738
SD	±387.2	±679.6		±1,559

birds (Table 2). This can be compared with 0.3 snipe/hunter and calculated harvest of 3,564 birds in 1984. The 1971-76 and 1982-84 snipe harvest has averaged 3,738 birds (Table 9). About half (56%) of the 1985 harvest occurred in Cook Inlet with the southeast and Y-K Delta regions contributing an additional 22% and 16%, respectively (Table 3).

Discussion:

Although duck stamp sales and hunter activity have been declining in the Pacific Flyway since 1975, this was the 1st year a significant decrease in hunter activity was noted in Alaska. Duck stamp sales, number of active hunters, and hunter-days were all down substantially from 1984. Hunter-days were down 40% in Cook Inlet alone. Factors contributing to reduced hunter activity and waterfowl harvests include stabilization of the state's population growth (especially in Anchorage); lower participation resulting from discouraging fall flight predictions; and reduced size of fall flights. Although the total duck harvest was down, mean ducks per hunter and mean ducks per day increased, suggesting that the more proficient hunters were afield.

A poor fall flight was expected because of long-term declines in duck populations and lower production as a result of a late spring. As recommended by the Pacific Flyway Council, Alaska implemented a 3-pintail limit within the daily duck bag limit in the Gulf Coast Zone. The calculated reduction of 14% in the pintail harvest was proportional to the reduction in total duck harvest.

The statewide goose and crane harvests were down considerably from 1984, probably in part because of continued restrictions on western Alaska geese and dusky Canada geese, and a generally rapid outmigration of birds from the state. Continued restrictions contributed to further harvest reductions for emperor geese (-30%) and brant (-53%) in 1985.

In 1985, the Canada goose season in Units 5 and 6 was delayed an additional week (September 21 opening) to allow dusky Canada geese to leave the state. Survey estimates indicate that the Gulf Coast Canada goose harvest was reduced by 89%. An early departure of geese, resulting in lower statewide harvest, is indicated by low goose, duck, and crane harvests in the interior and a 76% reduction in statewide harvest of white-fronts, an early migrant. Although statewide and central region crane harvests were half of what they were in 1984, the proportion of Pacific Flyway cranes in the state harvest showed a more pronounced reduction, from 16.4% to only 5.7%.

The state will not conduct a harvest survey for the 1986-87 season in order to change the method of sampling hunters and improve the accuracy of the data. For the 1987-88 season, survey cards will be distributed to a sample of state duck stamp buyers and a list of all stamp buyers will be available. This should improve the hunter-harvest survey by: (1) sampling directly from waterfowl hunters, rather than from a pool of all licensed hunters; (2) increasing the sampling intensity to increase the number of usable responses; (3) reducing memory-exaggeration biases inherent in mail surveys conducted well after season closing; and (4) greatly improving the cost effectiveness of forms, mailing, and reminder questionnaires.

DUSKY CANADA GOOSE STUDIES

Production

Conditions on the Copper River Delta were a mixture of poor and good weather for nesting in 1986. Spring weather was unseasonably cold and wet until the 2nd week of May when conditions improved and remained good for nesting, with above-normal temperatures and little precipitation. While foliage emergence was only about 1 week later than normal, it is likely that dusky Canada geese (Brant canadensis occidentalis), which arrived on the Delta around mid-April, were under some energy stress for 3-4 weeks prior to nesting due to the cold, wet conditions and snow and ice pack on feeding and roosting areas. This stress probably had a negative influence on production as nest initiation, clutch size, and incubation patterns of the dusky are dependent upon conditions on the nesting grounds prior to and during early nesting (Bromley 1985).

Peak of nest initiation, as determined by back-dating from the age of floated eggs (n = 78), occurred during 7-12 May with a secondary peak around 21-25 May. The average clutch was 4.9 ± 1.7 eggs compared with the 1959-85 average of 5.0 eggs (Table 10). While clutches initiated between 7-12 May appeared to be considerably larger ($\bar{x}$=5.3±1.7) than those initiated after 12 May ($\bar{x}$=3.6±1.5), the timing of data collection probably resulted in underestimates of the size of later clutches. Information collected in June suggested that the clutches in nests initiated between 21-25 May were still being laid when visited by field personnel and that an average clutch size of 5.7 ± 1.6(n = 20) was more accurate.

For the 2nd consecutive year, nest success was very poor. Only 11.4% of the nests on the 1.69-mi² study area were successful (Table 10), although 9% of the nests were still

Table 10. Dusky Canada goose nest densities, hatching success, and average clutch size on the west Copper River Delta study area, 1959-86.

Year	Nests/mi²	Nest success		Clutch size	
		n	%	n	$\bar{x}$
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
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	-	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
1959-85$\bar{x}$	128		65.7		5.0
1986[a]	116	201	11.4	78	4.9

a Preliminary pending final analysis.

being incubated during the late-June nest survey. This was the 2nd lowest success rate ever recorded for the dusky, with only 1985 (8.9%) being lower.

The calculated density of nests on the study areas was 116/mi², the highest since 1979 but still below the 1959-85 average of 128/mi² (Table 10). While the increase could have been the result of renesting, the large average clutch size (5.7 eggs) for late-hatching clutches, and documented low renesting effort by the dusky in the past (Bromley 1976) make it unlikely that renesting was the reason for the increase in 1985.

As in at least the past 13 years, predation was the primary cause of nest failure in 1986. About 67% of the 201 nests on the study plots were destroyed by predators. This was the 2nd highest nest predation rate on record, surpassed only in 1985 (79%). Over 83% of the nest destruction was attributed to coyotes and brown bears, with avian predators destroying an additional 5.2%. However, because of the high predation rate and complete nest destruction by large mammals, the more subtle evidence of avian predation (typically destruction of only part of the clutch) may have been masked and avian predation underestimated. While final classification of specific predatory agents is not yet complete, approximately 47% of the nest predation by mammals is attributed to brown bears, 17% to canids, and 20% unknown. About half of the "unknown" category is suspected to have been brown bears, but evidence is inconclusive. Predation on nesting geese, primarily by coyotes, was also a significant factor in 1986. Thirty-four goose carcasses or kill sites were located on the study area during May 1986. This compares with 17 carcasses or kill sites in 1985 and 4 in 1984 (incomplete record). The loss of adult geese, many of which were taken off nests, probably attributed to the higher nest abandonment rate of 9% in 1986, compared with a 1959-85 average of 2.9% (Table 11).

Thirty-one control (previously unvisited) nests were located after the 2nd sampling of study plots in June 1986. There was no significant difference ($\underline{X}^2 = 1.53$, $\underline{P} > 0.50$, df = 3) in success rates of nests between the study plots and control areas.

A 5th year of nesting habitat data was collected in 1986. These data will be analyzed and compared with habitat availability information to determine how duskys are using changing habitat on the Copper River Delta for nesting. Results of this analysis will be presented in a special report in 1987.

Table 11. Fate of dusky Canada goose nests on the west Copper River Delta study area, 1959, 1974-75 and 1982-86.

Year	No. nests	% Successful	% Abandoned	% Fate unknown	% Destroyed	Type destruction: % Mammal	% Avian	% Flooded	% Unknown
1959[a]	1,162[b]	79.6	1.8	2.0	6.0	0[d]	11.4[e]	88.6	0[d]
1974[c]	81	82.7	2.5	ND[d]	14.8	ND[d]	-[e]	0	ND[d]
1975[c]	215	31.6	3.7	ND[d]	64.6	ND[d]	-[e]	0	ND[d]
1982	158	49.2	1.8	ND[d]	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	75.8	3.1	6.2	14.9	62.4	37.6	0	4.0
1985[f]	168(258)[g]	8.9(7.0)	3.6(1.9)	6.5(10.9)	78.6(81.0)	78.8	18.4	0	2.8
1986[f]	201	11.4	9.0	12.5	67.2	83.7	5.2	0	11.1

a Trainer, 1959.

b Eggs rather than nests.

c Bromley, 1976.

d Not reported.

e Percentages not given, but major losses attributed to avian predators.

f Preliminary, pending further data analysis.

g Numbers in parentheses are for the study area plus additional sample areas on the CRD.

A production/inventory survey was conducted on 16 July 1986. Parallel transects at 1/4- to 1/2-mile intervals were flown in a Cessna 185 between saltwater and shrub-bog habitat, including the barrier islands, on the west Copper River Delta. Two observers and a pilot were used, with the pilot and front-seat observer searching for flocks and navigating. The 2nd observer, seated behind the front passenger seat, assisted with the search until geese were spotted. At that time, passes or circles were flown so that the 2 observers on the right-hand side of the aircraft had an unrestricted view of the geese. The front observer counted adults and periodically photographed flocks, while the rear observer counted young geese and recorded data. Elevation and speed of the aircraft varied according to conditions and group size. Searches were conducted at 500-800 ft altitude and at approximately 100 mph. Once geese were spotted, airspeed and altitude were reduced to allow adequate counts and classifications. Photographs of flocks were taken periodically to facilitate development of weighted regressions that would provide estimates of total geese and number of young in the population.

Approximately 11,365 geese were visually counted during 4-1/2 hours of flying. Incorporation of visual counts and counts from photographs into weighted regressions resulted in a population estimate of 13,309 geese, composed of 11,892 ± 933 adults and 1,417 ± 55 young (10.7%).

Population Status

As specified by the Dusky Canada Goose Management Plan (Pacific Flyway Council 1985), the mid-winter inventory is used as the dusky Canada goose population index. Based on a 1986 mid-winter index of 12,190 (Cornely et al. 1986), the 1986 fall flight estimate is 13,150 geese. Because of recent disparities in population indices, such as a 58% difference between the 1985 mid-winter index and the July 1985 count on the Delta (Campbell and Rothe 1986), or a 38% increase in the mid-winter index between 1985 and 1986 (Table 12), when production was at an all time low (3.8% young), the use of the mid-winter inventory as the sole population index is questionable. We have begun to recognize the increasing difficulties of censusing duskys among a large and growing wintering Canada goose population dispersed throughout western Oregon and southwestern Washington, and there is some evidence that some portion of the dusky population may be wintering out of the survey area, north of Washington. Population indices based on spring or summer surveys may be more useful in assessing trends and status of the population. Efforts to develop alternative population indices should continue to be a high priority at the state, Flyway, and federal level.

Table 12. Summary of population and production data for dusky Canada geese, 1971-1986.

Year	Mid-winter population index	Spring population[a]	Young produced	Fall flight	Fall-spring losses[b]
1971	19,800	19,060	3,690	22,750	4,850
1972	17,900	17,230	2,045	19,275	3,475
1973	15,800	15,210	8,560	23,770	5,170
1974	18,600	17,900	18,935	36,835	10,335
1975	26,500	25,510	5,565	31,075	8,075
1976	23,000	22,140	6,975	29,115	5,015
1977	24,100	23,200	18,460	41,660	17,660
1978	24,000	23,100	7,635	30,735	5,235
1979	25,500	24,545	4,680	29,225	7,225
1980	22,000	21,175	6,575	27,750	4,750
1981	23,000	22,140	4,830	26,970	9,230
1982	17,740	17,075	5,310	22,385	5,385
1983	17,000	16,360	2,890	19,250	9,150
1984	10,100	9,720	2,180	11,900	4,400
1985	7,500	7,220[c]	510[d]	--	--
1986	12,190	11,735	1,415	13,150	

a Mid winter less 0.0375 mortality (Chapman et al. 1969).

b Fall flight forecast minus mid-winter population estimate.

c An estimated 13,780 geese were observed on the Copper River Delta in July 1985.

d Based on a sample of 13,780 geese.

Banding

As recommended by the Pacific Flyway Technical Committee, duskys were banded and collared for the 3rd consecutive year in 1986 to support studies on the wintering grounds. Conditions were very poor for handling geese, with low ceilings, limited visibility, cool temperatures, gusty winds, and rain. Although no mortalities occurred during banding, the operation was terminated early due to concerns that geese could be lost from stress and hypothermia. A total of 812 geese were captured between 21-23 July using portable drive nets and a Bell 206 Jet Ranger helicopter. One hundred and fifty-eight of these were recaptures and 654 were unmarked geese (Table 13). Two of the recaptures (Band Nos. 578-51226 and 578-51720) were marked at an unknown location other than the Copper River Delta. Six hundred and fifty-four geese were banded and 477 were collared as well. The number, age, and sex of birds marked in 1986 are summarized in Table 13.

One hundred and thirteen geese collared in 1984 (24) and 1985 (89) were recaptured in 1986. Of the 24 birds marked in 1984, 8 were missing their collars for a 2-year collar loss rate of 33.3%. This is in comparison with a 1st year collar loss of 22.8%. Of the 89 geese collared in 1985, 2 were missing their collars for a 1st year collar loss of only 2.2%. No explanation for the large difference in collar loss rates between 1984 and 1985 can be offered until additional analysis of the age and sex of marked geese is completed.

Band recovery data, since banding was initiated in 1951, are currently being analyzed using models developed by Brownie et al. (1985). Analysis should be completed and the results reported in 1987.

BROWN BEAR ACTIVITY AND IMPACTS ON NESTING GEESE ON THE WEST COPPER RIVER DELTA

Introduction

A 3-year investigation of the activity of brown bears (Ursus arctos) and their impact on nesting dusky Canada geese was initiated in 1984 (Campbell and Rothe 1985). The primary objectives of this study are to document the timing of brown bear movement onto the west Copper River Delta in the spring, their home ranges, and their use of habitat during the period when geese are nesting (May-June). A secondary objective is to collect information such as annual home ranges, seasonal fidelity to the Delta, denning locations, and denning dates. Progress reports for the 1st 2 years of the study have been written. The 3rd year of data collection and analysis is

Table 13. Summary of dusky Canada geese captured and marked on the Copper River Delta in 1986.

Capture location	Total geese captured	Number of recaptures	Unmarked geese captured	Number of geese banded						Number of geese collared			
				AHYM	AHYF	AHYU	LM	FL	LU	AHYM	AHYF	LM	LF
Mountain Slough	213	68	145	58	47	0	20	20	0	58	47	7	5
Glacier Slough	55	5	50	12	13	0	9	15	1	12	13	7	4
Pete Dahl Slough	253	36	217	112	105	0	0	0	0	94	85	0	0
Walhalla Slough	291	49	242	136	105	1	0	0	0	91	54	0	0
Total	812	158	654	318	270	1	29	35	1	255	199	14	9

currently underway and results will be reported in a final report in late 1987 or early 1988. The following is a brief, preliminary summary of activities during the period covered by this annual report of survey and inventory activities (1 Sep 1985 - 31 Aug 1986).

July-Winter 1984 and Spring 1985 Investigations

After the goose nesting season, radio-collared brown bears were relocated once every 2 weeks from July 1985 until all had entered winter dens (January 1986). The den sites of collared bears were checked in mid-March and mid-April for signs of activity and spring emergence. Relocation efforts were increased to once every 3-4 days after bears emerged from winter dens in mid-April and continued until mid-May when geese began to nest and bears moved onto the Delta.

Ten radio-collared bears were active on or near the Delta during part or all of late summer 1985-spring 1986 (Table 14). Unfortunately, the project continued to be plagued with equipment failures: the radio collars on 5 of the 10 bears either failed or dropped off during that period (Table 14).

Radio-collared bears provided 158 relocations between July 1985-May 1986. All of the tagged bears continue to use the Delta until late September-early October, although there was a general movement inland to areas with salmon spawning streams or lakes in early August (Fig. 7). Concentrations of marked and unmarked bears were observed at the head of Hartney Bay, Upper Alaganik Slough-McKinley Lakes, and Ibeck Creek, from August through October. The absence of bears and signs of activity, such as trails and beds, on the coastal Delta after early October suggested little use of the area in the fall.

The general movement of bears inland during late summer and autumn was reflected in habitat selection by tagged animals (Table 15). Over 75% of the relocations were in forest or inland tall shrub habitat types. With the exception of immature bears, which were occasionally relocated in coastal habitats, the distributions of relocations by habitat type were similar for all age and reproductive classes during the late summer and fall.

Home Range:

Seasonal home ranges of radio-collared brown bears between May and denning in 1985 averaged 91.1 ± 47.3 mi^2 (Table 16). Excluding bear 105 whose collar failed in early fall, and yearling cub 200 who was with female 014, male bears had an average home range of 128.5 ± 62.5 mi^2 compared with 76.0 ± 30.2 mi^2 for females. Warm temperatures and heavy rains in

Table 14. Sex, age, reproductive condition, and status of radio-collared brown bears on the Copper River Delta between 7 July 1985-19 May 1986.

Bear	Sex	Age	Reproductive condition	Date collared	Date of last relocation	Status as of 19 April 1986
010	F	7.5	w/2 yearling cubs	5/20/85	5/19/86	Transmitter functioning.
011	F	10.5	w/2 yearling cubs	5/20/85	5/19/86	Transmitter functioning.
012	M	5.5	breeding	5/21/85	1/16/86	Unknown, suspected transmitter failure. Last relocated in closed winter den.
014	F	10.5	w/2 yearling	5/22/85	5/19/86	Transmitter functioning.
015	M	1.5	inactive (offspring of 010)	5/23/85	9/11/85	Breakaway collar apparently dropped (collar never located).
016	M	5.5	unknown	5/23/85	5/19/86	Transmitter functioning.
040	F	15±	unknown	5/12/84	9/21/84	Unknown, very poor signal heard on 8/29/85. Transmitter suspected to have failed 9/84. (Probably observed on Delta during summer 1986 w/yearling cub, see Table 19.
105	F	6.5	barren	5/12/84	7/18/85	Unknown, transmitter failure (see Table 19).
106	M	3.5	inactive	5/12/84, 5/21/85	4/86	Unknown, break-away collar apparently dropped during winter or at spring emergence.
108	F	4.5	inactive	5/13/84, 5/21/85	5/19/86	Transmitter functioning.

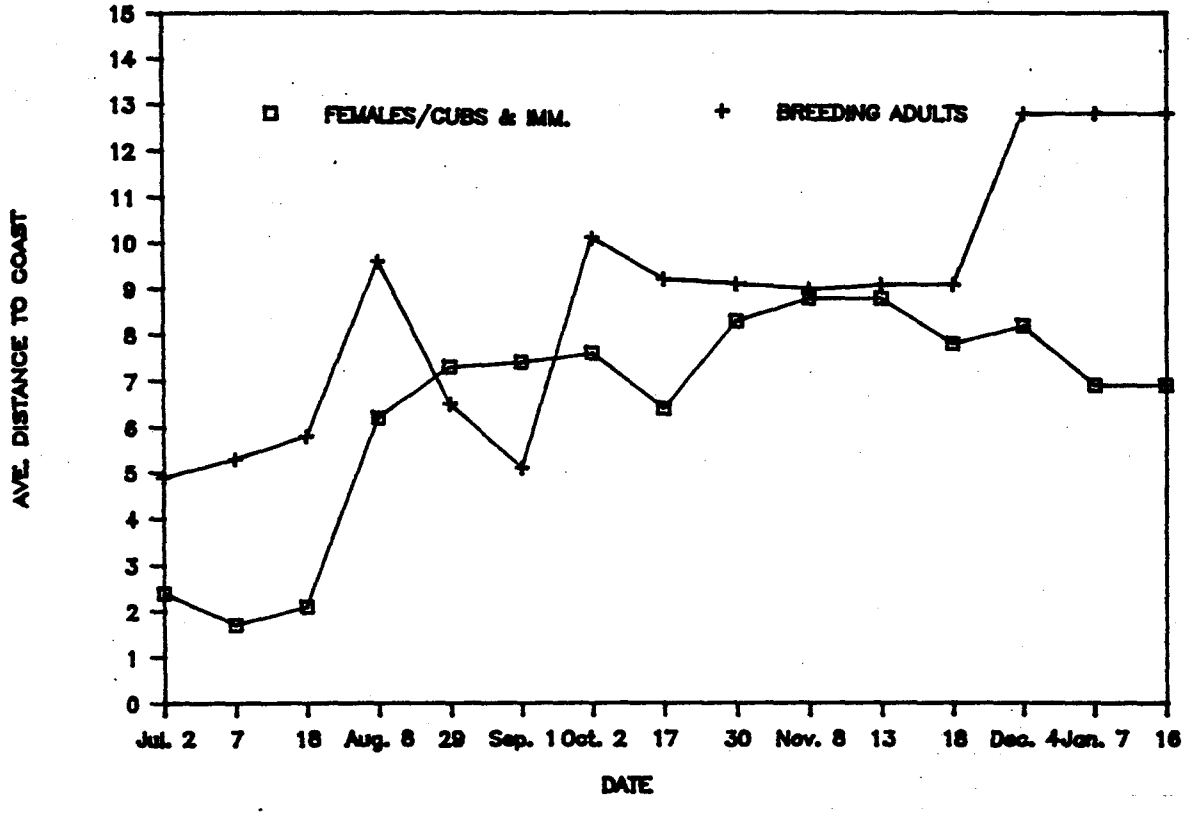


Figure 7. Distribution of radio-collared brown bears in relation to the coast on the west Copper River Delta, July 1985-Jan. 1986.

Table 15. Distribution of radio-collared brown bear relocations, by habitat type, on the West Copper River Delta during July-December 1985[a].

Class	Number of relocations	Coastal			Inland				Upland			
		Sedge meadow %	Alder/ willow %	Low-shrub %	Shrub bog %	Alder/ willow %	Low-shrub %	Forest %	Forest %	Alder/ willow %	Montaine meadow %	Krummholz (subalpine) %
All bears	80	3.8	6.3	0	0	25.0	1.3	23.8	26.3	6.3	3.8	3.8
Males	36	8.3	11.1	0	0	25.0	0.0	25.0	19.4	2.8	2.8	5.6
Adult males	21	0.0	9.5	0	0	19.1	0.0	28.6	28.6	4.8	4.8	4.8
Females[b]	44	0.0	2.3	0	0	29.5	2.3	22.7	31.8	4.5	4.5	2.3
Females with cubs	33	0.0	3.0	0	0	24.2	3.0	21.2	36.4	9.1	3.0	0.0
Immature bears	20	15.0	5.0	0	0	30.0	0.0	20.0	15.0	0.0	5.0	10.0

a For active bears only, does not include repetitions of habitat in which den occurred after animal became inactive.

b Collar failure prevented collection of habitat selectivity data for breeding females.

Table 16. Home ranges of radio-tagged brown bears on the West Copper River Delta, May to denning, 1985.

Bear	Age	Sex	Reproductive status	Number of relocations	Area (mi^2)	Comments
010	7.5	F	2 yrlg cubs	41	56.6	
011	10.5	F	2 yrlg cubs	41	61.4	
012	5.5	M	breeding	40	200.9	
014	10.5	F	2 yrlg cubs	40	121.1	
015	1.5	M	inactive	33	84.9	Disappeared Sep 1985
016	5.5	M	breeding	39	93.6	
105	6.5	F	estrus	40	44.4	Radio failure Sep 1985, home range based on 1984 den location to time of radio-failure
106	3.5	M	inactive(?)	41	91.6(323.5)[a]	
108	4.5	F	unknown	40	65.0	

a Home range including area covered during 72-hour exploratory movement in June.

late December-early January resulted in a short period of activity and 2 bears (adult female 011 and immature female 108) moved to new dens.

Denning:

The 1st evidence of winter denning was observed on 8 November 1985 when adult male 016 was relocated in a den (Table 17). By November 13, all but female 010 and her yearling cubs and male 020 were in dens. Bears 010 and 020 apparently did not enter dens until December.

The dens of 7 radio-collared bears were located during the winter of 1985-1986 (Table 17). Based on the location of these, Upper Ibeck Creek in the foothills of the Chugach Mountains, and the Heney Range, were important denning areas for study animals in 1985. Southeast-facing slopes above 1,000 ft elevation and covered by open stands of alder or islands of subalpine vegetation (Krummholz) were most commonly used for denning.

Bears began emerging from dens in late April and moved onto the Delta by the 2nd week of May (Table 18). With the exception of 1 adult male (016) that moved directly onto the Delta after emerging from his den, all of the marked bears were active primarily on avalanche chutes or in heavy upland timber until mid-May.

May-June 1985 Investigations

Ten bears were captured and an additional 2 were drugged but not handled during 19-23 May (Table 19). Radio collars were placed on 4 2½-year-old bears that were with marked females; failed or failing radio collars were replaced or removed from 3 bears; 2 large adult males that have been known to frequent the Delta were collared; and 1 immature female was collared.

Mark-recapture data, collected during tagging and applied to the Peterson index, provided an estimate of 32.5 ± 17.7 brown bears active on the west Delta during mid-May. The range of the estimate, which is large, but similar to other bear population estimates in Alaska (Miller and Ballard 1982), was refined to 35-48 bears because at least 35 different individuals were known to be active on the west Delta during May-June. Of those 35 individuals, 37% were known to be immature bears (4.5-or-less years old), 40% were known or appeared to be adult bears, and 23% were of unknown age.

Table 17. Approximate denning dates and characteristics of dens of radio-collared brown bears on the West Copper River Delta, 1985.

Bear	Age	Sex	Reproductive status	Date first observed in den	Denning habitat type	Den elevation (ft.)	Aspect	General location
010	7.5	F	yrlg cubs	12/04/85	Upland alder/willow	1,500	S.E.	Ibeck Creek
011	10.5	F	yrlg cubs	11/13/85	Upland spruce forest	1,000	S.E.	Henney Range
012	5.5	M	inactive	01/07/86	Upland alder/willow	2,200	E.S.E.	Ibeck Creek
014	10.5	F	yrlg cubs	11/13/85	Upland alder/willow	2,100	S.E.	Sheridan Glacier
016	5.5	M	inactive	11/08/85	Krummholz	1,900	S.E.	McKinley Peak
106	3.5	M	inactive	11/13/85	Krummholz	2,500	S.E.	Ibeck Creek
108	4.5	F	unknown	11/13/85	Krummholz	1,000	S.E.	Heney Range

Table 18. Approximate dates that radio-collared brown bears emerged from winter dens and moved onto west Copper River Delta in 1986.

Bear	Sex	Age	Reproductive condition	Approximate emergence	Date observed on Delta
010	F	8.5	w/2 2-yr-old cubs	4/16/86	5/15/86
011	F	11.5	w/1 2-yr-old cubs	4/29/86	5/2/86
014	F	11.5	w/2 2-yr-old cubs	4/16/86	5/15/86
015	M	2.5	w/female 010	4/16/86	5/15/86
016	M	6.5	unknown	4/22/86	4/29/86
106	M	4.5	unknown	4/29/86	unknown, collar dropped
108	F	5.5	unknown	4/29/86	5/12/86
609[a]	M	15.5	unknown	unknown	5/6/86

a Not radio-collared but easily recognized.

Table 19. Summary of sex, age, reproductive condition, and status of brown bears captured and/or handled on the west Copper River Delta 19-23 May 1985.

Bear	Sex	Age	Reproductive condition	Associations at capture	Status/comments
013	F	12.5	w/cubs	2 yearling cubs	Failed radio collar deployed in 1984, (3 mos. operation) removed. Neck in excellent condition. Had been observed on CRD w/ 3 cubs-of-the-year on 7/18/85.
015	M	2.5	inactive	w/female 010, female sibling (018)	Recollared. Had been collared w/breakaway collar 5/86. Collar shed 9/85.
016	M	6.5	unknown	none	Functioning collar replaced as insurance against established pattern of collar failures. Neck in fair condition with some rubbing and 2 areas slightly abraded.
018	F	2.5	inactive	w/female 010, male sibling (015)	Collared.
019	M	2.5	inactive	w/female 014, male sibling (021)	Collared.
021	M	2.5	inactive	w/female 014, male sibling (019)	Collared.

Table 19. Continued.

Bear	Sex	Age	Reproductive condition	Associations at capture	Status/comments
023	F	3.5	possibly coming into estrus	none	Collared
105	F	7.5	barren	none	Failed radio collar deployed in 1984 (15 mos. operation) removed. Neck in poor condition with severe rubbing and large open sores. Administered bicillin and released uncollared.
030	M	10+	unk	none	Very large male, poorly anesthetized and hyperthermic. Collared. Shed collar 8 days after release.
609	M	15.5	unk	none	Very large male, hyperthermic. Collared. Shed collar 3 days after release. This animal has been active on CRD since initiation of study in 1984.
Unknown	F	unk	w/cub	1 yrlg cub	Animal darted but lost in timber. Later observed 5 times w/cub on coastal CRD during May-June 1986. Appeared to be either carrying or recently slipped a collar. Animal greatly resembled female 040, collared in 1984, whose transmitter failed after 4 months.
Unknown	M	unk	unk	none	Animal darted twice but failed to become sufficiently anesthetized to handle. Antagonist administered by dart. Observed several times on CRD during May-June 1986.

Home Range:

Radio-tagged animals were relocated a total of 328 times between 6 May and 30 June 1986, when geese were nesting. Activity ranges varied considerably, from 14 mi^2 for a female (013) with 2 yearling cubs, to 108 mi^2 for adult male 016 (Table 20). Average ranges for age classes and reproductive condition were, adult males: 108 mi^2 ($\underline{n}$ = 1); all adult females: 38 mi^2 ($\underline{n}$ = 5); females with cubs: 26 mi^2 ($\underline{n}$ = 3); breeding females: 69 mi^2 ($\underline{n}$ = 2); and immature bears: 61 mi^2 ($\underline{n}$ = 4). Average activity ranges for May-June 1984-86 are compared in Table 21.

Geographic segregation of bears by age class and reproductive condition, similar to 1984 and 1985 (Campbell 1985 and 1986), was observed on the Delta during the period when geese were nesting in 1986. Adult breeding males were active an average 3.9 ± 2.7 mi from the coast; adult estrous females were active an average 4.7 ± 2.7 mi from the coast; females with young were active within an average 2 ± 2.0 mi of the coast; and immature bears were active within an average 2.4 ± 1.9 mi of the coast. Age-sex segregation was reflected also in habitat use (Table 22). Females with cubs and immature bears were most frequently observed in coastal alder/willow thickets while adult males and breeding females were most frequently observed in inland alder/willow thickets and spruce forest.

Nest predation was high in 1986 (Table 11). While data analysis is not yet complete, about half of the 67% nest loss was attributed to brown bears. Since a majority of the bear relocations in or near major goose nesting areas were of either immature animals or females with young, a relationship between high levels of nest predation and the activities of immature or female bears with cubs was probable.

1987 Work Plan

Radio-collared brown bears will be relocated twice per month until they have denned to determine late summer and fall home ranges, habitat use, denning time, and location. Denned bears will be checked periodically during late March-early May 1987 to determine approximate emergence dates. Once bears become active, radio-tracking will be intensified to determine when bears move onto the Delta. After radio-collared bears move onto the Delta, as many animals as possible will be captured, radio collars will be removed, and the study will be completed. Final data analysis and a report will be completed in 1987 or early 1988.

Table 20. Activity range of radio-collared brown bears on the west Copper River Delta during the period when geese were nesting (6 May-30 June) 1986.

Bear	Sex	Age	Reproductive condition	Associates	Activity range mi^2	Comments
010	F	7.5	Estrus	019 & 021 until 5/29/86	95.9	Family group broke up 5/29/86, estrus after 5/29/86. Home range size increased dramatically after 5/29/86.
011	F	11.5	Cubs	w/2.5 year-old-cub	25.5	Not active on Delta.
013	F	12.5	Cubs	2 yearling cubs	14.1	
014	F	11.5	Cubs	2 2.5-year-old-cubs (015 and 018)	38.6	
015	M	2.5	Inactive	female 014, sibling 018	38.6	
016	M	6.5	Unknown	none	107.6	
018	F	2.5	Inactive	female 014, sibling 015	38.6	
019	M	2.5	Inactive	female 010 & sibling 021 until 5/29/86	83.0	Family group broke up 5/29/86. Frequently with sibling 021 through 6/30/86.
021	M	2.5	Inactive	female 010 & sibling 019 until 5/29/86	84.8	See 019.
023	F	3.5	Inactive-estrus	several males after 6/15/86	42.4	Apparently became estrous about 6/15/86.
030	M	10.0+	Breeding	010, 023, unmarked females	insufficient data	Collar slipped 8 days after tagging.
108	F	5.5	Unknown-probably in estrus	none	17.3	Animal primarily active off Delta.
609	M	15.5	Breeding	010, 023, unmarked females	insufficient data	Collar slipped 3 days after tagging.

Table 21. Average activity ranges (mi^2) of radio-collared brown bears on the west Copper River Delta during the period when geese were nesting, 1984-86. Sample sizes shown in parentheses.

Class	1984[a]	1985[b]	1986
All bears	59(9)	51(9)	52(11)
Adult males	81(2)	95(2)	107(1)
All adult females	45(4)	32(4)	38(4)
Females with young	23(2)	27(3)	26(3)
Breeding females	52(2)	33(1)	69(2)
Immature bears	65(3)	58(3)	61(1)

a From Campbell 1985.

b From Campbell 1986.

Table 22. Distribution of radio-collared brown bear relocations, by habitat type, on the West Copper River during May-June, 1986.

Age or breeding class	Number of relocations	Coastal delta					Inland delta				Upland				
		Mud flats %	Sedge meadow %	Alder/ willow %	Low-shrub %	River bar %	River bar %	Alder/ willow %	Low-shrub %	Spruce/ hemlock %	Spruce/ hemlock %	Alder/ willow %	Mtn. meadow %	Krummholz %	Snowfield %
All bears	329	1.2	5.1	31.6	2.4	1.5	0.9	24.2	7.3	12.2	10.3	0.9	0.3	1.2	0.6
Bears active on delta[a]	298	1.3	5.7	34.9	2.7	1.7	1.0	26.5	7.7	10.7	4.3	0.3	0	1.3	0.7
Adult males	45	0	4.4	24.4	0	0	2.2	44.4	6.7	17.8	0	0	0	0	0
Breeding females[a]	87	1.1	2.3	11.5	0	1.1	0	35.6	8.0	20.7	16.1	1.1	0	1.1	1.1
Females[a] with cubs	57	1.8	5.3	63.2	7.0	1.8	1.8	10.5	3.5	3.5	1.8	0	0	0	0
Immature bears	108	1.9	9.3	43.5	6.5	3.7	0	20.4	10.2	4.6	0	0	0	0	0

a Excluding a female that spent over 90% of her time to the west of the Delta on the Heney Mtn. range and Point Whiteshed.

INVESTIGATIONS OF LEAD SHOT INGESTION BY WATERFOWL

The effects of ingested spent lead shot on waterfowl have been studied in Alaska since 1974. In 1978 and 1979, the Alaska Department of Fish and Game, in cooperation with the U.S. Fish and Wildlife Service, conducted the most detailed study to date to evaluate the extent of lead poisoning occurring in waterfowl in Cook Inlet (Timm 1980). One outcome of that study was the recommendation that monitoring studies be continued to assess the ingestion of spent lead shot by waterfowl in Cook Inlet.

In 1985, the FWS formulated criteria for establishing guidelines to identify areas where lead poisoning of waterfowl is a significant problem (U.S. Fish and Wildlife Service 1986). These criteria superceded Pacific Flyway criteria established in 1981. The guidelines included "triggering" criteria for initial identification of areas where lead poisoning may be a problem and "decision" criteria for determining whether or not a problem actually exists. Up to this time, there had been no national criteria to identify areas where nontoxic (steel) shot should be required.

Under these guidelines, areas identified by the "triggering" process would be monitored to determine whether there was a lead poisoning problem as defined by the following "decision" criteria.

1. Three or more dead individual specimens confirmed as lead poisoned during the monitoring year; or

2. One or more ingested shot in 5 percent of the gizzards sampled; and either

   (a) 2 parts per million (ppm) (wet weight), or higher, lead in 5% or more of the livers sampled; or

   (b) 0.2 ppm lead in 5% or more of the blood samples; or

   (c) protoporphyrin levels of greater than or equal to 40 ug/dl in 5% of the blood samples.

Based on these guidelines and the suggestion of Timm (1980), ADF&G initiated a new study in 1985 to determine the incidence of ingested shot in the gizzards, and the concentration of lead in the livers, of mallards and pintails (species highly susceptible to lead poisoning). The goal was to sample at least 100 hunter-killed birds of each species from heavy harvest areas. Originally, samples were to be collected from the Minto Flats, Mendenhall Wetlands, and Cook Inlet marshes. The difficulty of collecting sufficient samples, and lower

waterfowl harvest rates at Minto Flats and Mendenhall Wetlands, precluded inclusion of these 2 areas in the initial study; the focus was therefore restricted to Cook Inlet marshes. Because of the difficulty of finding individual lead-poisoned birds over the vast area of Cook Inlet marshes, and the difficulty of obtaining blood from a large sample of birds, ADF&G chose to collect paired samples of livers and gizzards from hunter-shot birds.

Shot present in the gizzard reflects the degree of recent exposure to lead shot. Lead in the liver reveals the degree of assimilation of lead into the tissues and indicates the presence of an actual health threat. Because lead is absorbed rapidly by the liver, but not stored there, lead concentrations indicate recent assimilation; storage in bones indicates exposure over a longer term.

Samples were collected during the 1985 and 1986 fall hunting seasons from the Palmer Hay Flats, Susitna Flats, and Redoubt Bay. A summary of the sampling distribution by species, location, and time is presented in Table 23. A summary of sample distribution by species, location, age, and sex is presented in Table 24.

For areas where the number of samples is adequate, data will be analyzed by time period and age, sex, and species of bird. Where fewer than 100 birds were collected, all samples will be analyzed and additional samples may be collected in subsequent years. For Redoubt Bay, results for mallards and pintails will be combined for purposes of approximating the FWS guidelines of 100 birds per area.

Gizzards will be visually examined for clinical signs of lead poisoning and presence of spent lead shot and x-rayed as a further check on the presence of lead. Livers will be analyzed for lead absorption by use of atomic absorption spectophotometry. Results should be reported in 1987.

PALMER HAY FLATS WATERFOWL ENHANCEMENT PROJECT

In 1986, Ducks Unlimited, Inc. (DU), and the Alaska Department of Fish and Game cooperated to develop a waterfowl enhancement project in the Palmer Hay Flats State Game Refuge (PHFSGR). The purpose of this pilot project is to test the feasibility of more extensive habitat enhancement projects on the refuge. This was the 1st enhancement project under a cooperative agreement between the ADF&G and DU, whereby DU funds projects to restore or enhance wetlands and increase waterfowl production on state lands.

Table 23. Summary of sampling distribution for paired samples of livers and gizzards from mallards and pintails collected from 3 locations in Upper Cook Inlet in 1985 and 1986. Numbers in parentheses represent percent of total.

	Pintails		Mallards	
Location	Sep 1-8 (%)	Rest of season (%)	Sep 1-8 (%)	Rest of season (%)
Palmer Hay Flats	94(91)	8(9)	84(93)	6(7)
Susitna Flats	118(67)	58(33)	47(48)	50(52)
Redoubt Bay	44(85)	8(15)	18(56)	14(44)
Totals	256(78)	74(22)	149(68)	70(32)

Table 24. Summary of paired samples of livers and gizzards collected for mallards and pintails (by age and sex) in 1985 and 1986 for 3 locations in Upper Cook Inlet.

	Pintails						Mallards						
	Adults		Immature				Adults		Immature				
Location	M	F	M	F	Unk	Total	M	F	M	F	Unk	Total	Grand Total
Palmer Hay Flats	7	7	47	41	0	102	4	6	47	33	0	90	192
Susitna Flats	14	15	64	70	13	176	11	14	34	33	5	97	273
Redoubt Bay	1	4	16	16	15	52	4	2	13	12	1	32	84
Totals	22	26	127	127	28	330	19	22	94	78	6	219	549

Located on both the east and west sides of the Glenn Highway and about 1 mile north of the Matanuska River, the project encompasses about 135 acres (Fig. 8). The western site is located near the northern boundary of the refuge (T/17 N, R/1 E, NW/¼ S/34) and is bordered to the east by the Glenn Highway, to the west by Rabbit Slough, and to the north by a tributary of Rabbit Slough. The eastern site (T/17 N, R/1 E, SE/¼ S/34; T/16 N, R/1 E, NE/¼ S/3) is located between the Glenn Highway and the Alaska Railroad.

The project is designed to increase nesting and brood rearing habitat for mallards and pintails. Thirteen ponds totaling 18 acres and averaging approximately 1.4 acres (ranging from 0.89 to 1.6 acres) are interconnected by almost 3 miles of level-ditches, all constructed between 19 March and 20 April 1986. Twelve of the ponds average between 1.5 and 2 feet deep, with greatest depths rarely exceeding 3 feet. Each pond contains from one to three islands (24 total) varying in size from 0.1 to 0.5 acres. Island size will diminish as thawing and settling occur.

On the east side, 1 pond is 10 feet deep for approximately half its surface area and 2 large islands are located outside the pond's perimeter. This pond was designed to provide overwintering habitat for juvenile coho salmon.

Of the thirteen ponds, six were constructed east of the highway and seven to the west. Each pond has a diameter of about 250 feet. The level-ditches connecting ponds are 3 feet deep and 18 feet wide at the surface. Level-ditches alter direction approximately every 75 feet. Spoils from excavating level-ditches were placed along the edge of the ditch to increase potential nest sites and provide loafing mounds.

The final construction cost of the project was $86,175. The project was excavated using 2 D-8 Caterpillar tractors, a John Deere 890 backhoe, and a D-5 low ground pressure Caterpillar tractor.

On 23 May 1986 nest searches located nests of the following species: mallard (2 nests), pintail (2 nests), northern shoveler (2 nests), American wigeon (1 nest), and Canada goose (2 nests). The 2 goose nests, 1 mallard, 1 pintail, and 1 northern shoveler nest were found on the east side and the others were found on the west side of the highway. A brood of 7 American wigeon was also observed on the east side. Nests were not found on the newly created islands, which were still unvegetated, but on existing areas of slightly increased elevations within the project boundaries.

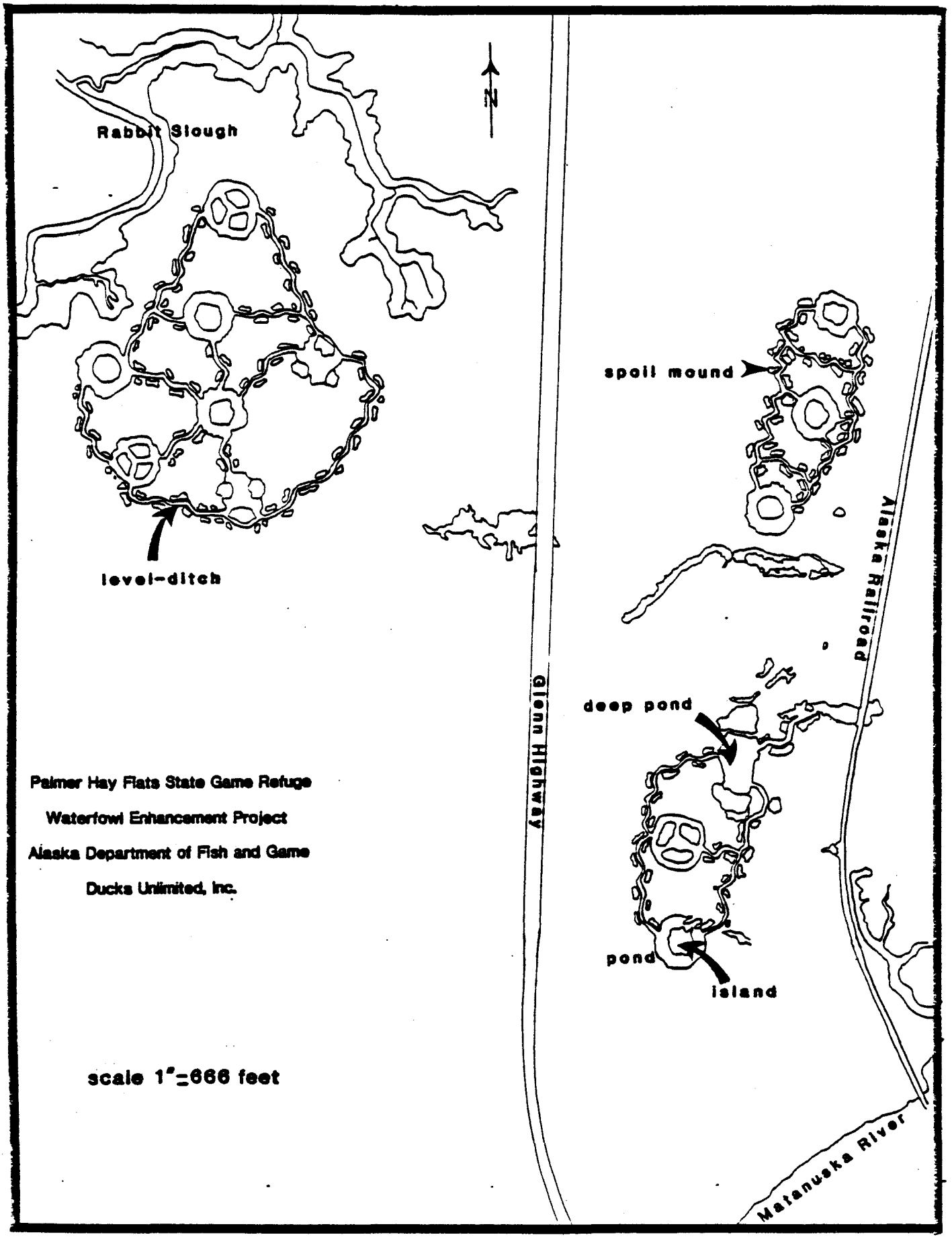


Figure 8. Waterfowl enhancement project map, Palmer Hay Flats State Game Refuge.

The project was seeded and fertilized on 16 and 17 June 1986. Just over 11 acres of spoil deposits were revegetated. Grass seed was hand-broadcast at the rate of 25 pounds per acre and 20-20-10 fertilizer was broadcast at the rate of 450 pounds per acre. Peripheral areas were also fertilized to stimulate seed production in existing vegetation. Some islands and level-ditch mounds were not seeded or fertilized while other areas were fertilized but not seeded in order to assess the effectiveness of no, or limited, treatment.

The following seed mix was used on the majority of the project: 8 parts Beckmannia syzigachne var. Egan, Bering hair grass var. norcoast (Deschampsia beringensis), and red fescue var. arcta red (Festuca rubra); 3 parts polar grass (Arctagrostis latifolia); and 2 parts bluejoint var. sourdough (Calamagrostis canadensis). Due to a shortage of bluejoint, a portion of the west side was seeded with the above mix, minus this species.

Weal barley (Hordeum vulgare) and Bebral rye (Lolium multiflora) were seeded on the south side of the eastern portion of the project on 3 July 1986. Mixed together, these species were applied at the rate of 10 pounds per acre over approximately half of that area.

Four hundred and thirty-eight sprigs of willow (Salix sp.) were planted throughout the project on 14 and 18 August 1986. Two hundred thirty-eight sprigs were planted on the west side and 200 on the east side.

A detailed interim and final report on the methods and results of the revegetation and monitoring will be presented to the U.S. Army Corps of Engineers as required in the wetland permit. The interim report is due in December 1987, and the final report, 1 year later.

VANCOUVER CANADA GOOSE TRANSPLANT TO KODIAK

Since 1973 the Alaska Department of Fish and Game has considered transplanting Vancouver Canada geese (Branta canadensis fulva) from southeast Alaska to the Kodiak Archipelago in order to establish a wild, viable population (Timm 1973). In August 1973, 8 young and 5 adult Vancouver Canada geese from a captive-reared flock in Juneau were released in Lilly Lake, a float plane lake, in Kodiak City. All of these birds, which were wing clipped at the time of release, eventually disappeared (Timm 1973). A 2nd transplant of 7 wild and 9 captive-reared Vancouver Canada geese was attempted in 1975. These birds, released in Terror Bay, on Kodiak Island, apparently traveled 25 miles (40 km) southwest

to Zachar Bay. Resident Canada geese have been observed in Zachar Bay from the mid-1970's to the present. Presumably, these geese are related to or are part of the original group released in Terror Bay. Annual counts in Zachar Bay have ranged from 0 - 13 birds, all adults. Sightings of goslings have never been reported.

Prior to the mid-1970's there were no documented records of Canada geese nesting or wintering in the Kodiak Archipelago. With the exception of Kodiak, Canada geese are widely distributed along coastal areas of southcentral and southeast Alaska. Suitable climate and habitat appear to be available throughout the Kodiak Archipelago and the reasons for the absence of Canada geese are unknown.

In 1986, the ADF&G reviewed available ecological information, historical records, and past efforts to introduce Vancouver Canada geese to Kodiak (ADF&G 1986) and proposed a transplant. Vancouver Canada geese are a resident subspecies occupying coastal habitats in southeast Alaska. Because of latitudinal, climatic, topographic, and vegetative similarities between southeast Alaska and Shuyak Island, Afognak Island, and portions of Kodiak Island, and the nonmigratory nature of this subspecies, Vancouver Canada geese were chosen for the transplant (ADF&G 1986).

The Kodiak Archipelago appears to offer potential goose habitat, without competition with existing waterfowl populations. Additionally, the purposes of a transplant to Kodiak are consistent with objectives of the National Waterfowl Management Plan for the United States and the North American Waterfowl Management Plan (ADF&G 1986). The transplant is also supported by local residents.

On 20 and 21 July 1986, the ADF&G transplanted 209 Vancouver Canada geese from southeast Alaska to Kodiak and Shuyak Islands. Two hundred twelve birds were removed from a molting flock of approximately 565 birds captured on 20 July 1986 in Fool Inlet, located at the north end of Seymour Canal on Admiralty Island. Lebeda (1980) reported a molting flock of 300 birds in Fool Inlet. The Fool Inlet molting flock contained all adults except for 10 goslings. During the capture, 1 adult suffered a broken wing and died on transport to Juneau. This bird was the only mortality. Birds were crated, transported to Juneau on the MV Surfbird, a FWS vessel, and then flown to Kodiak on a U.S. Coast Guard C-130 cargo plane. Two adult geese escaped from their crates while being transported by ship from Admiralty Island to Juneau.

One hundred ten adults (60 females and 50 males) were released in Weasel Cove, Spiridon Bay, in the Kodiak National Wildlife

Refuge, on western Kodiak Island. All birds were banded with FWS aluminum leg bands on the left leg and 99 of the birds were also banded with colored plastic tarsal bands on the right leg. These bands are rust colored with white numbers, 01 - 99, read from the ground up. Three birds were also fitted with backpack radio transmitters.

Ninety-nine geese (91 adults, 8 goslings) were released in Big Bay, located in Shuyak State Park in the northwest portion of Shuyak Island. Of the 91 adults, 61 were males and 30 females. All birds, except for 1 escapee, were banded on the left leg with FWS aluminum leg bands and on the right leg with colored plastic tarsal bands. These bands are white with black numbers, 00 - 99, read from the ground up. Two adult males were fitted with backpack radio transmitters.

Periodic aerial surveys are being conducted throughout the fall, winter, and spring of 1986-87 to monitor the movements, behavior, and fate of the transplanted birds. As of 1 December 1986, the transplanted geese had fragmented into several smaller flocks, with the majority remaining within 25 miles (40 km) of their respective release sites. Approximately 13 Shuyak-released birds and 4 Spiridon Bay-released birds were observed along the road system south of Kodiak City on 23 August 1986, about 1 month following the transplant.

Monitoring results from this winter and spring will be used in determining whether an additional transplant will be conducted in July 1987. Game Management Unit 8 has been closed to all Canada goose hunting.

This transplant was the 1st project supported with funds from the Alaska Waterfowl Conservation Stamp (duck stamp). The U.S. Fish and Wildlife Service cooperated with the ADF&G in the transplant.

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